

Hot, congested, crowded and diverse: Emerging research agendas in planning

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Abstract

This special issue explores emerging research agendas in planning. It brings together scholars from diverse schools working on new areas of research and application in urban design and planning. Emergent research agendas include both novel areas of research and important shifts in the direction of a research area. The challenge for planning schools is to reflect critically on these changes and develop long-term research agendas that can better position our field in society and academia, and provide a basis from which to assess our academic programmes. The chapters presented in this issue reinforce key aspects of planning: multi-scale, and multi-faceted, yet integrative in its intent, stressing the physical, yet inescapably social. At the same time, they identify research areas that respond to major social and environmental changes. Blanco and Alberti focus on the latest findings in climate change science and on planning for adaptation; they highlight the opportunities that planners have to provide leadership in this area. Forsyth, Krizek and Rodríguez take up the issue of non-motorised travel, a topic of increasing interest for urban designers, public health experts and transportation and energy planners. For Talen and Ellis, an emerging challenge is the need to plan for diverse and compact communities. What social factors, policies, programmes and planning processes facilitate compact and diverse communities?

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Keywords: Climate change adaptation; Urban planning and climate change; Non-motorised; Walking and cycling; Social diversity; Compact development

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Chapter 1. Emerging research agendas in planning

Hilda Blanco and Marina Alberti

This is the first of two planned special issues in *Progress in Planning* exploring emerging research agendas in planning. The idea for this topic evolved out of a strategic planning effort we undertook for the interdisciplinary PhD programme in Urban Design and Planning at the University of Washington. As we began the planning process, we identified major changes that have occurred in society and in the field since our programme was developed and its curriculum set. We recognised that, in general, the challenge for planning schools is to reflect critically on these changes and develop long-term research agendas that can better position our field in society and academia, and provide a basis from which to assess our academic programmes. As a result, we first established a seminar called ‘Emerging research agendas’, where panels of faculty and students lead seminars on the directions of research emerging in various existing or emerging research clusters.

Through the seminar, we realised that this effort should be broader, going beyond our faculty and our PhD programme. These special issues aim to explore emerging research agendas in the planning discipline by bringing together scholars from diverse schools or fields working on new areas of research and application in the field of urban design and planning. *Emergent research agendas* include both novel areas of research as well as important shifts in the direction of a research area. We were pleased to obtain over three dozen abstracts to our announcement and we issued about a dozen invitations for authors to submit complete chapters on promising topics. This first issue contains three chapters that display the different scales and fields of planning, from research opportunities in climate change adaptation, that calls for a comprehensive approach with multiple facets, to narrower topics within a field of planning, such as non-motorised travel, which planners typically classify under the field of transportation but with

connections to public health and energy planning, and planning for diverse and compact communities, with strong urban design and social psychology aspects.

The chapters identify research areas that respond to major social and environmental changes. Blanco and Alberti focus on the latest findings in climate change science. These findings conclude that, regardless of mitigation efforts, because of a time lag in the ocean’s response to atmospheric temperature, the world will experience severe impacts of climate change during this century. Heeding the call that we need to prepare now for these impacts, Blanco and Alberti focus on planning for adaptation and highlight the opportunities that planners have to provide leadership in this area. Forsyth, Kreizek and Rodríguez take up the issue of non-motorised travel, a topic of increasing interest for urban designers, public health experts and transportation and energy planners. Given that motorised transportation requires energy which is often polluting, that public health experts have been urging us to walk or bicycle more for our health, as well as other reasons, Forsyth and her colleagues argue that in order to assess the contribution that non-motorised travel can make to our ways of life, we need research on conceptual models, methods, behaviours, and policy options. For Talen and Ellis, an emerging challenge is the need to plan for diverse and compact communities. More ecological ways of living may require more compact communities, people living in closer quarters. At the same time, the population in many parts of the world, as in the USA, is increasingly diverse. Differences at close quarters often engender conflict. What social factors, policies, programmes and planning processes facilitate compact and diverse communities?

Building capacity to adapt to climate change through planning

Relying on the fourth synthesis report (2007) of the Intergovernmental Panel on Climate Change (IPCC), Blanco and Alberti’s chapter makes the case that climate change is ‘unequivocal’, probably caused by anthropogenic release of greenhouse gases, and that our policy

response, which has been focused on mitigating the emission of greenhouse gases, must now become dual: mitigating the causes, and adapting to the impacts of climate change. The first parts of this chapter review the climate change literature on adaptation and briefly set out the major impacts of climate change which we can expect. A discussion of the relation of climate change adaptation to natural hazards mitigation planning and sustainable development follows.

The chapter then reviews the relevant literature and develops a planning research agenda for adaptation to climate change paralleling the planning process, which identifies a range of opportunities for planning researchers. First, with their knowledge of land use and land cover, planning researchers can collaborate with climate scientists to downscale global climate change models to make them applicable at the regional and local levels. Once the regional impacts have been determined, planners can develop adaptation plans, at an urban, sectoral or project scale. The chapter reviews early models of such planning efforts. Adapting to climate change has irreducible uncertainties, which will require innovative ways to manage risk. Some innovative responses have been developed, and are beginning to be applied, e.g., scenario-based and stakeholder involvement and robust decision-making approaches. Adaptation strategies to various impacts need to be identified and developed, including protection strategies, involving technical engineering solutions, accommodation strategies, involving changes in regulations and programmes, and retreat and abandonment strategies, which require large-scale policy changes. In addition, adaptation strategies need to be evaluated. How should this be done? What are the strengths and weaknesses of traditional assessment methods, such as cost–benefit analysis, cost-effectiveness, multi-criteria evaluation, when applied to climate change strategies? Planning researchers can also focus on implementation issues, anticipating institutional, fiscal and legal obstacles, as well as evaluating the preparation and implementation of adaptation plans.

Non-motorised travel research and contemporary planning initiatives

Forsyth, Krizek, and Rodríguez focus on the promise of non-motorised travel (NMT), particularly walking and cycling, to reduce automobile use. They review a growing body of literature that promotes NMT, and studies their determinants and secondary benefits. They point out that much, however, remains unknown about walking and cycling. What individual and environmental factors spur increased use of these two modes?

Are the factors similar or different? To what extent? Under what circumstances? What policy concerns can increased walking and bicycling help remedy? The enthusiasm generated over NMT has created a need for evidence on the extent to which different policies have succeeded in inducing walking and cycling travel and producing other benefits for communities.

This chapter explains why walking and cycling are rising in prominence as potential strategies to solve problems of traffic congestion, environmental conservation, health and livability. Focusing on adult populations, it distinguishes between walking and cycling, emphasising differences, including: who participates, the geographical range of movement, speed, needed infrastructure, responsibilities for planning that infrastructure, trip purposes, safety concerns, and barriers. Finally, it identifies research opportunities from the current knowledge base, while outlining effective strategies for why and how research on non-motorised issues could best be positioned in the future. Relevant areas include: theory, measurement and methods, behaviours, and policy. Overall there is a need to refine theories and data collection, improve research designs, and develop a base of evidence on walking and cycling to support more robust, realistic and targeted policy prescriptions.

Compact and diverse: The future of American urbanism

Talen and Ellis address a defining phenomenon of urban growth and change in the 21st century—the intensification of social diversity in conjunction with growing pressure to live more compactly. They point out that greater social mix will occur in urban places with limited capacities to expand further outward, due to the environmental, economic and social costs associated with sprawl. Development pressure on existing urban places, especially those that are well serviced by transit, will result in much higher land costs, making it that much more difficult to accommodate a society increasingly stratified by race, ethnicity, class, age, household type and other social factors. The result is likely to be not only further displacement and isolation of low-income populations, but also the rise of an urban pattern defined by spatial segregation of various kinds.

Talen and Ellis point out that, while social scientists grapple with the racial, ethnic and class tensions this growing diversity entails, urban planners have yet to formulate a well-reasoned response to the issues surrounding social diversity in the urban context. The authors find this curious, given that a vibrant social mix is

both a normative goal of planners and a significant challenge to urban stability. Growing dissatisfaction with the lack of well-serviced urban places capable of accommodating a diverse society will require urban planners to shift focus. Specifically, Talen and Ellis identify the emergence of four broad areas of research that have previously been only weakly developed. First, the need to better understand existing diverse communities, i.e., why some places, despite opposing pressures, manage to be both compact and diverse. A second area of research could focus on identifying policies and programmes that are effective in sustaining and promoting environments that are diverse and compact. The third research area concerns the planning process itself. That is, what planning processes can be formulated to encourage and sustain social diversity in urban places? Finally, the fourth research area involves assessing the role of urban design and physical planning in accommodating diversity, with a focus on developing a practical catalogue of patterns, models, examples and standards for use by planners and designers during the coming decades of rapid urban growth. In this area, Talen and Ellis argue, research should address issues such as neighbourhood structure, housing mix, civic spaces, defensible space, school location, and land use patterns.

Highlighting the dual nature of urban planning, the chapters in this issue are a blend of the physical and the social. For Blanco and Alberti, adaptation planning is regionally and locally grounded, and, given the uncertainty of impacts, the planning process needs to be based in science and analysis and be broadly participatory, paying attention to institutional, fiscal, legal as well as regulatory factors. In the case of non-motorised travel, we cannot get more physical than reengaging people on foot or on a bicycle with their communities. And yet, this increasing societal interest in non-motorised travel is probably affected by social, economic and psychological factors. The very topic of Talen and Ellis—diverse and compact—underlines the interconnection between the physical and the social that is inescapable in planning.

This multi-author monograph reinforces key aspects of planning: multi-scale, and multi-faceted yet integrative in its intent, stressing the physical, yet inescapably social. At the same time, the authors identify opportunities for planning academics and the profession to engage in research on emerging issues of central importance for our times. Such research can contribute to a reinvigorated planning practice providing the leadership needed to confront the planning challenges of the 21st century.

Chapter 2. Building capacity to adapt to climate change through planning

Hilda Blanco and Marina Alberti

2.1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) (IPCC, 2007a: 5) concludes that the ‘warming of the climate system is *unequivocal*’ and that ‘Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* [assessed likelihood over 90%] due to the observed increase in anthropogenic greenhouse gas concentrations’ (p. 10). The major policy response around the world, including that of the Kyoto Protocol, thus far has focused on efforts to reduce or mitigate the emission of greenhouse gases (GHGs) to avoid the predicted worst possible warming scenarios. But, even if we succeed in capping GHGs to 2000 levels, there is a time lag in the oceans’ response to atmospheric temperatures, and temperature and sea levels will continue rising for another century. Adapting to climate change is increasingly being recognised as equally important as reducing the anthropogenic causes of climate change (IPCC, 2007a: 17). And adapting to climate change is at its core a call for planning. As such, it provides the planning profession with opportunities to provide leadership in responding to this great global challenge.

This chapter begins with an account of adaptation, including its meaning and the likely impacts to which we will need to adapt. We also explore the linkage of climate change adaptation to the related fields of natural hazards mitigation and sustainable development. The chapter then discusses how, although much of the recent interest in adapting to climate change is focused on adaptation strategies, adapting to climate changes provides broader and multiple opportunities for planning research. The rest of the chapter sketches out the many roles that planners can play, and reviews the existing research in these areas. These areas include: the emerging science of climate change adaptation, including vulnerability assessments; an integrative and strategic planning process based on collaborative scenario development; the identification and development of adaptation strategies; evaluation research focused on such strategies; and, finally, research on implementation issues, including institutional, fiscal and legal.

2.2. Adaptation and mitigation

Although the UN Framework Convention on Climate Change (1992) identified two responses to climate change, mitigating change through the reduction of greenhouse gas emissions *and* adaptation to its impacts, not until IPCC’s third assessment report (IPCC, 2001a) did the subject of adaptation begin to receive separate and adequate attention in the assessments. The major IPCC policy focus has been the mitigation of GHGs, and, as indicated, this has also been the focus of the major global treaty to address climate change, the Kyoto Protocol. Technological and economic issues have been the main concerns of research on mitigation, a research focused on global-scale, top-down aggregate modelling. Although a smaller effort, there is a growing body of research focused on adaptation that emphasises local and place-based analysis, and uses approaches more akin to development studies and disaster and natural hazards risk mitigation.

The increasing evidence for climate change, and the lack of adequate action on mitigation, has brought renewed emphasis on adaptation policies. The IPCC Fourth Assessment of mitigation efforts ‘shows that current commitments would not lead to a stabilization of atmospheric greenhouse-gas concentrations,’ and that, due to lag times in the climate system, ‘no mitigation efforts, no matter how rigorous and relentless, will prevent climate change from happening in the next few decades’ (IPCC, 2007b: 748). During this century, regardless of mitigation efforts, we will either suffer the adverse impacts of, or successfully adapt to, climate change.

Mitigation and adaptation, however, do not pose either/or policy decisions—both are needed. Without successful mitigation measures, the magnitude of climate change may be so great as to make adaptation strategies ineffective. Successful ‘mitigation reduces the adaptation challenge’ (IPCC, 2007b: 750). But the Fourth Assessment report makes clear that the relations and interrelations between mitigation and adaptation efforts are only beginning to be examined; research results thus far indicate that the relations are not straightforward, and that such efforts may be difficult to integrate (IPCC, 2007b: 752–760, 770–771).

Since IPCC reports cast their projections in terms of emission scenarios ending in 2100, a common perception is that we will not experience the worst impacts until 2100, and that we have almost a century to prepare. But even though mean global temperature rise over the next centuries may be gradual, the frequency of episodic

climate events, such as droughts, floods and heatwaves, may increase significantly much before the end of the century. And not all impacts of climate change are gradual, some may be abrupt. In addition, some adaptation strategies may require institutional capacity and financing that require time for planning and implementation.

Planners have roles to play in mitigating greenhouse gas emissions, through land use policies that reduce vehicle travel, building standards that reduce the need for cooling and heating, encouraging the use of alternative energy sources, and other related policies. And, cities in the US have increasingly taken leadership in reducing greenhouse gases. At the end of 2007, mayors of over 700 cities in US had signed a pledge to meet or surpass Kyoto targets to reduce GHGs, and to lobby their states, and the federal government, to adopt such policies. However, mitigation measures require global action to be effective, and national and international policies will be required to achieve stabilisation of greenhouse gases. On the other hand, adaptation policies are more closely tied to the local and regional level, since impacts, strategies and benefits are local. Thus, adaptation planning is the type of planning that fits naturally the agenda of urban and regional planning. And adapting to extreme impacts of climate change is fundamentally a planning challenge, which is likely to call for public, community-wide planning and not just individual or autonomous adaptations.

2.2.1. What does adaptation mean?

In the climate change literature, adaptation is defined in the context of vulnerability, sensitivity and adaptive capacity. Vulnerability is often defined as the propensity of human and ecological systems to suffer harm, and adaptive capacity as their ability to respond to stresses as a result of climate change effects. Sensitivity refers to the degree to which a system is affected by climate change impacts. Adaptive capacity is seen as a function of behaviour, resources and technologies. Vulnerability is seen to be influenced by development path, physical exposure, distribution of resources, prior stresses and social and government institutions (IPCC, 2007b: 720). The concept of resilience is seen as the ‘flip side of vulnerability—a resilient systems or population is not sensitive to climate variability and change and has the capacity to adapt.’ (IPCC, 2001b: 89). Füssel and Klein (2006; Füssel, 2007) have argued for an integrative concept of vulnerability that incorporates two factors: an external dimension responding to the exposure of a system to climate impacts; and an internal dimension corresponding to a system’s sensitivity and its adaptive

capacity. IPCC’s AR4 definition of vulnerability follows this integrative concept:

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. (IPCC, 2007b: 883)

Adaptation then becomes defined as the adjusting of systems, natural or human, in response to actual or expected impacts of climate change, such as sea level rise, to reduce vulnerability or increase resilience in response to observed or expected changes in climate and associated extreme events (IPCC, 2007b: 869). Vulnerability is also inherently connected to the concept of risk, which is typically defined as the combination of the magnitude of the impact with the probability of its occurrence. Risk refers to the uncertainty in the processes of climate changes (IPCC, 2007b: 782). The recent IPCC assessments, however, acknowledge the lack of common metrics for vulnerability or risk assessments. Adaptive capacity also remains a cloudy issue, although there is wide agreement that some dimensions of adaptive capacity are generic and others specific to particular climate change impacts (IPCC, 2007b: 727).

Smit, Burton, Klein, and Wandel (2000) unpack the concept of adaptation further, by posing the related questions and key variables:

- *Adaptation to what?* The what are climate-related stimuli, which can be expressed as climate or weather conditions, e.g., sea level rise, or as ecological effects, such as drought, or human impacts, e.g., crop failures over the relevant time period.
- *Who or what adapts?* Systems adapt, and concern here is with the characteristics of a system related to its adaptive capacity. The systems involved can be human or ecological systems, cities or wetlands, or sectors, such as transportation systems.
- *How does adaptation occur?* Adaptations can occur in multiple ways. Types of adaptation include reactive, versus anticipatory, autonomous or planned. They can be short- or long-range, localised or regional. They ‘can be distinguished according to whether they are technological, behavioural, financial, institutional or informational.’
- *How good is the adaptation?* This calls for the evaluation of a system’s adaptation, which involves identifying evaluation criteria, principles or

processes for evaluating adaptations (Smit et al., 2000: 229–245).

We address many of these aspects of adaptation in the sections below.

Biological adaptation is reactive, that is, organisms react to an external change after the change has occurred. Individual and societal adaptations to climate change can be reactive, e.g., emergency response, or they can be proactive, anticipating the expected impacts. According to the IPCC, reviews indicate that reactive adaptation to climate change impacts may be ‘inefficient or unsuccessful in addressing irreversible damage’ (IPCC, 2007b: 721). Anticipatory adaptations are typically planned adaptations. Although the high cost of adaptations to climate change may deter adaptation efforts, the recent IPCC report recommends that adaptive capacity can be improved ‘by including adaptation measures in land-use planning and infrastructure design’, as well as by ‘including measures to reduce vulnerability in existing disaster risk reduction strategies’ (IPCC, 2007b: 20). Thus, not only is planning at the heart of anticipatory adaptation, but major elements in urban and regional planning are recognised as essential to improving adaptive capacity.

2.2.2. *Adaptation to what? IPCC projections*

The major impacts of climate change, to which we will need to adapt, are changes in temperature, sea level rise, precipitation change, and extreme events.

- *Temperature change.* According to the latest IPCC reports the change is projected to be: a global warming of about 0.2 °C/decade for a range of emission scenarios (with higher than average warming for North America) (IPCC, 2007c: 12).
- *Sea level rise.* Model-based projections of global average sea level rise by the end of the 21st century are from 0.18 to 0.59 m for a range of emission scenarios *but excluding future rapid dynamical changes in ice flow* (IPCC, 2007c: 13) [our emphasis].
- *Precipitation change.* Average mean precipitation is very likely to increase in high latitudes and likely to decrease in most subtropical land regions (IPCC, 2007c: 16); snow cover is projected to contract (IPCC, 2007c: 15).
- *Extreme events.* It is ‘very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent’ (IPCC, 2007c: 15).

The Fourth IPCC Assessment Report conditions its model-based projections of sea level rise with the

phrase, ‘but excluding future rapid dynamical changes in ice flow’. This is worth discussing briefly. Research on the increasing rate of the melting of the Greenland glaciers and Antarctic ice shelves was just emerging at the time of the AR4 preparation, and the climate change models do not reflect such changes. Today, the rapidity of the observed changes in ice flow has led some researchers to question the AR4 projections (Dowdeswell, 2006; Kerr, 2006; Rignot & Kanagaratnam, 2006) and to project mean sea level rise of up to 1.4 m or more by 2100 (Hansen, 2007; Rahmstorf, 2007).

Note also the importance of temporal scales in interpreting these impacts. IPCC impacts are stated in terms of long-term trends, e.g., mean temperature increases. A common misperception is that we will experience such changes in a gradual way. But these long-term trends are subject to variability around the norms. Beyond normal variability, climate change variability can be compounded by shifts in the very shape of the frequency/probability distributions of climate variables, e.g., El Niño Southern Oscillation (ENSO) or volcanic eruptions or storms (Schneider, Easterling, & Mearns, 2000; Smit et al., 2000). This type of compounded variability can generate more frequent extreme events, such as more intense hurricanes. The magnitude of impacts will also vary according to the specific characteristics of a region or place. Some regions, for example, are highly likely to experience a temperature increase three times the global mean increase, up to a 6 °C increase. Other regions will experience greater than normal inundations to sea level rise because of land subsidence or erosion.

The major global impacts cited above are too general to help us craft adaptation strategies. In order to design such strategies, we will need to develop regional scale climate change models, with specifics on regional precipitation patterns, coastal characteristics, including land and settlement patterns, geomorphology, water resources, weather patterns, and related variables. Based on such data, regional models could be linked to global climate change models to determine more place-based climate change impacts for a region. Local and regional impact projections are necessary to begin to determine a region’s vulnerability.

In the US, the first nationwide assessment of climate change impacts was initiated in 1997. It sponsored 18 regional assessments, and provided a range of estimates based on two larger-scale models for several sectors of the economy, as well as for large regions of the country: Northeast, Southeast, Midwest, Great Plains, West, Pacific Northwest, Alaska, and the Islands. The assessment concluded that temperature

changes in the US will average 5–9 °F over the course of the 21st century, or 3–5 °C, more than the projected global increase (National Assessment Synthesis Team, 2001). An update to this report, *Global climate change impacts in the United States*, is currently undergoing public review (US Climate Change Science Program, 2009). These reports do not directly address the impacts of climate change on cities. But, to illustrate the inevitability and magnitude of adaptation challenges in the decades to come, let us examine climate change impacts on sea level rise, the type of impact that will directly impact coastal communities and their habitats in the continental US. Titus and Richman (2001) conducted a spatial analysis of coastal areas in the Atlantic and Gulf areas prone to tidal inundations, which was incorporated into the national assessment. Their analysis maps coastal areas in elevation contours. Although this mapping does not take into account erosion and other important variables that could result in a more adequate projection of future shorelines, the 1.5 m contour mapping provides a rough estimate of areas inundated at high tide if the sea rise were to rise by 50 cm. Titus and Richman's research reveals that four states in the Atlantic and Gulf areas will be most impacted by sea level rise over the coming century: Florida, Louisiana, Texas and North Carolina, accounting for 80% of the lowlands, and that, in total, 22,254 square miles (amounting to the areas of Massachusetts, Vermont and Delaware), would be below the 1.5 m contour and at risk of tidal inundation over the next two centuries⁴ (Titus & Richman, 2001: 28). Beyond inundation and outright land loss, other key impacts of sea level rise include: wetland displacement, shoreline erosion, more severe storm-surge flooding, saltwater intrusion into estuaries and freshwater aquifers, altered tidal range in rivers and bays, changes in sedimentation patterns, and decreased light penetration to benthic organisms (McG Tegart, Sheldon, & Griffiths, 1990). These other impacts of sea level rise make it clear why local/regional analyses are crucial for adaptation planning, since tracing the relevant impacts of sea level rise for a community requires local knowledge of wetlands, erosion rates, estuaries, aquifers, river tides, and so on.

⁴ These figures are likely to be adjusted, given more up-to-date studies. The scientific background reports supporting the forthcoming assessment of the US Climate Change Science programme on Coastal Elevations and Sensitivity to Sea Level Rise were released in early 2008 (Titus & Strange, 2008).

2.2.3. *The relation of adaptation to natural hazards mitigation*

The literature of planning for adaptation to climate change is not extensive, has been focused on conceptual issues (Füssel, 2007; Füssel & Klein, 2006; IPCC, 2007b: 749; Smit et al., 2000; Smit & Wandel, 2006), and more recently has begun to document case studies of adaptation practices (IPCC, 2007b: 721–724). As already indicated, the literature shares the research approaches of development studies and disaster risk management. Since natural hazards mitigation planning is a growing research area in planning, in this section we will explore the relation of natural hazards mitigation to adaptation planning.

Natural hazards mitigation planning and planning for climate change adaptation, as indicated, share the conceptual framework of vulnerability assessment. In both fields, however, vulnerability measures are still evolving. In the climate change literature, Füssel and Klein (2006), in a recent review article on vulnerability assessments, argue that vulnerability assessments have been changing to incorporate a more sophisticated approach to vulnerability, moving beyond impact assessment of climate change to vulnerability assessments focused on mitigation, and more recently to adaptation policy assessments. They point out the ambiguities involved in the concept of vulnerability, and identify three main models for conceptualising and assessing vulnerability: (a) the risk hazard framework, the more technical approach which conceives 'vulnerability as the dose-response relationship between an exogenous hazard to a system and its adverse effects'; (b) the social constructivist framework dominant in political economy and human geography, which focuses on social vulnerability and conceives it as an inherent condition of households or communities determined by socio-economic and political factors, clearly emphasising non-climatic factors in vulnerability; and (c) a more integrative concept of vulnerability, such as the concept used in the IPCC's Fourth Assessment Report, which incorporates external and internal dimensions, as discussed in Section 2.2.1. The natural hazards literature is also evolving towards a more integrative framework (McEntire, 2005), but currently the dominant definition of vulnerability is exposure to a hazard. The field also employs the concept of capabilities, analogous to the concept of adaptive capacity (Schwab, Topping, Eadie, Deyle, & Smith, 1998).

Drawing on the distinction Comerio (1998) and others (Olshansky & Chang, in press; Quarantelli, 1999) draw between disasters and catastrophic events, climate change impacts that call for adaptation can be categorised

as either disasters or catastrophic events. Catastrophic events, as compared with disasters, involve major loss of life and damages that test the limits of a region's or nation's response capacity. Based on this distinction, we argue that natural hazard mitigation planning is more pertinent to disasters, which have been the major focus of attention in the field. According to [Olshansky and Chang \(in press\)](#) in their review of research on recovery planning, research on catastrophic events and response to them is a neglected area in the field calling for future research. Research on responses to catastrophic events thus remains pertinent to both climate change adaptation and natural hazards mitigation. Natural hazards mitigation policies have also been reactive rather than anticipatory, although researchers in this area have been calling for more proactive approaches ([Blanco, 2008](#); [Godschalk, Beatley, Berke, Brower, & Kaiser, 1999](#): Chapter 1; [Mileti, 1999](#): Chapter 2; [Schwab et al., 1998](#)). Climate change impacts are systemic, whereas natural hazards are episodic. Natural hazards are typically temporally and spatially limited incidents, which leave the overall system unchanged. Climate change has the potential to change the system, in that the impacts are long-range and spatially broad, either large-scale regional or global. Natural hazards, even when they are catastrophic, can count on the natural conditions returning to a normal or steady state, or on a stable social condition. Some climate change impacts will change what is normal into disturbed conditions, which may remain chaotic and not settle into a steady state for decades or centuries. Climate change impacts are projected to increase the frequency of natural hazards, such as droughts or wildfires, which will put on trial the traditional institutions, practices and financing on which we count to respond to natural hazards or man-made disasters. Another important difference is policy stance. Although, as noted, some researchers in hazards mitigation have called for anticipatory planning, the field of practice is still dominated by a reactive approach and Federal funding provided for anticipatory planning is insufficient⁵ ([FEMA, 2007](#)). In the case of catastrophic climate change impacts, however, waiting until after the effects to take action may prove to be too costly. Based on these differences, the traditional focus, policy mechanisms, and institutions of the natural hazards field are likely to be inadequate to address catastrophic climate change impacts. Planning for climate change adaptations

presents a broader range of research and practice opportunities for the profession.

2.2.4. *The relation of climate change adaptation to sustainable development*

The IPCC Fourth Assessment report ([IPCC, 2007b](#): 811–841) devotes a final chapter to the relation between climate change and sustainability, concluding that:

- Non-climatic stresses, such as poverty, or unequal access to resources, increase vulnerability to climate change impacts.
- Adaptation and sustainable development share common goals and determinants, but sustainability research has not incorporated adaptation concerns, and some development activities could result in increases in vulnerability to climate change impacts.
- Reducing vulnerability to hazards will also tend to reduce vulnerability to climate change, but it will not be sufficient to eliminate all damages.
- Climate change will result in net costs into the future, and these costs will increase over time.
- Climate change will impede a nation's ability to achieve sustainable development pathways.
- Synergies between mitigation and adaptation are highly likely to remain effective until 2050, but even a combination of aggressive investment in mitigation and adaptation measures would be overwhelmed thereafter by climate change impacts ([IPCC, 2007b](#): 813).

As clear from the summary above, the IPCC report balances the opportunities for synergism with the challenges facing the sustainable development and climate change adaptation efforts. The concept of sustainability is holistic, pertains to more than energy and the emission of greenhouse gases, and encompasses economic and social dimensions, in addition to environmental ([Kates et al., 2001](#)). When mitigation was the sole policy aim of climate change science, the sustainability and climate change agenda coincided over energy policy. In effect, the findings of climate change science that warming of the planet is occurring, and that it is very likely that most of the greenhouse gases concentration is due to human activities, makes one of the strongest cases that our development pathway is unsustainable. Climate change findings make a key argument for a sustainable development approach, and reduction of greenhouse gas emissions is a prime goal of sustainable development. Now, however, it is clear that mitigation will not be enough, that even if we carry out the most aggressive mitigation strategy, we will need to

⁵ The federal funding for pre-event mitigation planning and projects in the US was US\$100 million in 2007.

cope with major climate change impacts over this century, and perhaps for longer. Attaining sustainable ways of life in an evolving world is difficult in itself, leading to ongoing debates on what are more sustainable activities and at what scale. But variability in climate change and underlying uncertainties will compound this problem. Climate change impacts throw into question whether sustainable development goals may be achievable.

Since the 1990s, the concept of sustainability has gained popularity in planning (Beatley, 1995; Campbell, 1996; Krizek & Power, 1996; Wheeler, 2004), but the profession has also perceived sustainability as ‘old wine in a new bottle’, more new rhetoric than new substance (APA, 1993), since many of the urban development strategies in a sustainability agenda are just good urban planning policies, e.g., growth management, urban design, environmental protection. A study by Berke and Conroy (2000) seems to confirm this. The authors analysed comprehensive plans for 30 cities to determine whether plans that stated their intent to incorporate sustainable development differed from those that did not, and they found no major differences in the inclusion of sustainability measures between plans that stated a sustainability intent and those that did not. But it is clear that sustainability efforts in urban planning have made more salient the need for efficient use of materials and energy, for example, in the emphasis on green building technology, or alternatives to automobile travel, and have increased our understanding of the factors required to achieve sustainable development, such as access to resources, institutions and governance, and human capital, etc., which coincide with the factors that influence adaptive capacity (IPCC, 2007b: 816). While planning for adaptation shares a risk management framework with natural hazards mitigation, it will also benefit from the holistic framework of sustainable development, its environmental values and the enhanced understanding of the factors that support both sustainable development and planning for adaptation.

2.3. Planning for adaptation

Although economists, engineers and other scientists have assumed the conceptual and analytical roles in the development of climate change mitigation programmes, there is a strong role for urban planning in implementing such programmes. And since such programmes need to be implemented at the local level, planners will play a crucial role in establishing regulatory programmes and standards to reduce fossil fuel energy use

at the land use and building scales, as well as in the transportation sector. Research in climate change adaptation is still in a formative stage, has affinity with an emerging research area in planning, i.e., natural hazards mitigation, involves fundamentally a planning process, and recognises the importance of climate change adaptations in core areas of planning, land use and infrastructure systems. As such, planning for adaptation offers a rich arena for planning research, and not just in the area of implementation. Thus far, however, planning literature directly related to climate change adaptation is very sparse. However, in 1990, Jim Titus from the US Environmental Protection Agency, currently a project manager for sea level rise at the agency, wrote a seminal article in *Journal of the American Planning Association* on strategies for adapting to climate change. He argued for taking anticipatory steps in long-term projects, setting priorities, and undertaking strategic assessments, as well as the need for research, development and education on climate change adaptation (Titus, 1990a).⁶ Since then, a few studies have focused on a specific impact of climate change and its implications for planning, including the urban heat island effect, ground level ozone pollution and climate change (Stone, 2005); adaptation of storm water systems to increased rainfall (Waters, Watt, Marsalek, & Anderson, 2003). In the US, this lack of professional planning focus has not been balanced by federal research on the impacts of climate change on cities and the planning required. In contrast, the European Union has begun to develop an approach to adaptation (2007), and OECD has commissioned a series of studies on climate change impacts on cities (Hallegatte, Henriot, & Corfee-Morlot, 2008; Hallegatte & Patmore, 2008; Hunt & Watkiss, 2007; Nicholls et al., 2008). In this section, we discuss the multiple roles that planners can play in planning for climate change adaptations. To demonstrate this, we use the steps in the planning process model to organise the following discussion.

2.3.1. Planning analysis: The science of climate change adaptation

The first step in the planning model calls for the analysis of a problematic situation and/or problem identification. It is in this step of the planning process that planners typically use scientific frameworks and findings to analyse a problem, although planners, until

⁶ See also Titus's related article dealing more extensively with sea level rise appearing in *Land Use Policy* (1990b).

recently, have mainly employed linear population and economic projections to develop urban plans. Adaptation planning for climate change will need to rely on an emerging interdisciplinary scientific field, which couples human and natural systems and their interactions. While natural hazards mitigation leaves planners as consumers of research by geologists and other scientists, a new science of landscape and land use ecology is emerging, to which planners can contribute (Alberti, 2008; Feddema et al., 2005; Liu et al., 2007; Turner, Lambin, & Reenberg, 2007). This new research field melds science and policy, draws on complexity studies and systems analysis, and identifies vulnerabilities and adaptive capacities.

More specifically, the emergence of this science will be crucial in identifying the regional and local climate change impacts necessary to initiate climate change adaptation plans.

In order to determine the feasibility of adaptation responses at a local or regional scale, global climate change models need to be coupled with regional-scale models that take into account local geomorphology, atmospheric, land use, land cover, and infrastructure systems. There are several regional-scale models that incorporate geomorphology, hydrology, and land cover, but the representation of the human dimension in earth systems models is often too simplistic and fails to fully represent the urban land use and infrastructure systems and the highly heterogeneous urban land cover at the appropriate scales for developing adaptation plans. A major challenge in modelling land cover/climate change and their impacts in urbanising regions is in representing explicitly the human and biophysical processes at a level of disaggregation that allows us to explore the mechanisms linking human decisions and urban patterns to environmental change (Alberti, 1999). Traditional land cover change models are based on average characteristics of the population, households, and businesses as a whole, and cannot capture the fine-scale interactions between the many agents and drivers of land use and land cover change. Many models also assume no relevant spatial and temporal dynamics (Alberti & Waddell, 2000). In reality, the dynamics vary across time and space, and have intrinsic feedbacks and thresholds.

As part of the Puget Sound Biocomplexity Project (NSF funded) Alberti, Morawitz, Blewett, and Cohen (2006) have developed a high-resolution, spatially explicit land use/land cover change model (LCCM) (Alberti et al., 2006; Hepinstall, Alberti, & Marzluff, 2008) that can be coupled with the Puget Sound regional-scale models such as the Distributed Hydro-

logy Soil Vegetation Model (DHSVM) (Cuo, Lettenmaier, Mattheussen, Storck, & Wiley, 2008) and the Weather and Research Forecasting (WRF) model (Mass et al., 2003; Salathé, Mote, & Wiley, 2007) developed by the UW Climate Impacts Group⁷ (Snover & Miles, submitted for publication) to yield the type of high-resolution projections needed for determining local and regional climate change impacts. The LCCM uses a set of spatially explicit multinomial logit models of site-based land cover transitions. The transition probability equations are estimated empirically, as a function of a set of independent variables comparing land cover data at different points in time (presently for 1991 and 1999 in Puget Sound). Results from the implementation of the model in the Central Puget Sound region showed strong predictive skills when validated with independent land use/land cover datasets (Hepinstall et al., 2008). This is one example of emerging coupled models that planning researchers can apply in collaboration with atmospheric and other scientists to develop regional-scale adaptation plans.

In addition to contributing to the science of climate change projections specific to a region, planning researchers can also contribute to the development of vulnerability analyses. Füssel and Klein (2006) trace the evolution of vulnerability assessments in the climate change literature from a concern with mitigation policy to adaptation policy assessments. The questions that such assessments address are: ‘What adaptation policies are needed, and how can they best be developed, applied and funded?’ (Burton, Huq, Lim, Pilifosova, & Schipper, 2002). Unlike assessments focused on mitigation of climate change, which rely on the physical and biological sciences, adaptation assessments focus on economic and social variables in a local development context, are more integrative in nature, and thus are more compatible with current planning expertise.

2.3.2. *The planning process and urban adaptation plans*

Urban planning and adaptation planning can be conducted at various scales, at the community, system or the project scale. The planning process for community-wide climate change adaptations needs to be integrative, strategic, participatory and incorporate innovative ways to manage risk. Integrative across a wide

⁷ The UW Climate Impacts Group is one of only nine research groups in the US that have this regional modelling capability, and not all regions in the US can count on such regional models.

range of physical, biological and social sciences, since climate change models, climate impacts, and vulnerability assessments call for such integration, as we discussed in the section above. In planning practice, this call for integration will require at a minimum incorporating shoreline, watershed and land use and infrastructure planning, including energy planning. To illustrate the need for integrative planning, let us focus on the impacts of sea level rise on coastal areas. In addition to inundations, these impacts include more frequent or intense storm surges, greater flooding potential, and droughts, which will require comprehensive and effective regional land and water resource management along the coastal regions. The Coastal Zone Management Act (CZMA) of 1972, as amended, is the key federal legislation to address coastal issues in a comprehensive, integrated way, recognising state and local roles in addressing coastal issues. CZMA provides incentives and funding for the preparation and implementation of state/local shoreline master plans. Shoreline master plans are major tools for managing extreme coastal region conditions, but these plans are often inconsistent with local land use plans, except in states where consistency between plans is required. Watershed planning is the other major mechanism which many states and local governments use to manage the quality and quantity of their water resources within drainage areas or watersheds. The preparation of such plans is recommended by EPA in the case of ‘impaired’ water bodies—water bodies that do not meet the criteria for their designated use. Watershed plans are often not integrated or consistent with local land use plans, and fail to protect water resources. Adaptation planning thus challenges planning to fulfill its promise of comprehensiveness.

Many cities today have incorporated climate change mitigation measures in their urban plans. These are typically part of a broader sustainable development agenda. For example, the City of Seattle has adopted LEED (a green building rating system) principles in the construction of its public buildings and in its downtown density bonus regulations. Local governments have been slower to respond to adaptation planning. In this respect, King County in Washington State has shown exceptional leadership in developing a county climate plan that incorporates both mitigation and adaptation measures (King County, 2007; Swope, 2007). Based on the impacts projections of the University of Washington’s Climate Impacts Group for the Puget Sound, King County has developed a set of guidelines for incorporating mitigation and adaptation goals into county and city agencies, has identified a set of urgent

adaptation needs, for example, specific water supply pipelines or county roads within or close by floodplains, and is taking steps to improve its capacity to undertake adaptation planning by, for example, entering into a collaborative agreement with the Climate Impacts Group, educating appropriate county staff in climate change science, and raising public awareness on this issue. Although the plan does not include specific implementation steps, its goal of incorporating climate change adaptation considerations in all relevant county plans and projects is farsighted. The incorporation of climate change adaptation concerns in existing guidelines or review processes is referred to as ‘mainstreaming’, in contrast to efforts to create new processes. Mainstreaming climate change concerns is widely advocated to ensure that such concerns ‘become part of or will be consistent with other well-established programmes, particularly sustainable development planning’ (IPCC, 2007b: 732).⁸

On the other side of the country, NYC’s new plan, *PlaNYC 2030* (2007) is an early model of an integrated, strategic plan that incorporates both mitigation and adaptation strategies to climate change and addresses energy, sea level rise and water resources. Again, NYC’s plan benefited from sophisticated regional modelling of the greater New York region. It relied on the Metropolitan East Coast (MEC) Assessment for the New York region (Rosenzweig & Solecki, 2001) that was prepared as part of US EPA’s National Assessment of Climate Change in the United States (National Assessment Synthesis Team, 2001). The MEC was the only of the 18 US regional assessments that was primarily focused on urban issues. In addition, MEC researchers continued to deepen their work on the impacts of climate change in the NY region, including adaptation assessments of the heat island effect (Solecki et al., 2005), heat-wave and ozone-induced health impacts (Kinney et al., 2007), as well as water supply, sewer and wastewater treatment (Rosenzweig et al., 2007). The Climate’s Long-term Impacts on Metro Boston (CLIMB) project modelled the impacts of climate change on the metropolitan area’s transportation, water resources, coastal and riverine flooding, energy and health, and conducted a cost-effectiveness analysis of three response scenarios, including no action

⁸ The King County Climate Plan also emphasises the value of ‘no regrets’ measures. A no regrets climate change adaptation is meant to provide benefits to communities whether anticipated climate change occurs or not, e.g., water conservation and demand management measures.

and early action responses (Kirshen et al., 2004; Kirshen, Ruth, & Anderson, 2008).

In Europe and world-wide, the city of London is a clear leader in planning for adaptation. Its efforts also began as part of a national programme, the UK Climate Impacts programme, geared to promote and coordinate research on impacts of climate change, which led to the formation of the London Climate Change Partnership (LCCP) (Penney & Wieditz, 2007). The Partnership, with great support from Mayor Livingstone, developed downscaling models to generate regional scenarios, and identified options and institutional strategies for temperature increases, flood risks, and water availability (LCCP, 2002, 2005, 2006). In Canada, the Clean Air Partnership (CAP) has undertaken a climate change adaptation programme for Toronto in partnership with the City. In addition to stakeholder workshops, CAP prepared a scan of climate change impacts for the city (Wieditz & Penney, 2006), a study of six major cities' climate change adaptation efforts (Penney & Wieditz, 2007), and a set of options for two areas, the urban forest (Wieditz & Penney, 2007a), and heat, including heat's impacts on health and energy use (Wieditz & Penney, 2007b).

In addition to individual cities' efforts, the IPCC and the literature on vulnerability to climate change have emphasised the importance of stakeholder involvement (Burton et al., 2002; IPCC, 2007b: 141–142) in the planning process, an emphasis consonant with the participatory ethos of planning. Adapting to climate change has irreducible uncertainties, requiring innovative ways to manage risk. Some innovative responses that incorporate strong participatory processes have been developed and are beginning to be applied, e.g., scenario-based and stakeholder involvement approaches, such as that developed by the Urban Ecology Lab at UW (Alberti & Russo, *in press*) and applied to the Pacific Northwest, as well as the robust decision-making approach developed by RAND researchers (Lempert, Groves, Popper, & Bankes, 2006) and recently applied to water resources in California.

In contrast to community-wide planning, planning for climate change adaptation can also be conducted from a functional or sectoral perspective. Transportation, energy, public health, and water infrastructure planners can play significant roles in developing such plans. Several countries, and some regions, are beginning to prepare vulnerability assessments or climate change plans for infrastructure systems. For example, the government of Canada has published a nationwide report on climate change impacts and challenges (Lemmen and Warren, 2004a, 2004b) and a subsequent

2006 literature review described efforts across Canada to assess the vulnerability of infrastructure systems to climate change impacts and adaptation efforts (Infrastructure Canada, 2006). In addition, Waters et al. (2003) examined the impact of increased rainfall due to climate change on typical urban catchments in southern Ontario, Canada, and identified adaptive measures. The Climate's Long-Term Impact on New Zealand's Infrastructure (CLINZI) project is a research project which has begun applying a quantitative model to the infrastructure systems in several cities in New Zealand to determine their vulnerability to climate change impacts (Jollands, Ruth, Bernier, & Gloubieswki, 2007). Water resources, especially in the western US, where precipitation changes due to climate change will have significant impacts, have been the subject of several studies, including Tanaka et al.'s (2006) study of California's water systems, Mote et al.'s (2003) study of the impacts of climate change on the Pacific Northwest's water resources and ecosystems, Payne, Wood, and Hamlet's study of the Columbia River basin (2004), and Frederick's (1997) broader study on water supply and demand. The California Energy Commission has developed scenarios of climate change impacts in California for several sectors, including natural resources, ecosystems, infrastructure, health systems and the economy (Cayan et al., 2006; Hayhoe et al., 2004), as well as studies on the impact of climate change on extreme heat and energy demand (Miller, Jin, Hayhoe, & Auffhammer, 2007).

With respect to the impacts of climate change on transportation systems, the US Department of Transportation (DOT) held an important research workshop on the potential impacts of climate change on transportation (USDOT, 2002), which generated case studies of climate impacts on the transportation systems in the New York Metropolitan Area, the Gulf Coast/Mississippi Delta Region, the Great Lakes, California, Alaska, and the Atlantic Coast. Many of these case studies focused on sea level rise and increased flooding impacts. Since then, US DOT has commissioned two major studies, currently under way:

- (a) A consultant study of how sea level rise and storm surges could affect transportation infrastructure on the East Coast (ICF International, 2007). The first phase of the study identifies impacts on highways and arterials in North Carolina, Virginia, Washington DC, and Maryland, and the second phase will address impacts in New York, New Jersey, Pennsylvania, Delaware, South Carolina, Georgia, and the Atlantic Coast of Florida.

(b) A study of the impacts of climate change and variability on transportation systems and infrastructure focusing on the Gulf Coast (US Climate Change Science Program, 2008). In addition to sea level rise, the impacts of warming effects on permafrost and their effects on transportation have been subjects of concern in Canada and Alaska (Infrastructure Canada, 2006).

Planning for climate change adaptations in infrastructure systems can also be accomplished at the project level. A few such cases have been documented, including the Deer Island sewage treatment plant in Boston. In this case, the location of a sewage treatment plant was changed to a higher elevation to take into account projected climate change impacts. The original site was for a lower elevation, but projected sea level rise would have required a wall around the original site proposed for the treatment plant and this would have required expensive pumping to surmount such a wall (Easterling, Hurd, & Smith, 2004). In addition, communities can ensure that adaptation concerns are addressed in the design of individual infrastructure projects, by incorporating or mainstreaming such concerns in guidelines for project development, such as King County in Washington State is requiring of county projects (King County, 2007).

2.3.3. Identifying and designing strategies

At the stage of identifying alternative strategies in the planning process, a whole array of strategies can be identified and developed for various climate change impacts. For example, for sea level rise, three broad types of strategies have been identified: protection strategies, aimed at protecting land from the sea so that existing uses can continue by constructing hard structures (e.g., seawalls) or using soft measures (beach nourishment); accommodation strategies, whereby people continue to occupy the land, but make some adjustments, such as elevating buildings on piles; and retreat or abandonment strategies, where there is no attempt to protect land from the rising sea (Bijlsma et al., 1996). Identifying strategies also entails an analytic process to unpack the features of alternative strategies.

Continuing with our example of sea level rise strategies: if protection measures, such as dikes and levees, are an option, to what specification should a dike or levee be developed? To the last storm, to predicted sea level rise by mid-century, to the sea level rise projected by the end of the century? But determining the specifications of a levee to adapt to

climate change impacts is further complicated by the variability inherent in climate change impacts and the likelihood of extreme events. Also, protection schemes such as levees or dikes may further disturb ecosystems, such as marshes or wetlands, which may pose their own detrimental consequences. In identifying strategies, in addition, planners must consider their financing. Typically, levees are public projects and publicly financed. Who will bear the costs and through what fiscal mechanisms? Should a special tax or property tax be used? Fiscal means have different distributional impacts that should be considered. Also, what will be the effects of such measures on migration? And then there is the issue of timing such an adaptation, should a levee be constructed after a major flood event or before?

If we consider strategies of accommodation to sea level rise, such as requiring the raising of structures, such strategies may involve changing building codes and zoning to require building on piles in certain areas, as well as raising roads and other infrastructures. How high should the structures be raised, to what specification? When we consider building code changes which apply to new construction, how can we ensure that existing buildings meet the new codes? In this case, some of the costs of the adaptation strategies, e.g., the cost of raising buildings or private utilities, will be private, others public, such as the costs involved in raising government structures, including roads and other infrastructure. How should the revenues to pay for the public costs be raised, through special districts? What about poorer individuals or communities who could not afford such improvements? What arrangements should be made for them? Also, as with protection strategies, accommodations strategies could fail to protect in the case of extreme events.

Managed retreat strategies for sea level rise, such as density restrictions in areas impacted by sea level rise, would provide more protection, but would involve property rights issues, and would probably require public land acquisition or easements (Titus, 1998) at varying costs. At the far end of retreat strategies, a community might consider abandonment of areas threatened with inundation. Such an approach might involve deconstruction of existing settlements and development of new settlements in less vulnerable areas, and require strengthened redevelopment powers to condemn and deconstruct existing development and compensate individuals, to plan and relocate the community out of harm's way, and to finance the plan and relocation.

2.3.4. Assessing strategies

Adaptation strategies need to be evaluated. How should this be done? What are the strengths and weaknesses of traditional assessment methods, such as cost–benefit analysis, cost-effectiveness, or multi-criteria evaluation, when applied to climate change strategies? The *Stern Review* (2006), an influential economic evaluation of mitigation and adaptation efforts conducted for the British government, uses a cost–benefit analysis approach, but has been widely criticised for various reasons, among them the discount rate used, but a compendium of evaluation tools has been identified by the *United Nations Framework Convention on Climate Change* (Stratus Consulting Inc., 1999). A recent OECD report (Hallegatte, Henriet, et al., 2008) develops a conceptual framework for assessing costs and benefits at the city scale. Building on the growing interest for adaptation planning at the city scale, the report outlines a process of economic evaluation which incorporates downscaling socio-economic scenarios as well as climate predictions. Whatever type of method is used to evaluate strategies, methods need to incorporate criteria that take into account interdependencies, e.g., how seawalls will affect marshlands, as well as distributional impacts, e.g., how will the strategies affect poor or elderly people?

Another significant aspect of evaluation is the extent of public participation and support for the selected strategies. Many evaluation methods, including cost–benefit analysis, however, are highly technical, obtain little public input, and because of their technical nature do not get wide public attention. This is why stakeholder or participatory scenario-based forums, which incorporate the evaluation of strategies by large groups of stakeholders, hold such promise. In addition, participatory processes could also include technical evaluation techniques, as long as the participants are educated in the assumptions, mechanics and inputs used in such methods. Such evaluations will be required for expensive climate change adaptation measures, and many planning researchers are equipped to undertake such studies.

2.3.5. Implementation issues

The AR4 report emphasised the importance of further research on ‘the practical, institutional, and technical obstacles to the implementation of adaptation strategies’ (IPCC, 2007b: 804) to improve our understanding of adaptation and adaptive capacity. It indicates that we require ‘a richer characterization of the perception–evaluation–response process at various

levels and scales of decision making, from individuals to households, communities and nations’ (p. 804). In general, implementation issues plague the best of plans. In this section, we explore three key implementation issues for climate change adaptation plans: institutional, financial, and legal.

2.3.5.1. Institutional. Institutional designs and practices can clearly decrease or increase exposure to climate risks. Identifying the institutional mechanisms that can be used for planning and implementing adaptation strategies is an important task. In most cases, these would be existing institutions in charge of planning, water resources, transportation and other relevant agencies. Existing institutions may need to adapt themselves to confront climate adaptation issues. Many public institutions are not very innovative, functioning on standard operating procedures. How can organisational learning be facilitated in these institutions? Since understanding of climate change impacts is relatively new, and particular to a region, institutions first need to learn how these issues will impact the services that they provide. King County’s outstanding efforts on climate change focus on the issue of institutional learning first. Their climate plan aligns the County government with experts in climate science to facilitate this understanding, designates specific staff to become experts in these issues, and sets up processes for staff in various county agencies to learn and incorporate climate change concerns in their activities. Without such institutional learning, institutional inertia is likely to become a prime obstacle to climate change adaptations (Berkhout, Hertin, & Gann, 2006). But some adaptive responses may call for new agencies. Today, the Corps of Engineers is in charge of the relocation of the dozens of villages in northwest Alaska threatened by sea level rise and erosion from storm surges, but the Corps, an institution based on a command and control structure, may not be the appropriate agency for leading community decisions that require a participatory approach. What kind of institutional design would facilitate the task of relocating and developing new settlements for communities threatened by extreme climate change impacts?

In addition, since climate change impacts on cities will require an integrated approach to planning, how can adaptation planning address the existing fragmentation of planning and regulatory mechanisms within cities, where the various urban systems are typically planned and operated by different local agencies, and when the modern metropolis is

fragmented into multiple government jurisdictions, lacking effective metropolitan governance structures?

2.3.5.2. Financial. Research on the fiscal mechanisms for implementing adaptation options, especially some of the protection or retreat options, is needed. What types of fiscal mechanisms could generate funds in a future where energy prices will probably be higher, and in a context where there is an existing deficit in maintaining the infrastructure that we now have. Currently, the American Society of Civil Engineers (ASCE, 2005) estimates that we need to invest US\$1.6 trillion in infrastructure systems over the next five years to bring the systems into good order. One major impact of climate change will be greater precipitation in many parts of the country, which is likely to result in more flooding in many places at high and mid latitudes. In many cities, sewage systems are combined, which is likely to mean more combined sewer overflows (CSO) events, and a heightened need to separate sanitary from storm drainage systems, as well as a need to expand capacity for storm drainage systems. This would add to the US\$1.6 trillion figure. In order to address the magnitude of these investments, do we need a national capital budget such as the ASCE calls for? States and cities typically have budget stabilisation or rainy day funds that provide short-term fiscal cushions. More recently, state and local governments have been exploring emergency trust funds (stormy day funds) (Gullo, 1998). The cost of land acquisition or infrastructure improvements called for by adaptation plans could be financed by a similar type of trust fund. Such a fund could be generated, for example, by a surcharge on property insurance programmes. In addition to government fiscal tools, planning researchers could also address the roles of insurance and markets in adaptation plans (Ward, Herweijer, Patmore, & Muir-Wood, 2008).

2.3.5.3. Legal. The expanded use of regulatory tools to adapt to climate change is advocated in the IPCC assessments. Urban planners are the experts in the use of land use planning tools, but the expanded use of such tools, for example, the expansion of protected areas due to changes in floodplains or sea level rise, may be contested in courts, given the current legal climate, especially in the US Supreme Court. There is

also the issue of how to deal with existing land uses in areas that are vulnerable to climate change impacts. Adaptation measures will require more vigorous use of planning and regulatory powers, but in order to exercise these public powers, legal issues related to the interpretation of police power, the public trust doctrine, and takings may also need to be addressed.⁹ In effect, adaptation is likely to require strengthened police and public trust powers at a time when the creative tension between individual property rights and public powers are tilted in the courts towards property rights. What kind of legal mechanisms or reasoning could be useful to bring about a more appropriate balance at a time when we face adaptation challenges?

2.4. Conclusion: Opportunities for the profession

Climate change will be increasingly experienced over the 21st century. Societies throughout the world will either choose to wait and react to climate impacts, or plan ahead to adapt to changing conditions. The planning profession can play a vital role in every aspect of adaptation planning, including:

- Contributing to the emerging science with land use and land cover at its centre.
- Entering into collaborative research with climate science experts to develop regional climate impact models.
- Designing and facilitating community and stakeholder participatory processes to develop the political will to make planning choices.
- Identifying and developing alternative adaptation strategies.
- Evaluating adaptation strategies.
- Contributing research and solutions to the implementation challenges ahead.

As a profession dedicated to the public interest, in developing a research agenda for climate change adaptation, we can lead our communities to plan and act on two fronts: mitigation to avoid the worst possible scenarios in the long run, and adaptation to respond to already apparent and projected climate change impacts.

⁹ See Titus (1998) for a promising regulatory mechanism, 'rolling easements', which are meant to address both property rights concerns and climate impacts. But success of rolling easements depends on stable changes in sea level rise and fails to deal with the issue of climate variability.

Chapter 3. Non-motorised travel research and contemporary planning initiatives

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3.1. Introduction

As nations and communities across the globe wrestle with traffic congestion, depleting non-renewable resources, the threat of global warming, increasing obesity, and decreasing quality of life, the automobile is often targeted as a primary culprit for such problems. Disciplines from public health to architecture, sociology to civil engineering are re-evaluating the means by which people transport themselves, not just within central cities but also in suburban areas and beyond. Such discussions have increasingly turned to non-motorised travel (hereafter NMT), particularly walking and cycling, as a means to address myriad issues.

Despite a growing body of literature touting the merits of NMT, researching their determinants, and conjecturing about secondary benefits, much remains unknown. What individual and environmental factors spur increased use of these two travel modes? Are the factors similar or different? To what extent? Under what circumstances? What policy concerns can increased walking and bicycling help remedy? Where are their empty promises? Overall, the enthusiasm generated over NMT has created a need for evidence on the degree to which different policies have succeeded in inducing walking and cycling travel and producing other benefits for the community.

This chapter identifies the increasing research and policy relevance of NMT for the general population, determines gaps in the evidence, discusses planning implications, and helps set an agenda for future research. This chapter has three parts: (a) explaining why walking and/or cycling are rising in prominence among urban planning issues; (b) distinguishing between walking and cycling; and (c) identifying research opportunities from the current knowledge base while outlining how research on non-motorised issues could best be positioned in the future. The issue of liveability, while difficult to define, is probably the most robust justification for increasing use of, and research on, NMT.

3.2. Rise and prominence of walking and cycling issues

Research and attention to NMT is burgeoning, with widely varying motivations (see Table 1). Some professions and disciplines (e.g., traffic engineers) have had long interest in looking at these matters; others are relative newcomers (e.g., public health). Some professions see NMT as creating problems; for example, safety conflicts between motorists, cyclists and pedestrians. Others, such as environmentalists and public health officials, see NMT as a solution. Still others see NMT as representing a desirable state of affairs, embodying vibrancy and vitality in city streets. For many, NMT is a means to reach a set of ends, some unsupported or weakly supported by research; these ends range from reducing car use and non-renewable energy consumption to increasing social cohesion and population health.

In addition to those described in Table 1, other groups include landscape architects; parks and recreation planners; educators; activists; local politicians; and decision-makers who champion NMT. For example, trail advocates aim to increase off-street networks, primarily for cycling. While recreation was an early focus of trail advocates, funding priorities from departments of transportation and a desire to meet the needs of low-income populations has meant increased emphasis on trails that serve travel purposes. Advocates and other neighbourhood groups interested in traffic calming and other street designs that promote liveability, such as complete or shared streets, view NMT as a central building block for the success of such initiatives.

We identify four predominant motivations for promoting NMT—congestion, environmental conservation, health and liveability. They provide the focus for much current professional and activist concern about NMT, and explain the increasing attention that the topic is garnering. We address each motivation below, recapping its relationship with NMT, how NMT is slated to help, and the limitations of NMT to effectively or comprehensively address issues within this policy area.

3.2.1. Traffic congestion

In most, if not all, urban areas traffic congestion is perceived by residents and businesses as a problem. Although an often glossed over benefit of vehicular congestion is urban vibrancy and vitality (Taylor, 2002), concerns about productivity losses and harmful emissions that ensue are paramount. From London to Lagos, residents of cities lament traffic volumes, the accom-

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Table 1
Interest in NMT, by profession/discipline.

Group	Concern(s)	Predominant prescription	Key references
Traffic engineering	Focused on improving vehicular flow, measured in terms of speeds, delay and level of service, while attaining safety standards. Mixing travel modes is often seen as confusing and unsafe, with pedestrians and/or cyclists competing for the same travel space with cars (although there is increasing concern about pedestrians and cyclists competing for similar thoroughfares)	Separate facilities for different modes of travel	Forester (1982, 2001) and Pucher (2001)
City planning	Seen as a way to address congestion and liveability. Increasingly aware of urban development actions and local policies that can support or hinder NMT. Emerging interest in bicycles, as these require more specific infrastructure than pedestrians and in the hazard-related evacuations for those without cars	More compact urban form, bringing origins and destinations closer together, 'complete streets', but sometimes separate facilities for different modes	Popular in Europe and Australia as a planning goal; see review of British policies (Williams, 1999); and Dutch policies (Schwanen, Dijst, & Dieleman, 2004)
Urban design	Interested in street life. People walking along the streets are key to creating vibrant public areas at a human scale. Little concern with cycling	Eyes on the street to create vibrancy and vitality. Aesthetics is also key	Lynch (1962), Appleyard and Lintell (1972), Alexander et al. (1977), Appleyard (1981), Lynch (1981), Gehl (1987), Whyte (1988), Jacobs (1993), Southworth and Ben-Joseph (1997)
Environmental studies and advocacy	Concerned with the environmental impacts and sustainability of contemporary urban areas and prevailing travel patterns	NMT can be make cities more sustainable by achieving reductions in the use of non-renewable energy sources, carbon emissions, impervious surface cover, while improving air quality	Campbell (1996), Newman and Kenworthy (1999), Beatley (2000), Berke, Godschalk, Kaiser, and Rodríguez (2006) and Wolch (2007)
Public health	Interested in environments supportive of healthy lifestyles (mostly physical activity and access to healthy foods) and potential for environments to address health concerns. Somewhat interested in physical access to health-related destinations, particularly for those without cars	Providing for built environments supportive of walking and cycling, ranging from mixed use to mode specific infrastructure. Also include educational/programming campaigns	Handy et al. (2002), Frank, Engelke, and Schmid (2003) and Frumkin, Frank, and Jackson (2004)

panying noise from cars and trucks, and the attendant environmental effects (examined below under environmental conservation). The time spent in traffic congestion is often viewed as wasteful; in the US it is a barometer the Texas Transportation Institute measures in its annual mobility report (Schrank & Lomax, 2006). Rapid increases in vehicle ownership in many cities in Asia or India (Dimitriou, 2006; Gakenheimer, 1999; Pucher, Peng, Mittal, Zhu, & Korattyswaroopam, 2007; Sperling & Clausen, 2002) accompanied by the emerging interests of industrial

conglomerates in producing a truly popular car that will result in mass motorisation, promise to keep vehicular congestion as a primary motivator for NMT research.

A primary argument in favour of NMT over cars relates to space. A normal-sized car with a single passenger (the driver) consumes, on average, 107 ft² while static (assume the auto is 16.5 ft long and 6.5 ft wide). A static bicycle requires 15 ft² (5 ft × 3 ft). Fruin (1971) suggests a static pedestrian requires 3.2 ft² (1.64 ft × 2 ft). These dimensions increase once set in motion (i.e., moving cars require braking distance, etc.),

dramatically so for higher speeds. Given limited space for movement (e.g., a road) cars require the most space. Fitting too many cars into too little space results in traffic congestion. Walking and bicycling therefore fit many more travellers into available space and result in less overall congestion, at least for autos.

Given auto driving, there are several technical and pricing policies to address auto congestion concerns. People could use smaller cars, policies could restrict car use during certain peak hours, as in Bogotá and Mexico City, intelligent transportation systems could space cars better or provide timely information to travellers, or pricing could moderate congestion, as in London or Singapore. However, some propose alleviating auto congestion by diverting short trips from autos to transit, walking and bicycling.

The auto is so extensively used because of the convenience it provides for relatively long travel distances; the average length for a trip in the US is 10 miles (Hu, 2005). Prevalent urban development patterns, with increasingly distant origins and destinations, require motorised modes. Long trips tend to be related to work purposes and therefore occur during few hours of the day (the a.m. and p.m. peak periods) and must rely on limited road facilities. Short trips, such as shopping and school-related trips, rely more on neighbourhood streets, with usually less congestion.

Bringing origins and destinations closer together by increasing density or mixing land uses may help spur NMT (Apogee Research, 1998; Ewing, Pendall, & Chen, 2003). However, the efficacy of land-based strategies to address auto use and congestion has its sceptics (Downs, 1999). Empirically, fairly large increases in density would be required to observe decreases in trip lengths (Giuliano, 1995; Ewing, Pendall, et al., 2003; Schimek, 1996), while others have suggested that trip distances (Levinson & Kumar, 1997) and VMTs (vehicle miles travelled) may increase with density (Rodríguez, Targa, & Aytur, 2006). As a result, travel modes that can better cater to longer trips should receive more attention than those serving short trips for congestion relief. Bus and rail transit are natural front-runners, but cycling could compete in some markets. Improving access to transit by non-car modes can be a promising strategy to shift long trips from automobiles to mass transportation, while decreasing some of the auto's deleterious impacts. Under such reasoning, NMT's contribution to congestion relief appears most promising when viewed as an enabler for other transportation modes.

Claims that significant modal shifts can reduce congestion assume that people who would normally be driving would switch to NMT. Vehicular travel currently

comprises 89% of all trips in the US, walking 8%, and cycling a mere 0.8% (Hu, 2005). Doubling the number of NMT trips—a dramatic increase—means that almost a combined 20% of all trips would be by walking or cycling. The differences that would be noticeable from such a change would most likely be detected in parking requirements (again, bicycles require much less space for storage and pedestrians require no storage), and probably would not be detected in congestion reduction. Thus, advocates who tout the merits of providing for NMT as a means to address congestion face a difficult challenge, given the magnitude of the change that would be required to produce substantial improvements.

3.2.2. *Environmental conservation*

While congestion creates productivity costs and may be a daily irritation for many, a variety of environmental problems also stems from excessive motorisation. Most vehicles still rely on fossil fuels. These have well-known costs, including localised air pollution, contributions to global warming, and a role in promoting geopolitical strife. While electric cars, hybrids and even vehicles relying on bio-diesel are growing in numbers, they still use carbon-based sources of energy. However, the environmental effects of motorisation in Asian and other developing cities suggest that impacts of auto use will also be a motivator for NMT research and policy.

A major move back to non-motorised modes, some propose, would circumvent emerging environmental problems. A classic article by Lowe in 1989 highlighted the bicycle's advantages in decreasing the overall footprint for transportation-related services (Lowe, 1989). Such ideas, namely that NMT epitomises environmentally benign travel, have been most popularised within the urban planning literature by Newman and Kenworthy (1989, 1992), correlating energy use and density for 30 cities around the globe. Similar relationships have been identified elsewhere (Banister, Watson, & Wood, 1997; Rickaby, 1987). This research highlights the link between urban form (namely density) and consumption of natural resources, thereby suggesting a role for NMT in environmental conservation.¹¹ Many claim such dense cities can be sustainable or green cities (Beatley, 2000).

¹¹ It is important to mention that the Newman and Kenworthy work provoked many critics and subsequent questions. A cursory glance at tables shows that cities with similar densities have vastly different energy use and there are obviously many factors at play apart from city form—policy, pricing, culture (Gordon & Richardson, 1989).

The high-density, low-energy, NMT-supportive city is not the only vision of the green city. Dating back to the 19th century suburban developments and the work of Ebenezer Howard, some have proposed a lower density, visibly greener version that is more spread out. This allows other environmental and social benefits, such as water infiltration and access to nearby nature (Calthorpe, 1993; Calthorpe & Fulton, 2001; Hall & Ward, 1998). This is the vision favoured in some urban development circles, and by professions such as landscape architecture (Arendt, 1994, 1999). In the more polycentric and compact ‘garden city’ version of this approach, walking and cycling are modes that support trips for daily sustenance like shopping and recreation within each node of development. Adequate transit access is needed to connect nodes.

Urban patterns alone, however, do not appear to be enough to change behaviour to achieve a sustainable city. Reaching such environmental sustainability requires a combination of changes—ranging from urban form, to pricing and cultural expectations. Spatial structures of a given city matter, but so do relationships across cities. Consumption and production nodes now have global links, requiring freight transportation and long distance journeys dependent on fossil fuels, and that cannot be substituted by NMT modes. These intra-city and inter-city relationships raise questions about the feasibility and complexity of the sustainable city.

3.2.3. Health

A major impetus for NMT over the past half dozen years has come from the field of public health, in efforts to address decreases in physical activity and concomitant increases in obesity, cardiovascular disease and diabetes. An individual’s weight is a function of energy consumed in food minus energy expended in physical activity. The increase in weight may therefore be due to an increase in energy intake (food), a decrease in energy expenditure (physical activity), or some combination of the two. While weight is a factor in a number of diseases, such as coronary heart disease and diabetes, physical activity is independently associated with these and other health problems (Spanier & Marshall, 2006; Warburton, Nichol, & Bredin, 2006). Increased use of NMT could be part of the solution to counteract people’s sedentary behaviour—some think a major part. Both forms of NMT require human propulsion, which help address matters of human energy balance.

A predominant hypothesis at the onset of recent health-related research was that a decrease in walking for utilitarian purposes (both the commute to work and other

routine walking) was a major culprit for observed increase in weight (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003). Bicycling was not seen as important, because of the low numbers of cyclists relative to walkers. If true, the policy solutions that would result were obvious. However, lacking reliable longitudinal data on physical activity as a whole, or walking and cycling—with the exception of the commute to work—it is difficult to examine this hypothesis.

A number of studies have, however, shown that walking for transportation seemed to be higher in locations with higher densities, mixed uses, connected street patterns and supportive pedestrian-oriented design features (Cervero & Kockelman, 1997; Frank & Pivo, 1994; Handy, 2005; Saelens, Sallis, & Frank, 2003; Steiner, 1994; Transportation Research Board, 2005). The focus of this research was a carrots approach, making the built environment more supportive of walking. By contrast, urban planners point out that making motorised travel more expensive and difficult could also be an effective way to shift travel to non-motorised modes—a sticks approach. Other studies have found that making parking difficult or having no access to cars can increase transportation walking or moderate physical activity (Dombois, Braun-Fahrlander, & Martin-Diener, 2007; Forsyth, Oakes, Schmitz, & Hearst, 2007; Rodríguez, Khattak, & Evenson, 2006). Furthermore, the evidence suggests that some environments also support walking for recreation, but these tend to be different from the environments that support walking for transportation (Forsyth et al., 2007; Giles-Corti et al., 2005; Hoehner, Ramirez, Elliott, Handy, & Brownson, 2005; Lee & Moudon, 2006; Rodríguez, Khattak, et al., 2006). A small amount of work has examined whether different kinds of people—e.g., the healthy, those with children, different ethnic groups—walk more in specific areas, but results are mixed and more study is needed (Forsyth et al., 2009). Discerning how different environments play roles of varying importance as supports and barriers of various types of walking is a promising line of research.

The growing debate is about how much of the higher rates of walking observed can be attributable to the environment itself, or to the selection of people who like using NMT in environments that provide some support, so that the environmental effect is magnified by personal preferences, termed self-selection (Krizek, 2003a, 2003b; Cao, Handy, & Mokhtarian, 2006; Handy, Boarnet, Ewing, & Killingsworth, 2002). To some extent, this sorting by environmental preferences is precisely what planners would like to achieve, particularly in areas where environments that support

walking are lacking, due to planning constraints. However, the importance of isolating the impact of residential sorting on observed walking behaviours from the environmental impact itself is still important. If findings of people walking more in certain places are mostly due to their preferences and self-selection, and there are enough environments that such people find supportive to fulfil their needs, then creating more such environments will probably have little effect.

Beyond walking, the more ambiguous findings stem from studies assessing NMT in relation to overall physical activity.¹² One reason is that outdoor walking makes up perhaps 15–20% of physical activity (Forsyth et al., 2007). Another reason is that individuals can substitute physical activity in one location for physical activity in another location, depending on the presence or absence of walking supports (Krizek, Birnbaum, & Levinson, 2004; Rodríguez, Khattak, et al., 2006).

3.2.4. *Liveability*

Congestion, traffic jams, car costs, air pollution, ugly freeways and bare parking lots waste time and money, cause daily irritations, and limit the pleasures of living in cities. In suburban environments, many lament the need to get in the car for simple errands. Parents' need to chauffeur children between activities is seen as a burden; the lack of face-to-face interaction and subsequent decline in social capital has been mentioned as a drawback of the lack of NMT as well (Duany, Plater-Zyberk, & Speck, 2000).

In contrast, the 'success' story in almost all city planning initiatives is a 'walkable' area, with an array of shops, perhaps a hardware store, outdoor cafes, a library or post office, and an interesting mix of houses and people. Not all are high income; some are more modest working class areas. City planners boast about the new transit stop with easy access and egress to an array of employment opportunities. Public works officials may quickly point to a new bicycle trail that now connects two formerly separated areas. Landscape architects relish the enhanced aesthetics brought by the new public garden established adjacent

to the walking zone. Do any of these benefits directly counter the problems of congestion, environmental conservation or public health? Not likely. In contrast, they claim to enhance the overall experience—either directly or indirectly—of life in cities.

It is argued that walking and cycling, and cities designed for these modes, can help increase the liveability of urban areas and some residents are willing to pay for the presence of such facilities (Krizek, 2006). If social capital has been flagged in the social science literature as an elusive concept to define and measure (Portes, 1998), liveability proves even more elusive (Hortulanus, 2000). Compact, walkable and bikeable, urban forms can allow urban dwellers to conduct their daily affairs without the need of driving. They can mean that non-drivers—mainly children, older people and people with low incomes—are put on a more equal footing with motorists. Money previously put into road and transit investments can be redirected to housing, education, health and recreation. Physical activity can be gained doing normal daily activities, saving trips to the gym for those who dislike such things (Calthorpe, 1993; Duany et al., 2000). Together, such urban forms support the quality of life of urban dwellers.

Despite its challenges with respect to definition and measurement, liveability appears to be the strongest policy argument for NMT (Levinson & Krizek, 2008: 210). It has intuitive appeal for voters and decision-makers.

3.3. *Importance of considering walking versus cycling separately*

Conventional thinking about walking and cycling typically considers them jointly. The above narrative suggests that the central motivations for these modes share similar ground and other reasons make sense as well. Combined, walking and cycling represent less than 10% of all trips in the US. In addition, they share many similarities as described below:

- **Energy source:** both modes are human powered and are considered environmentally benign. Most people in developed countries eat more than enough to provide this energy and are even trying to manage potential weight gain. The energy source may even save money (i.e., relative to health club memberships).
- **Exposure to the environment:** both modes require more direct exposure to environmental conditions than transit or auto. Rain and cold weather are deterrents for such travel, because they require having the right attire or protection.

¹² Studies include those with a pre-post design related to building a facility (Evenson et al., 2005; Merom et al., 2003). Others look at overall physical activity or total walking using a cross-sectional design have had mixed results, the majority finding significant effects on travel walking but not on overall physical activity (Forsyth et al., 2007; Frank, Schmid, Sallis, & Chapman, 2005; Jago, Baranowski, & Baranowski, 2006a; Jago, Baranowski, & Harris, 2006b; King et al., 2005; Rodríguez, Khattak, et al., 2006; Rodríguez, Targa, et al. 2006; Rutt & Coleman, 2005).

- Regulation: walkers and cyclists are subject to regulations, but typically do not need to be licensed. This means that the age range for participating is wider than that for driving motor vehicles.
- Purpose: both cyclists and walkers may use the mode for transportation (to work, on errands, at work) or for recreation (for exercise, relaxation). Many people combine the two. While this chapter focuses on transportation uses, it is sometimes difficult to distinguish purposes.
- Burden to carry goods: both modes have limitations in the bulk and weight of goods that can be transported. While such concerns can be addressed to some extent, the casual user may fear being stranded.
- Marginalisation: both can be seen as marginal modes, until recently undercounted in traffic statistics and rarely emphasised in transportation planning.
- Social interaction: because both modes are not enclosed, it is possible to interact socially with other cyclists and pedestrians (Oregon Department of Transportation, 1995).

Such similarities are important to realise. Considering the modes in a combined sense helps make a stronger case for incorporating them into planning, including the important dimension of increased funding. The bulk of available NMT research, and certainly the policy attention to date, has considered the two modes jointly. Considering them together also strengthens coalitions of interests brought together around NMT topics. Local and regional planners, health agencies, advocacy groups and a variety of researchers have coalesced around NMT as a topic of interest. NMT is no longer solely the purview of engineers, designers and planners. This has translated into additional governmental and non-profit funding for NMT projects and assessments.

From the perspective of both practice and research, however, aggregating proves troublesome. For planning purposes, walking and cycling demand different infrastructure; for research, the behaviours of walkers and cyclists are wildly disparate and demand different planning responses. It is likely that future research will consider walking and cycling independently, and below we recount why it is important to do so.

With few exceptions, all trips, regardless of mode, start and end on foot. When combined with other trips, pedestrian trips are usually short, often no more than a few city blocks (as their own trip). Pedestrians are sensitive to distance and will take short cuts where available, even if these are not designed as such. Most importantly, the factors that may influence the choice to walk for travel are likely to differ from those that

influence cycling. For example, the attractiveness of the route (e.g., interesting facades, a variety of architecture, the absence of long, blank walls), variety of route choices, pedestrian safety, and the number of destinations within a walkable distance (e.g., work places or close-by stores) may affect an individual's willingness to walk for transportation (Forsyth, Hearst, Oakes, & Schmitz, 2008; Hess, Moudon, Snyder, & Stanilov, 1999; Humpel et al., 2004). Until recently, the literature on the walking environment has been dominated by urban designers (Gehl, 1987; Jacobs, 1993), with a sprinkling of technical manuals (Zegeer, 1995).

By contrast, bicycle trips traverse longer distances at higher speeds than pedestrian trips, requiring longer corridors (such as wide curb lanes and on-street or off-street bike paths). Bicycles frequently are considered street-legal vehicles for most local roadways. The bulk of bicycle trips, at least in the US, are discretionary. Whereas most travellers can walk, bicycling applies to a considerably smaller market of travellers. Cycling equipment must be stored when not in use. Furthermore, not everyone owns or has access to a bicycle. During the summer months in most of the US, the cycling market includes just over a quarter of the American population, but there are far fewer year-round cyclists using this mode for travel rather than recreation (Bureau of Transportation Statistics, 2003). Bicyclists who share the road also have unique safety concerns, dealing with the close proximity of autos speeding by, for example. The literature on cycling has been more integrated with general transportation plans, with some manuals for facility design (Forester, 1994; Hudson, 1982). We provide Table 2 to describe such differences between the modes in more detail.

When directly comparing the differences between walking and cycling, the two modes are more different than they are similar. Such differences underscore two points. First, they suggest that any attempt to fully understand the behaviours of pedestrians versus cyclists needs to do so using different conceptual models; the behaviours are too different. As discussed below, even within each mode, the behaviours for different trip purposes warrant different approaches. Second, efforts to account in detail for walking and cycling in future planning applications also need to do so under different banners; the infrastructure requirements and environmental supports for each vary too much.

The differences between NMT modes serve to set up many of the future research needs as they apply to walking and bicycling. The third part of the chapter turns to discussing voids in the existing knowledge base and describing future streams of research that are needed.

Table 2
Key differences between walking and cycling.

Dimension	Specific to walking	Specific to cycling	Key differences
Participants	Almost everyone except some with mobility impairments	There are at least three different types of cyclists ^a : A (Advanced), B (Basic), and C (Children)	Cyclists demand more specific environments, depending on participants or purpose; they also require heightened physical skills (e.g., balance) ^b
Range/scale	Local walking, mostly up to a mile in length. The average trip length is 1.2 miles and between 47% and 60% of walking trips are less than 0.5 miles. Recreation and work trips tend to be longer	Local and regional cycling. The average trip length is four miles and 57% of cycling trips are less than two miles	Cyclists travel much further
Speed	Depends on the purpose of trip, but ranging from 1 mph (dawdling) to top speeds around 4–5 mph for more active walking	Usually range from 8 mph to 20 mph	Cyclists travel much faster
Infrastructure	Infrastructure requirements for safe use include sidewalks and perhaps paths that are often preferred, particularly for children	Can share roads with cars, though with safety issues; lanes and paths are options; need infrastructure at destinations (parking, showers)	Cyclists require more infrastructure at destinations (e.g., parking)
Infrastructure planning responsibility	Local land use planners, and transportation planners; also considered in subdivision layout and urban design	Engineers and transportation planners responsible for on-road infrastructure; parks and recreation planners for off-road infrastructure	Responsibility does not always coincide, making coordination more difficult
Trip purpose	Transportation (including accessing other modes, e.g., parked cars, transit) and for recreation travel	In the US, a clear majority of bicycle trips are for reasons related to exercise, health or recreation; cycling for transportation often plays a stronger role in many other cultural settings	Cycling primarily viewed as a recreational activity, at least predominantly in the US
Safety concerns	Crime (real and perceived); safety from traffic at crossings and on streets without sidewalks	Safety from traffic, particularly in narrow streets and at intersections with roads	Pedestrians tend to be more concerned about avoiding areas of high crime; bicyclists' prominent safety concern often stems from automobile traffic
Key barriers	Distance or perceived distance? Safety from crime or traffic	Distance. Safety from traffic. Cost of equipment?	
Interface with automobiles	Mainly at intersections, but also any locale without sidewalks	Bicycles are often perceived as unwanted distractions in existing roadway space; conflicts also occur where trails intersect with streets	Cyclists often perceived to be competing for limited roadway space with automobile drivers
Interface with transit	Focus on the area around bus or LRT stops to make them pedestrian accessibility and attractive for walkers	Require front racks or other means to accommodate bicycles. Requires parking at transit stops	Cyclists are more cost prohibitive to account for

Sources for table: Oregon Department of Transportation (1995), Forester (1994) and Zegeer (1995); statistics from US Department of Transportation (2002) and Bureau of Transportation Statistics (2003).

^a Class A cyclists are generally considered to be experienced riders who can operate under most traffic conditions. Class B cyclists are the casual or new adult and teenage riders who are less confident of their ability to operate in traffic without special provisions for bicycles. Some will develop greater skills and progress to the advanced level. Class C cyclists are pre-teen or other riders whose roadway use is initially monitored by parents or avoided.

^b Oregon Department of Transportation (1995: 36).

3.4. Specific issues requiring further research

The existing literature on NMT is vast; it can also be remarkably specific, depending on the topic being

addressed. We definitely know a lot more about walking and cycling than we did 25 years ago, and even five years ago. However, like many research topics, the increased knowledge allows us ask more precise questions.

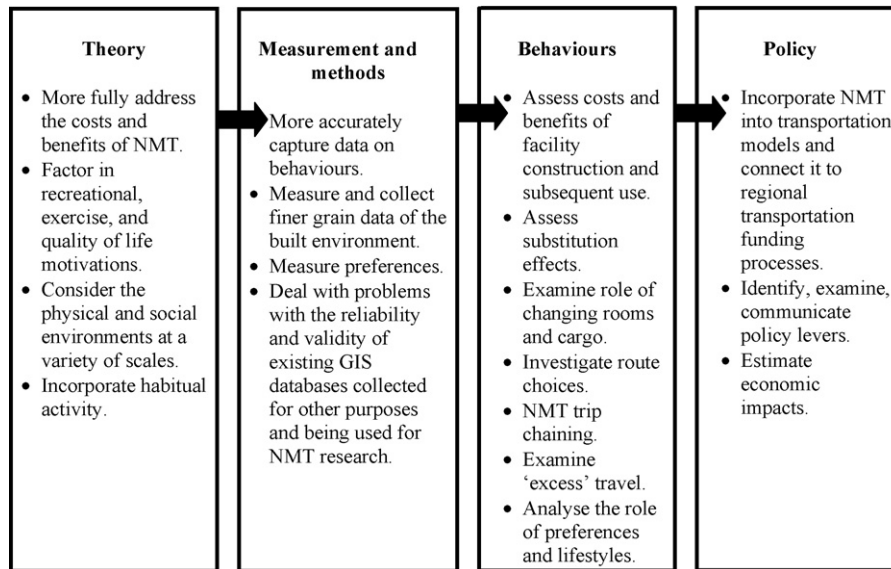


Fig. 1. Overview of future needs of NMT research.

After a flurry of work on walking and cycling there is a need to revisit many fundamental assumptions and ask some basic questions. An advantage now is that such questions can be asked at a far deeper and more specific level than they were previously, given the deeper knowledge now available.

This final section focuses on important and outstanding questions to help frame the next generation of NMT research. Spanning multiple disciplines and issues we position NMT—and the impact it can have—against the larger context of research relating to urban planning and transportation. Our discussion below, as depicted in Fig. 1, addresses the need to:

- tackle theoretical underpinnings and conceptual models,
- account for different measurement and methods,
- better understand specific behaviours of the modes, and finally,
- craft more precise messages for policy.

3.4.1. Theory

The behavioural and social sciences provide several theories to model and predict human decision-making. The goal of almost all theory is to help explain some outcome (behaviour) as a function of some inputs (variables), proposing some relationship between them. However, a major shortcoming is that existing NMT research is guided by relatively general theory. For example, common measures of the built environment (e.g., density) are often correlated with bicycling

and walking, and even different purposes of NMT-type trips. This is problematic because different purposes of walking or cycling are likely to be driven by different factors. A recreational cycling trip should be theorised to be prompted by a different set of built environment features from a utilitarian walking trip, demanding different types of theories. We discuss the value of different theories below as they generally relate to predicting NMT use.

Economists developed the concept of utility based on the general proposition that people make decisions to advance their self-interest. People prefer alternatives with higher utilities—an unobservable characteristic derived from the attributes of the choices available. The utility maximisation framework has enjoyed widespread use in predicting travel choices, mainly driving versus using transit, reflecting what is referred to as the generalised cost of travel.

Alternatively, social learning theory proposes that by 'observing others, one forms an idea of how new behaviours are performed, and on later occasions this coded information serves as a guide for action' (Bandura, 1977: 22). The theory suggests that outcomes occur as the result of an individual's behaviour and that individuals then expect similar outcomes to occur in the future in response to the same actions (Transys-transportation, 2007). A different approach, the theory of planned behaviour (Ajzen, 1988, 1991), focuses on the role of different types of beliefs in explaining behaviour. Behavioural beliefs ('What will result?') contribute to people's perceptions of possible outcomes

weighted by an evaluation of those outcomes. Normative beliefs ('What would other people think?') consider the reactions of referent individuals weighted by an individual's motivation to comply with those referent individuals. Control beliefs ('What else would facilitate or constrain this behaviour?') suggest the user considers an array of factors which may advance or inhibit the behaviour and these are weighted by the perceived power of each factor.

Each of these cognitively oriented theories, however, gives little attention to the role of the physical environment (as opposed to the social environment) (King & Stokols, 2002). By contrast, more recent models are being used in physical activity research within the field of public health, providing useful conceptual frameworks to study NMT (Northridge, Sclar, & Biswas, 2003; Sallis & Owen, 1997). For example, the ecological framework suggests that factors operate at multiple levels to influence individual action. It distinguishes between individual, social-environment and physical environment factors in explaining individual behaviour. Individual factors include attitudes, preferences and beliefs, as well as confidence in one's ability to engage in the behaviour (a concept called 'self efficacy' in the field of public health). Social-environment factors include the cultural norms of the community, as shown by the collective behaviours of its residents. Physical-environment factors refer to the type of land use patterns, urban design features and transportation infrastructure. According to this model, NMT is likely to be influenced by individual preferences for NMT, the culture of the community towards NMT, and the degree to which infrastructure and land use patterns are supportive of NMT. It may further specify a community context that refers to different levels of the physical environment, from the micro-scale (e.g., the home), to the meso-scale (e.g., the neighbourhood), to the macro-scale (e.g., the region and beyond) (King & Stokols, 2002). The ecological model helps researchers discern factors that can be more easily modified by policy at different scales (e.g., physical features of the built environment and parking policy) versus individual factors (e.g., more likely influenced by education programmes or not modifiable).

Juxtaposing these theories and modelling approaches with the similarities and differences of walking and cycling suggests that we require more complex and comprehensive models that include a variety of behaviours and motivators. For research relying on ecological models, it is important to introduce generalised costs (monetary and non-monetary) as a characteristic of options that can guide individuals' behaviour. By

necessity, this also introduces the idea of substitutes—the possibility that other behaviours could (not) be chosen because the perceived cost of a given behaviour is deemed too high (low). In practice, accounting for the possibility that a cycling improvement may attract former walkers provides behavioural realism and theoretical soundness.

For transportation planning, theoretical improvements could involve incorporating more subtle psychological and behavioural issues to account for the interconnections between NMT for leisure and for recreation. Many pedestrian or cycling trips that can be seen as involving transportation also involve elements of recreation or exercise. This means that calculating the costs and benefits of a trip is made far more complicated, because the benefits calculation may include the benefits of exercise or recreation—or even travelling for the sake of travelling (Mokhtarian, 2001; Mokhtarian & Salomon, 2001)! This is an insight that has been at the base of much writing on urban design—that people want to be out and about and will walk to enjoy places. Similarly, both recurrent travel choices like the trip-to-work and physical exercise appear to be consistent with habitual behaviour (Aarts, Paulussen, & Schaalma, 1997; Aarts, Verplanken, & Van Knippenberg, 1997; Matthies, Kuhn, & Klockner, 2002). Rather than the utility-maximisation calculus that individuals are presumed to make for every choice, habitual behaviour relies on limited awareness, restricted cognitive effort, and perceived lack of control. Yet, habits tend to be environmentally conditioned (Staats, Harland, & Wilke, 2004) and therefore environmental changes may result in higher susceptibility towards behavioural change in general, and NMT in particular. Thus, behavioural theories that account for habit-forming events or milestones can also enrich future enquiries for NMT research.

Overall, it is possible to develop theories that address the costs and benefits of NMT; factor in recreational, exercise and quality of life motivations; consider the physical and social environments at a variety of scales, from the home to the neighbourhood region; and incorporate habitual activity. The same conceptual model does not need to be used for every study; different investigations may demand different models. However, the conceptual models that most studies are based on woefully lack a full consideration of multiple factors, much less how such factors interact with one another.

Many factors lead to NMT use. However, most research to date has been built on inadequate theoretical constructs; it may not sufficiently capture salient variables. Sometimes this is due to lack of data; other

times it is because of problems with theory. More complex and robust theory is the first step in developing more detailed models of NMT behaviour—and hence, better understanding to guide policy.

3.4.2. Measurement and methods

Once robust theories are identified and employed, the next step is to gather data to test and analyse such theories. The lack of data for NMT research has been on the radar for years (Bureau of Transportation Statistics, 2000; Krizek, 2005). Fortunately, the field of urban planning collaborating with public health has brought increased sophistication to planning and transportation in two areas—measurement and analysis (Forsyth, Schmitz, Oakes, Zimmerman, & Koepp, 2006; Moudon & Lee, 2003). Different types of NMT require different protocols, measurement devices and analytical approaches. Improvements in all are envisaged. Protocols summarise the steps taken to conduct the study, from sampling frame, to data collection and analysis. They should be detailed and well documented. For researchers, well-documented protocols enable replicable research, sharing of datasets, and assist in the standardisation of practices. For practitioners, protocols can create efficiencies in project management and personnel succession.

For measurement, NMT data is regularly collected for the journey to work and the school trip by the decennial census and the National Household Travel Survey (NHTS). Metropolitan planning organisations collect regional travel data to calibrate their forecasting models used for long-term transportation planning. Increasingly, such data include NMT. To complement their planning information, some localities collect counts of pedestrians, bicycles or both at particular locations (Schneider, Patton, Toole, & Raborn, 2005). There is a surprising lack of consistency in how such behavioural data are collected. Similarly, the validity or even the reliability measures of prevalent travel measurement tools, like travel diaries and retrospective surveys, rarely exist. Piloting data collection instruments is useful, but not enough. A better understanding of the psychometrics of a data collection instrument is critical to understand the quality of the data and their meaning (Streiner & Norman, 2003).

Built environment data are even less consistent than NMT data; land use categories vary from municipality to municipality; businesses databases are extremely ‘dirty’ and incomplete; data is almost absent on pedestrian infrastructure and amenities such as sidewalks and street trees, let alone architectural quality (Forsyth et al., 2006). New environmental audits of the pedestrian environment

and new computerised environmental assessment techniques have been created to assist in such data collection (Clifton, Livi, & Rodríguez, 2007; Day, Boarnet, Alfonso, & Forsyth, 2006; Forsyth et al., 2006).

In addition to the measurement properties of existing data collection tools, new tools and technologies also provide opportunities to complement or replace existing tools. A next generation of measurement tools for NMT will include new gadgets, improved data assessment and combined methods:

- Positioning devices, such as global positioning (GPS) units and GPS-enabled mobile phones, that can provide context to where walking and cycling activity occurs, and that may eventually replace a diary or travel survey.
- Personal digital assistants and text messaging, allowing quick reporting of information.
- Infra-red beams and motion detectors for not only counting users but also monitoring behaviours of the users, of particular relevance for trails.
- More sophisticated accelerometers to measure physical activity with increased accuracy.
- More rigorous comparisons of existing GIS spatial data and commercial databases to assess the reliability of data such as sidewalk completeness or business location.
- More rigorous testing of the proprietary procedures in GIS software for generating buffers and other measurements; more elaborate tools such as surveys combined with seven-day travel diaries or longer, for example (Axhausen, Zimmermann, Schönfelder, Rindsfuser, & Haupt, 2002).

The use of the above devices and measurement strategies are still in their infancy. Additional research is needed to validate how well they capture the behaviour they are intended to capture and how well the information gleaned from such measurement can be used in analysis. Many of the new gadgets collect a great deal of data that can be difficult to process. Cleaning data involves a number of assumptions that potentially introduce errors. There is a significant need for analyses of how sensitive findings are to data reduction and aggregation techniques.

3.4.3. Behaviours

Many land use-transportation models and paradigms are based on assumptions that have been put forth years or decades ago and rarely, if ever, verified or tested. Among the most visible example related to NMT is that people are willing to walk, on average, one-

quarter mile—a finding most reliably traced back to writings of the early 1980s (Untermann, 1984). They are too infrequently tested and usually apply to a specific population in a relatively specific environment. For example, it has been shown that walking distances differ by type of transit service (Ker & Ginn, 2003; Transit Cooperative Research Program, 1995). Furthermore, such guidelines need to invariably account for the characteristics of the individuals, including socio-economics, culture and preferences.

Several specific behaviours require further research in order to uncover sounder policy related to NMT. Key topics and questions include:

- If we build it, will they come?
- Substitution—will people drive less or exercise more?
- Changing rooms and cargo—what are the barriers?
- Route choices—where to go?
- Chained trips and interface with other modes—when is a mode changed?
- Excess travel and pedestrians—how to measure pleasure?
- The role of preferences and lifestyles—does the built environment matter, for whom?
- Where do behaviours occur?

3.4.3.1. If you build it, will they come? This is the predominant question for a majority of practitioners and researchers interested in NMT. Although not unanimous, empirical evidence shows a consistent association between such environment and non-motorised transportation, but more could be done to shed light on causal relations (Addy et al., 2004; Duncan, Spence, & Mummery, 2005; Garrard, Rose, & Lo, 2008; Krizek & Johnson, 2006; Merom, Bauman, Vita, & Close, 2003; Owen, Humpel, Leslie, Bauman, & Sallis, 2004; Rodríguez & Joo, 2004; Tilahun, Levinson, & Krizek, 2007; Wardman, Tight, & Page, 2007; Wendel-Vos et al., 2004). Quasi-experimental, pre-test/post-test research designs, complete with treatment and control groups, will inevitably go a long way towards addressing concerns about causality. From the methodological perspective, some are using statistical models that aim at disentangling self-selection problems, like the use of instrumental variables (Wooldridge, 2003), propensity score matching (Oakes & Kaufman, 2006; Rosenbaum, 2002), and selectivity models (Heckman, 1979). From the perspective of practical interventions, NMT investments in different urban contexts are likely to yield different results. A keen eye towards lessons learned in various contexts, and possible generalisation from individual cases is necessary.

A better understanding of the draw of particular facilities or the supporting role of infrastructure will feed back into improved measurement as well. At present it is unclear how far people will walk or cycle for particular purposes. Researchers are using GIS to create individualised buffers around homes, schools, workplaces and routes. Those related to destinations are making assumptions about distances people are willing to walk or cycle. Those related to the general environment—street patterns, densities, infrastructure—are making assumptions about a typical range of NMT activity. Are they the right assumptions?

3.4.3.2. Substitution—will people drive less or exercise more? The most recent push for NMT stems from its ability to spur heightened levels of physical activity. There are several parts to this argument; two stand out. The first relates NMT—and possibly physical activity—to the surrounding built environment. Recent research suggests that residents in more central city environments walk more for utilitarian purposes; however, their suburban counterparts walk more for recreational activity. The possibility that individuals substitute physical activity in one place for physical activity in another place is a possible explanation for research showing that in some cases, environmental changes may not yield higher overall physical activity (Evenson, Herring, & Huston, 2005; Forsyth et al., 2007, 2008; Rodríguez, Khattak, et al., 2006). Cycling's relationship to urban form is much more tenuous (Krizek & Johnson, 2006; Moudon et al., 2005).

Examining the potential for substitution requires understanding the context in which NMT behaviour occurs. Such behaviour is likely to concentrate at the locations where individuals spend most of their time; for adults it is the home and work neighbourhoods, for children it is the home and school neighbourhoods. When the context within which NMT behaviour occurs is better understood (e.g., home to work, work to retail, home to school walking), more accurate measures are likely to yield better fitting statistical models and clearer insights regarding relevant predictive factors. In addition, much time is spent inside buildings—how does this relate to these outdoor contexts? Results would determine whether interventions such as policy changes at work, environmental interventions in the home or work neighbourhoods, and programmatic changes to encourage walking to school, would be effective.

A related angle for the importance of substitution stems from NMT motivations, such as decreased congestion and pollution. This prompts an important issue: what NMT travel would be done anyhow and

what NMT travel is serving to take cars off the road (Greenwald, 2003; Handy & Clifton, 2001; Khattak & Rodríguez, 2005; Krizek et al., 2007; Shay, Fan, Rodríguez, & Khattak, 2006)? Unfortunately, the literature only has primitive knowledge of the destinations for NMT trips, their frequency, factors influencing these decisions, who is most likely to substitute NMT for auto travel, and the roles of distance and weather.

3.4.3.3. Changing rooms and cargo—what are the barriers? A hurdle for NMT stems from the need to carry cargo or, especially for bicycling, change attire. Backpacks, panniers and even carts provide a sort of solution. Most people, in the US at least, have either limited access or interest in using such accompanying devices; furthermore, many cargo items are too bulky. Parents who are responsible for transporting children have other challenges. Those who do not have access to changing venues claim such deficiencies limit their use of NMT. Planners can benefit from a stronger understanding of the degree to which these matters play an important role in NMT's limited use.

3.4.3.4. Route choices—where to go? Although the built environment's relationship to walking has been examined in terms of the number of trips made and the propensity to walk relative to other travel modes, there is limited research on the routes that pedestrians and cyclists take. While pedestrians often take short cuts that are not formal pedestrian routes, they do not always select the shortest route between a given origin and destination, but rather may seek routes that provide other benefits, including increased safety or variety (Duncan & Mummery, 2007; Elgethun, Yost, Fitzpatrick, Nyerges, & Fenske, 2007). Similarly, bicycle commuters often travel further distances—sometimes for the sake of travel for itself, other times for more enjoyable or scenic routes (Tilahun et al., 2007). By studying route choices, one can better elucidate the social and environmental attributes that attract pedestrians and cyclists, and the paths rejected by them.

One major barrier to understanding route choices is the limited data on actual and competing routes. The measurement innovations described above are a step forward (Rodríguez, Brown, & Torped, 2005). The problem of identifying feasible routes that were not chosen can be more difficult, as the number of routes can be infinite (Hoogendoorn & Bovy, 2004; Ramming, 2002). Techniques borrowed from operations research and statistics can assist in identifying subsets of feasible routes, although applications are incipient (Bekhor,

Ben-Akiva, & Ramming, 2006; Bovy & Hoogendoorn-Lanser, 2005; Frejinger & Blerlaire, 2007).

Another barrier is the lack of adequate network information for walkers and cyclists. Formal and informal trails and paths are often used by NMT. The feasibility and use of each for walkers is likely to differ compared with cyclists, but both are routinely ignored in auto-centric road networks prevalent in transportation planning practice. This creates problems for practice and research. Facilities that are not in a recognised network are less likely to receive funding for maintenance or upgrades. For research, the limited network further complicates the understanding of the behaviour of NMT users.

3.4.3.5. Chained trips and interface with other modes. People reach many destinations in one day. A mechanism for better accounting for travel associated with reaching various places is trip chaining—linking each small trip together in a single sequence of trips often referred to as a tour (or travel episode) that, for example, starts and ends at home. A tour may involve a change of mode—beyond the short walks that connect many driving trips together. This kind of behaviour is not well understood; using two modes in a single trip is not well understood either (Federal Highway Administration, 1994). One of those two modes is likely to be walking or cycling.

While surveys query the use of various modes in trips, NMTs are probably undercounted, particularly when walking is involved (cycling is more memorable). Further, how much walking constitutes a change of mode—a few metres to the bus stop, 200 metres across a busy shopping mall parking lot? These are issues that have practical implications for knowing where walking or cycling activity occurs, for identifying where improvements are needed, and for understanding the determinants of NMT use. Even if people are not necessarily frequenting establishments near their home via walking or cycling, they may be doing so elsewhere, primarily because these NMT trips are linked to other tours (Krizek, 2003).

Examples of these types of intermodal behaviours that are often discussed but too rarely understood include, but are not limited to, knowing the transit-shed and its ability to attract different types of walkers, increasing the range of a transit-shed by exploiting bikes on buses, walking in malls, and walking relatively long distances across parking lots or from inexpensive parking spaces.

3.4.3.6. Excess travel and pedestrians—travel to closest destinations? Related to the question of route

choice is the question of destination choice. Excess travel is a term in transportation planning related to the additional travel implied when people do not choose to frequent the nearest establishment (Hamilton, 1982). Research has suggested that about half of all commuting is in excess (Buliung & Kanaroglou, 2002; Giuliano & Small, 1993; Horner & Murray, 2002; Rodríguez, 2004). This runs against an implied principle in transportation planning stating that bringing origins and destinations closer together would reduce distance travelled, partly because some people would choose closer destinations than before. If people do not choose the closest establishment, then the effectiveness of land-based strategies to induce NMT use decreases.

3.4.3.7. The role of preferences and lifestyles—does the built environment matter, for whom? This issue of personal preferences is a particular concern for cyclists. Some people like to cycle and some do not. While the percentage of the population does vary by country—reflecting pricing, cultural norms, infrastructure, and social supports—within one place the number of people who are likely to change from motoring to cycling is likely to be small. But how small? Anecdotal evidence suggests increases in cycling in several European cities. Why? This is a subject for future research.

Further, certain groups of (potential) pedestrians may be more sensitive to changing travel modes, particularly those living in areas with adequate environmental supports. This is the principle behind social marketing. For example, when a large employer such as a university increases on-campus parking prices, students who are sensitive to pricing are likely to park further away or take transit, both potentially resulting in more walking. More needs to be known about the prevalence of comparable situations—even if such pricing changes do increase NMT, can they do so in enough populations to make a difference overall?

3.4.3.8. Where behaviours occur—policies around home, work, school or commercial areas? Not only are valid measurement tools required, but an understanding of the context in which those behaviours occur is important. Such behaviour is likely to concentrate at the locations where individuals spend most of their time; for adults it is the home and work neighbourhoods, for children it is the home and school neighbourhood. Understanding where activity concentrates and where it does not is a first step in contextualising physical activity behaviours, and in clarifying associations between the built environment and those behaviours.

3.4.4. Policy and practice

Finally, we turn to the issue of policy and practice that has been informed as much by anecdote as research. With the increasing evidence, basic work on NMT can focus on a number of frontiers, including:

- Incorporating NMT into transportation models and regional funding processes.
- More carefully crafting policy messages to a practice audience—evidence for whom?
- Demonstrating a wider range of benefits and outcomes, including economic ones.

3.4.4.1. Including NMT in transportation-land use models and regional funding processes. The limited information available about pedestrian and cycling networks is symptomatic of the wider marginalisation of NMT in the transportation planning and modelling process. Transportation planning literature and applications contain many cases documenting measures of accessibility that are calculated for urban areas and how these measures are largely restricted to motorised modes and to a handful of destination activities. These measures further the marginalisation of NMT that is extended to regional models used by metropolitan planning organisations (MPOs) in the US for long-range transportation planning. Although researchers and advocates have been supporting the development of multimodal transportation models since the early 1990s (Replegle, 1995), such efforts have yet to come to fruition in all but select cases.

Part of the difficulty of including NMT in regional transportation models is the difference in scale with motorised travel. By focusing on motorised travel, MPOs have emphasised regional travel patterns, sometimes at the expense of documenting local, pedestrian travel with high resolution. Some may argue that local jurisdictions, like towns and municipalities, should be responsible for NMT, since much of it is not regional in nature. This would, however, place NMT at a disadvantage in competing for US federal transportation dollars, because such funds are administered at the regional level by MPOs.

3.4.4.2. Policy levers and audience—evidence for whom? Different policy environments obviously demand different messages. Take, for example, two different environments with relatively high rates of bicycling: the Netherlands and China. The former sees cycling as something to continue to promote; policy decisions throughout the years have, in some situations, prioritised cycling over the automobile. In the latter case, the rapid motorisation of China is, quite literally,

running the bicycle off the road. The rapid onset of scooters and automobiles is winning the war of space. The corresponding message and research that needs to be communicated obviously varies considerably between the two. What this suggests is that the message for policy-makers is heavily dependent on context, with trends and trajectories providing a backdrop for possible sounds of alarm.

Expanding NMT to include health, environmental and development concerns also means that the audience of NMT research is more complex and expanding.

3.4.4.3. Expanding benefits and outcomes. Policy officials and advocates often seek information to quantify the secondary benefits from NMT travel. For example, legislation from Section 1807 of the US SAFETEA-LU legislation calls for the development of statistical information to detect the degree to which heightened NMT results in: decreased congestion and energy consumption, improved health and a cleaner environment. Measuring any one of these outcomes may be challenging. Although physical activity has been a powerful but recent motivator for NMT research, it is likely that future NMT research will branch out, to encompass a wider variety of community health outcomes. At the community level, NMT's contribution to social cohesion, hypothesised by some (Brown et al., 2008), should be examined further.

A central issue is that, to date, the data, models and subsequent understanding of such secondary benefits are so weak that any estimates that might be produced are only marginally better than guesses. Most NMT research has been built around a patchwork of local and regional planning and research-based efforts. At the federal level, collected data is weak, at best, focusing mostly on the trips to work and school (US Census) or on regional trips (NHTS). Yet, most policy and research applications call for geographically disaggregate NMT data. For modelling, the NMT community requires a stronger sense of the link between facilities and induced NMT travel, for whatever purpose, as well as accepted conversion guidelines to translate such use into secondary benefits, such as overall energy savings, decreased pollution or increased physical activity.

3.5. Conclusions

Non-motorised travel is enjoying a revival among planning research and practice circles. It is also attracting emerging interest from disciplines and professions previously unaffiliated with NMT, like environmentalists and health professionals. The attention and partnerships

are refreshing and long awaited. At the same time, the wide-ranging goals being asserted on behalf of NMT indicate an important role for interdisciplinary research.

We identified four primary and purported motivations for NMT: (1) congestion relief, (2) environmental conservation, (3) liveability, and (4) health. Research to date is uneven in the coverage of topics, data collected, and analyses conducted. It is therefore important to know more about NMT to help focus policy interventions in areas where they can actually deliver important outcomes, rather than where anecdotal evidence backs hopeful and grand policy claims. A critical review of the existing literature, combined with our own perspectives, suggests a paucity of empirical evidence in support of many claims. Of the four motivations, liveability, while difficult to define, is the most compelling justification. But rather than an indictment of NMT as a viable means to address these four concerns, we call for additional research to help elucidate the degree to which, and how, NMT can contribute to understand its motivations.

We draw attention to the differences between walking and bicycling, particularly as they relate to participants, travel characteristics (range, speed), infrastructure needs, trip purposes, safety concerns, key barriers, and interfaces with automobiles and transit. Fully understanding the behaviours of pedestrians versus cyclists warrants different conceptual models. Planning practice also needs to treat the two modes separately, as they have widely varying infrastructure needs.

To provide structure for promising research avenues, we classified and commented on four domains of needed research that aligns well with scientific methods of enquiry: theory, measurement and methods, behaviours, and policy. Overall, we found that many behaviours related to NMT are poorly understood. This is because important variables are rarely captured, due to lack of data or problems with theory. A similar limitation applies to the potential determinants of such behaviours. We suggest refining theories, data collection and analysis to yield more effective and targeted policy prescriptions.

The perspectives we offer suggest a tall charge for the next generation of NMT research. More robust and reliable analysis is much needed. Adhering to all of the prescriptions outlined herein is not expected in every study, nor is it possible; savvy and careful researchers carefully define their product accordingly. Our goal is to assist in orienting and defining these products. We therefore help both producers and consumers of NMT research to better understand the challenges in documenting the effects of NMT interventions. We look forward to learning of the next generation of NMT research.

Chapter 4. Compact and diverse: The future of American urbanism

Emily Talen and Cliff Ellis

4.1. Introduction

The emergent research agenda we explore in this chapter can be summarised as follows: we need to better understand how to create places that are both (a) socially inclusive and (b) sustainable in terms of land consumption, energy cost, and transit-readiness—i.e., compact.

Two phenomena will drive the need for this research. First, urban places will become increasingly diverse. By the mid-21st century, one-half of the population of the US will be composed of today's 'minorities', and Whites will be a minority (US Census, 2000). Second, urban areas will increase in density. As environmental, political and financial pressures work to contain urban sprawl, increase access to urban amenities, and lessen energy and infrastructure costs, pressure to develop in the core or in established, better-serviced neighbourhoods will increase, encouraged by a variety of containment strategies and regulatory requirements, in addition to consumer preference.

In this chapter we examine the implications that arise from these two conflicting trends. As urban areas diversify demographically, there will be pressure to separate population subgroups geographically. Social groups may seek to escape one another, exerting pressure to spread further and further away from dissimilar populations, often attempting to move away from denser locations at the urban core. This will continue a long-standing trend in American urban development, now constituted with greater force as urban populations become more heterogeneous. More importantly, the trend will conflict with pressure to live more compactly and closer to services and jobs. As higher income groups compete for better access to urban amenities, middle and lower-income groups will be pushed further out (Dreier, Mollenkopf, & Swanstrom, 2004).

The inherent conflict between social separation and increased density will not be easy to address (Jenks, Burton, & Williams, 1996). The ability of urban places to be both compact and diverse will be difficult to resolve politically, and the tension between them will exacerbate social, environmental and economic goals. The implications of this friction are becoming increasingly known. Recently, two of America's most prominent social scientists highlighted the conflicts involved in sustaining diverse urban neighbourhoods. Putnam (2007) found a surprising level of multicultural intolerance in his

longitudinal survey of 26,000 people in 40 communities. He concluded that although diversity is essential for productivity and social wellbeing, people in diverse places—even non-ethnic Whites—often become more socially isolated. Similarly, Harvard sociologist William Julius Wilson published the results of an ethnographic study *Neighbourhood* (Wilson & Taub, 2006), in which were exposed the worst sorts of racial prejudices. What these studies show is that the ability of urban places to be both compact and diverse is not going to be easy.

Motivating this chapter is a belief that planners have a role to play in addressing this challenge. While recognising that planners and policy makers are likely to find themselves in an uncomfortable position when attempting to support both compact living as well as social diversity, often thwarting one goal in an attempt to promote the other, renewed focus on the many issues and complexities involved will be crucial. Specifically, research in four main areas will be needed to help address the conflicting ideals inherent in promoting sustainable—i.e., compact and diverse—urban growth.

Research area 1: Existing diverse communities

First, there is a need to better understand why some places, despite opposing pressures, manage to be both compact and diverse. Despite the pressure to separate, there are still areas that manage to sustain social diversity amidst increasing densification. Why are certain areas stable and diverse, while others are not? Research is needed to uncover the degree to which historical development patterns, political and cultural activities, social structure, government regulations, or physical characteristics of the environment have an effect.

Research area 2: Policies and programmes

Second, there is a need to better understand what policies and programmes initiated by urban planning—both strategic public sector investment and regulation of the private sector—are likely to be most effective at sustaining and/or promoting diversity. In what contexts and under what conditions are these programmes and policies most successful, and under what conditions do they result in unintended negative effects like displacement?

Research area 3: The planning process

The third research area concerns the planning process itself. That is, what planning processes can be formulated to encourage and sustain social diversity in urban places? Are there methods of planning that could be specifically formulated to promote social diversity within the context of compact urban development? Neighbourhood planning as currently practised does not offer an explicit methodology for neighbourhoods with mixed social

structure. What would a neighbourhood planning process devoted to sustaining and promoting socially diverse places be like?

Research area 4: Diversity and city form

Finally, the fourth research area involves assessing the role of urban design and physical planning in accommodating diversity, with a focus on developing a practical catalogue of patterns, models, examples and standards for use by planners and designers during the coming decades of rapid urban growth. The goal is to understand how to create new communities—both on infill and greenfield sites—that are designed from the start with diversity in mind. Research would address issues such as neighbourhood structure, housing mix, civic spaces, defensible space, school location, land use patterns, and open space.

4.1.1. *Why are some urban places diverse?*

Why are some places socially diverse? Depending on how diversity is defined, every city has at least some neighbourhoods that are diverse, despite the enduring reality that American cities tend to be highly segregated. While there is no explicit definition of the ‘socially diverse neighbourhood’, people consider the mixing of residents by race/ethnicity and by income level or wealth to be the most essential forms, though the mixing of age, family type and household type are also important (Sarkissian, 1976). A diverse neighbourhood may have teenagers and elderly; married couples and singles; empty nesters and large families; waiters and teachers as well as professionals; affluent people and people on fixed incomes; and people of varying racial, ethnic and cultural backgrounds. In short, they are places that harbour a full range of human complexity. Rough estimates put the number of neighbourhoods that could be characterised as racially/ethnically and economically diverse at anywhere from 5% to 25% of neighbourhoods in the US.¹³

Explanations as to why some neighbourhoods are socially diverse are likely to be based on three sets of factors: historical/economic/social, policy-related, and physical/locational. Of course, these factors are inter-related. Historical/economic/social factors have an effect on policy, and in turn, some historical/economic/social and policy factors affect physical/locational factors.

Places that are diverse may, first and foremost, be those with a long tradition of diversity. They may be

places that functioned historically as immigrant ports of entry, and this openness may have translated into other forms of diversity, such as economic. Because of the historical rootedness of diversity, diverse places may therefore be older than non-diverse places. Older places may be more likely to have experienced a housing filtering process, whereby some proportion of the housing stock, because of its age, became more affordable. At the same time, there may have been an infiltration of new housing stock, creating a mix of building ages conducive to diversity (Jacobs, 1961). Building age mix is also likely to result in a lower median housing age for the area overall, as compared to newer suburban locations. A mix of building ages helps ensure a mix of rents and prices (for both owners and renters, and for both residential and non-residential users). Different types of uses require different types, and costs, of buildings.

The dynamics of the local housing market are likely to play a strong role in the effectuation of diversity. It has been shown empirically that racial inclusiveness is related to four housing market conditions: new housing (populated by younger Whites with more tolerance for diversity); multifamily housing; rental housing; and affordable rental housing (Pendall, 2000). These market conditions are also likely to affect income diversity. To the degree that housing unit type is a significant factor in social diversity, diversity is likely to be found where there is a mix of more than one housing type, including owner versus renter-occupied and single-family versus multi-family housing.

The employment sector is also likely to be related to residential income diversity. The location of industry seems to have been a particularly important factor. For example, income-diverse areas in Chicago and other major cities tend to be primarily in ‘blue-collar’, ethnic neighbourhoods located in inner-ring suburbs (Orfield, 2002). Many of these diverse areas started as industrial suburbs adjacent to railroad lines. Studies have revealed that middle-income suburbs, many of which consist of housing tracts developed near industry, also have the widest range of income groups (Oliver, 2001). Accordingly, the diversity of the older suburb has been heralded as the lynchpin of a new metropolitan structure (Hudnut, 2003; Orfield, 2002; Oliver, 2001).

Diverse areas may be places where macro processes of economic growth did not translate into widespread spatial mobility. Instead, some residents may have been able to ‘improve in place’. Or there may have been disruptions in the gentrification process—it may have stalled because of larger economic trends. Although many view the process of middle-class relocation to

¹³ Nyden estimated 5–10% at a recent panel discussion on diversity, which took place in Chicago on June 9, 2006 at the I-Space Gallery, 230 W. Superior Street.

inner-city neighbourhoods as mostly detrimental (Abu-Lughod, 1994), if gentrification did not result in complete displacement it may have been a significant factor in generating income mix. Some studies have shown this, arguing that gentrification promotes socio-economic mixing and probably only adversely affects a small number of older residents (Freeman & Braconi, 2004; Vigdor, 2002).

These kinds of processes generate what Nyden, Maly, and Lukehart (1997) refer to as a 'laissez-faire' diverse community. Examples include areas where gentrification stalled because of housing market changes, ageing communities where residents were replaced with younger people, neighbourhoods adjacent to fully revitalised areas, places that function as immigrant ports of entry, or the addition of affordable housing developments. Cohen (1998) documented the income diversity of a gentrifying Baltimore neighbourhood that resulted when two fractious community groups created an investment standoff.

The social cohesiveness of an area may play a role in promoting or sustaining diversity. If non-diversity (social separation) is a reflection of the instability of societal inter-relationships (Marcuse, 2001), the opposite may also be true: diversity is sustained wherever stable inter-relationships occur at a local level. The structural sources for fostering better social mechanisms like 'collective efficacy' are sometimes 'spatially embedded' (Sampson, Morenoff, & Earls, 1999), and the diverse place may be a neighbourhood that has been able to capitalise on this.

What might be the practical value of deeper knowledge about diverse places? As better understanding of the diverse neighbourhood develops, a renewed commitment to sustaining them is likely, and new approaches to supporting them through planning may follow. One outcome could be that neighbourhoods become targeted for planning efforts specifically directed at sustaining their diversity. This is not the usual procedure. Most often, neighbourhoods are selected for planning work based on level of distress or opportunity to stimulate private investment (see, for example, McCarron, 2004; Richmond LISC, 2005). Taking a somewhat different approach, planners could identify neighbourhoods with high levels of social diversity, defined either by income, race, ethnicity, or in relation to some other diversity criteria. Planners could also consider threats to existing diversity and the potential for instability (gentrification, displacement, disinvestment), and the likelihood of success (citizen interest, active and engaged local leadership). Depending on available resources, a number of diverse

neighbourhoods could be targeted for special planning effort and focus.

Planners could work with local leaders to help increase public awareness of the neighbourhood diversity that exists. Researchers who study diverse neighbourhoods have argued that the maintenance of diversity requires 'a publicly stated commitment' to inclusiveness, and that 'image creation and marketing' are important strategies (Maly & Leachman, 1998: 154). There needs to be an effort to increase recognition and understanding of the kinds of diversity present, which residents may only have a vague notion of. The ideas to be communicated would need to be simple, straightforward and visually interesting, presented in a manner that is readily understood, and suitable for publication and exhibition throughout the neighbourhood. They should highlight racial, ethnic, income, age and household diversity, and include some explanation about how the level of diversity has changed over time. Graphical output of various kinds could be exhibited in well-traversed public spaces and places, including websites.

A better understanding of diverse neighbourhoods will also be an essential basis for engaging with local leadership and possibly recruiting leaders in a strategic way, something that research has shown is critical for building citizen participation at the neighbourhood level (Marshall, 2004). Local leaders could be specifically enlisted by planners to support diversity-sustaining planning strategies. This would be essential, given the reality that effective social organisation and neighbourhood diversity do not generally correlate. As Wilson and Taub (2006: 181) put it, 'strong neighbourhoods...work against the notion of intergroup harmony and integration'. One way to counteract that tendency would be to develop a set of shared goals, around which diverse residents could unite. With a solid understanding of the diverse neighbourhood and how it functions, representatives reflecting the diversity of the neighbourhood could be the catalysts for formulating that shared set of objectives.

Planners could help resident groups work towards an appreciation of what diversity brings to the neighbourhood. Rather than being problematised, diversity would be considered as an asset and an essential part of the solution to community problems. Instead of viewing diversity as an imposed condition, whereby income and racial integration is forced by government fiat, diversity would be cast as something positive and unique. A sense of reciprocity and interdependence would have to be established, so groups could easily recognise and act on their shared concerns. Planners

could help articulate, for example, the ways in which the goals of diversity are interrelated: a neighbourhood that is open to a range of groups translates to improvements in neighbourhood services for all groups. A mix of uses that is good for the economic vitality of a neighbourhood adds interest and opportunity for every resident. Diverse people are more likely to have diverse schedules, thereby increasing the ability of the neighbourhood to informally patrol its streets at all times of the day. Diversity helps stimulate an expanded set of locally based social networks, which may be viewed positively by many residents. A community that wants to retain affordability for its children, the workforce and the elderly is going to have to publicly acknowledge the value of diversity.

4.1.2. *Policies and programmes to increase diversity*

The deliberate mixing of income groups started in the 19th century, as an explicit goal of social reformers concerned with constructing a socially just city (Talen, 2005). New town development, in the form of Garden Cities, was intended to mix people of various backgrounds by integrating different types of housing units within the same block. Design strategies focused on minimising the outward variation of housing type, for example, by making apartment dwellings look like large single-family homes. Urbanists continue to argue that there should be no difference in the design and quality of housing for different income categories (Brophy & Smith, 1997).

There are many possible policies and programmes to choose from in the attempt to stabilise and support diversity in urban neighbourhoods. Policies that keep units affordable, preserve neighbourhood assets, retain rental units, keep buildings occupied, revitalise the public realm, and distribute tax dollars to the places that most need it are all likely to help sustain diverse places. Organisations like PolicyLink and The Institute for Community Economics have compiled lists of actionable tools focused on promoting social equity in urban revitalisation strategies (see especially Harmon, 2003, 2004; Karlinsky, 2000).

Diverse neighbourhoods are often in need of public investment—for parking facilities, for upgrades to schools and parks, for incentives for new businesses or mixed use housing developments. It should be obvious that public investment and the private enterprise it stimulates can result in gentrification and displacement, especially in diverse neighbourhoods that have good access to the central city, historic housing stock, pedestrian quality, and lots of potential for revitalisa-

tion. While this investment has many positive benefits, it also has to be kept from stimulating too much growth. Rapid gentrification is an indicator that the neighbourhood is displacing rather than revitalising (Kennedy & Leonard, 2001). To counteract this, there will need to be policies aimed at retaining rental housing and commercial space for small business, keeping the pace of change slow and steady.

Policies that are designed to inhibit gentrification and displacement may have the effect of encouraging social diversity. These may include rent control and strategies for subsidising low-income housing (Kennedy & Leonard, 2001). Or there may be efforts to keep gentrification confined to small areas. Powell (1999: 12) asserts that ‘revitalization strategies relying on infill or partial/small-scale gentrification’ may have the potential to create stable, mixed-income neighbourhoods. Policies that seek to increase housing in downtown areas may have a similar effect. These include adaptive reuse, infill on reclaimed land, or niche housing for seniors or students (Birch, 2002). It has to be recognised, however, that infill policies that focus on increasing density could have the effect of increasing social segregation (Huie & Frisbie, 2000). Infill development does not always address affordability problems, as one quantitative study of housing patterns across the US showed (Steinacker, 2003).

A number of recent studies have focused on proactive efforts at income mixing undertaken through government programmes like the Department of Housing and Urban Development’s HOPE VI and Section 8 housing programmes (Schwartz & Tajbakhsh, 1997). Social diversity is promoted by either constructing new mixed income housing developments (the HOPE VI programme); by dispersing public housing in higher-income neighbourhoods through scattered-site housing; or by giving Section 8 vouchers (housing vouchers issued by the Federal government) so that tenants can rent housing in mixed-income neighbourhoods. Subsidised housing is therefore to be dispersed by demolishing public housing, relying more on tenant vouchers, allowing a greater income-mix in new subsidised developments, or dispersing the spatial location of new public housing projects (Goetz, 1996).

Empirical studies of these publicly funded attempts to mix income levels have been generally positive, although there are complaints that the projects do not always go far enough (Popkin, Levy, Harris, Comey, & Cunningham, 2004), and that mixed-income housing should not be seen as a ‘silver bullet’ that overcomes poverty (Smith, 2002). A study of the Lake Parc Place mixed-income housing

development in Chicago found that the development ‘accomplished the prerequisites for making mixed-income housing into a community’ (Rosenbaum, Stroh, & Flynn, 1998: 703). A study of ‘scattered-site’ public housing showed that residents of target neighbourhoods did not ‘flee’ or engage in panic selling (Briggs, de, Darden, & Aidala, 1999), and Feins and Shroder (2005) showed that the Moving to Opportunity programme resulted in positive improvements and no loss in social ties for residents relocated from poor to non-poor areas. Another study showed that the deconcentration of assisted housing can have ‘positive or insignificant effects’ in terms of property value and crime, if the target neighbourhood is not already low-valued (Galster, Tatian, Santiago, Pettit, & Smith, 2003).

Studies have been made of proactive efforts to maintain racially integrated neighbourhoods, which have been referred to as ‘diversity-by-direction communities’ (Peterman & Nyden, 2001). Such deliberateness tends to focus on Black–White integration. Planned diversity can either be a matter of government policy (e.g., Oak Park, Illinois’ ‘Diversity Assurance Program’) or a result of grassroots effort (the diversity of Park Hill, Colorado, was fostered by an organisation of church leaders).

Keating (1994) has written about the implementation and feasibility of housing diversity policies in the Cleveland area. Saltman (1990) studied the neighbourhood stabilisation efforts of five locales and found that the ‘fragile movement’ was buoyed by progressive non-profit organisations, school boards, and neighbourhood groups, working in concert with pro-integrative governments. Smith (1993) and Yinger (1995) reviewed the policies of proactive integration efforts and found strategies to improve information flow (counselling, for example), proactive marketing, and more accurate information about neighbourhood racial composition. Market intermediaries or housing counsellors have been enlisted to act as ‘brokering organisations’ for cultivating integration (Briggs, 2001: 58). Other strategies for stabilising diversity have included code enforcement, anti-blockbusting ordinances, bans on for sale signs, or even grants to individuals who work to support integration.

Regionalism, public transportation, and ‘open and democratic local governing’ are also believed to be ways of ‘integrating diverse groups and cultural practices in a just and equitable fashion’ (Polese & Stren, 2000). Local governments may enact fair share housing programmes, requiring new developments to provide a certain number of affordable housing units. For example, in Montgomery County, Maryland, 15% of housing units in new subdivisions must be

moderately priced, i.e., affordable to working-class households. Once income (or racial) mixing is in place, local governments may require that strategies be enacted to ensure that mixed-income housing projects are supported, through tenant screening, counselling, and project management.

Communities can adopt zoning ordinances intended to encourage diversity. A key component might be mixed housing unit type. Growth controls (building moratoria, permit caps and quotas) have the effect of preventing income and racial integration (Downs, 2000; Pendall, 2000), so changing these rules is believed to have a positive effect on diversity. It is a matter of reversing the rules by which social segregation occurred: allowing multi-family units where they have been excluded, and eliminating rigid building codes, minimum lot size, maximum density, minimum setbacks, and other barriers to infill development. This may also require changing lending policy, capital improvements budgeting, and the protocols of the home-building industry, which tend to favour large, single-use and single-type developments.

Finally, within the context of deliberate policy and programmatic intervention in promoting urban diversity, larger issues of citizenship and political theory need to be examined. Numerous authors have pointed out that the reigning political ideology in the US encourages people to think of themselves as consumers rather than citizens, pursuing ‘lifestyle choices’ rather than active and informed participation in political community (Beiner, 1992; Etzioni, 1995; Wolfe, 1989). It is legitimate to ask whether the coexistence of diverse social groups can be achieved programmatically against a background of diluted civic consciousness and shared destiny. While issues of social justice are critical, the quality of political life and the cultivation of character also demand attention, since they bear directly on the ability of policy-makers to institute an effective policy response.

4.1.3. Planning processes that support diversity

While there are plenty of ideas about policies and programmes to put in place to help diverse urban places stay diverse, what of the planning process itself? What planning processes would precede the implementation of policies and programmes aimed at preserving diversity? What would a neighbourhood planning process devoted to sustaining social diversity be like? There have been many excellent studies of the procedural factors that help in revitalisation efforts (e.g., Bright, 2003; Keating, Krumholz, & Star, 1996; Zielenbach, 2000), but diverse neighbourhoods have a

different set of issues, requiring a different set of strategies.

First and foremost, sustaining diversity at the neighbourhood level is likely to require neighbourhood level planning. Planning at the neighbourhood scale has always been a feature of urban planning, although the support of it rises and falls with the availability of municipal funds. Some neighbourhood planning approaches have become quite well known. Minneapolis' Neighbourhood Revitalization Program has been studied as a unique model of neighbourhood empowerment, where each of 66 neighbourhoods prepare a neighbourhood action plan and request funds for housing, parks, schools, security and the like (Fainstein & Hirst, 1996; Martin & Pentel, 2002). Non-profit groups in Chicago recently established a neighbourhood-based planning effort called the New Communities Program, funded by the MacArthur Foundation and Local Initiative Support Corporation (LISC), where neighbourhoods are encouraged to develop plans for macro (e.g., job creation) and micro (e.g., block renovation) interventions (McCarron, 2004). As with the Minneapolis neighbourhood planning effort, the goal is to bring residents together, build neighbourhood capacity among residents, and empower them to make decisions about their neighbourhood's future development.

These neighbourhood planning efforts are exemplary, but planning for highly diverse areas may require a few extra steps. Neighbourhood planning as currently practised does not really offer a way to account for mixed social structure; it is mostly conceived as being neutral to population heterogeneity versus homogeneity. There are strategies for getting under-represented people engaged in site planning (Lanfer & Taylor, 2006), and those ideas are useful, but planning for the diverse neighbourhood requires a specifically focused approach. In fact, the experience of neighbourhood planning in diverse areas has shown that there may be a problem getting diverse groups involved. The problem in Chicago was described like this:

At planning sessions in gentrifying neighbourhoods like West Haven on the Near West Side the word 'condo' is spat out like a four-letter word, and yuppies, though key to the location's future, are conspicuous by their absence (McCarron, 2004: 12).

The fact that there are no specific neighbourhood planning methods developed with diversity in mind is curious, given that a vibrant social mix is both a normative goal of planners and a significant challenge to neighbourhood stability.

Planning for places composed of a complex mix of people is likely to require something beyond inclusive exchange, or a focus only on empowering the under-represented. Because engagement in the planning process always runs the risk of being motivated by a desire for group self-preservation—protecting one group from another in ways that are not mutually reinforcing—something more strategic may be required. Those advocating various consensus-building approaches have recognised that dealing with diversity is likely to require something beyond merely democratising and opening up public engagement, or simply having a more broad-minded view about the legitimacy of alternative cultural expressions (Innes & Booher, 1999). What needs to be worked out is an approach that enlists ideas about consensus building and collaborative planning in ways that support socially diverse neighbourhoods specifically.

Formulating a planning approach that supports diversity may require an integration of centralised ('top-down') and localised ('bottom-up') approaches. Neighbourhood planning is sometimes dichotomised into these two categories: centrally led planning activities that are decentralised at the neighbourhood scale, and community-based neighbourhood planning, directed by and intended for neighbourhood residents. The former is generally written off as too controlling, while the latter is seen as empowering (Checkoway, 1984; Peterman, 1999). But in a diverse neighbourhood, both may be required. To begin with, local government planners are needed to help jumpstart the process and help diverse groups come together, since diverse places are prone to apathy and low levels of collective efficacy. In their recent study of diverse neighbourhoods in Chicago, Wilson and Taub wrote about the changes that occurred in a neighbourhood that had experienced high levels of ethnic in-migration:

Residents invested little effort in the social organization of the neighborhood...there was little collective supervision of community activities, and little participation in voluntary organizations such as block clubs, civic and business clubs, parent-teacher organizations, and political groups (Wilson & Taub, 2006: 173).

At the same time, neighbourhoods with strong community-based capacity and strong resident control have been shown to be the most successful at solving problems (Bright, 2003).

Neighbourhood planning for social diversity should embrace difference and work to sustain it. It should do this not by focusing on the empowerment of any particular group, but by ensuring that people are well

informed about the diversity at hand, what that diversity means for the future growth of their neighbourhood, and the positive ways in which it can be viewed. Tensions and conflicts that arise should not be neutralised or assumed away, but confronted straightforwardly. As much as possible, conflicts that affect the social make-up and wellbeing of the neighbourhood should be put into context and prevented from undermining the diversity of the neighbourhood.

We have already discussed how a better understanding of diverse neighbourhoods will likely yield a more targeted planning approach to sustaining them. This includes the need for new methods of engagement, motivated by the specific requirements of a diverse area. But there is also likely to be a change in how the neighbourhood plan itself is formulated. The formulation of a neighbourhood plan would be the critical means to putting the idea of a shared future in concrete terms. The plan would be used as a framework to channel individual ideas towards something tangible—collectively realised, positive outcomes for the diverse neighbourhood. Collaborative planning efforts of this type, often in the form of charrettes, are now recognised as indispensable (Lennertz & Lutzenhiser, 2006). The trick would be to orient them to the specific needs, issues and constraints of the diverse urban neighbourhood.

This is likely to be especially important in a socially diverse neighbourhood where lower-valued homes and businesses are seen as a threat to higher-valued ones. One study showed that the neighbourhood plan was critical for garnering support for affordable infill housing, because it embedded the infill within a larger context—i.e., the affordable housing was contextualised and planned for (Deitrick & Ellis, 2000). The plan makes it possible to ‘envision each building, each development project, in relation to a positive ideal’ (Brain, 2005: 32). Doing away with negative feelings about subsidised housing, small family-run businesses, or social service agencies in favour of positive feelings about diversity is going to require strong conceptualisation of neighbourhood, and the plan would be an essential means of accomplishing that.

During the creation of a neighbourhood plan in a socially diverse area, it may be especially important to employ participatory methods that avoid ‘the tyranny of structurelessness’ (Sirrianni & Friedland, 2001: 24). A variety of methods is possible, from week-long intensive charrettes to months-long visioning efforts. Whatever process is used, the key point for planning would be to keep informed about the trade-offs involved in whatever is being proposed—how the proposals

being advocated have consequences for other people in the neighbourhood as well as people in the surrounding neighbourhoods. If some residents propose, for example, to downzone portions of the neighbourhood so that multi-family units are disallowed, or to limit the ability to add accessory units, they need to be made aware of the effect this might have on reducing diversity, the ability to retain essential services they might deem important, the ability to sustain a walkable environment, the increase of traffic arterials through the neighbourhood, or the cost of housing for their children, the workforce and the elderly.

Of course, planners would need to be well informed about the various design strategies that could be used to stabilise and promote diversity. They could illuminate the importance of housing mix, business mix, facilities that support connection, and the potential benefits of breaking through residential enclaves. They could suggest locations for new non-residential growth—strategically targeted to function with the housing diversity that surrounds them. They could suggest ways to intersperse different housing types, and show how codes could be important for supporting the mix. They could show how strategically placed public investment can support diversity. Planners could be an essential resource on design ideas, pointing out when and where specific ideas being proposed may have the effect of undermining or supporting diversity.

Implementation of the neighbourhood plan could focus on three things:

- (a) Establishment of a process for shared management of the built environment as an ongoing neighbourhood-stabilising strategy.
- (b) Regulatory reform including new types of codes that encourage a coherent yet flexible guide for the built environment.
- (c) Recommendations for public investment that stimulates positive change, giving the neighbourhood the kinds of improvements it needs without undermining its diversity.

Many studies have shown that implementation of the best laid plans does not work if residents are not directly involved in the process (Halpern, 1995). Going one step further, a neighbourhood plan that supports diversity should lay out a process of collaboration whereby the diverse nature of the neighbourhood is borne in mind as proposals are presented and responded to. The emerging ‘collective intelligence’ of recurring responses should not devolve into control by one group or another. There needs to be an operating system that implements

whatever shared commitment to place is possible. This could take different forms. A citizens review committee could be established to provide some oversight of physical change in the neighbourhood. Community-based institutions—schools, neighbourhood associations, faith-based organisations and the like—could be enlisted to promote participation. Residents in diverse neighbourhoods need to be engaged in the shared management of everyday issues, and planners could help stimulate this kind of structure.

4.1.4. *Diversity and city form: The role of urban design and physical planning*

Certain urban design and land use patterns are believed to be associated with social diversity. Many of these characteristics can be seen as outcomes of the historical, economic and social factors already discussed.

Exploring the link between the built environment and social diversity has been revealed in rich descriptive geographic and ethnographic studies. Geographers have been interested in the patterns of social diversity emerging in cities, revealing a complex urban landscape (Bourne & Ley, 2002). The built environment reinforces cultural stereotypes and fears about diversity, at the same time that it provides an outlet for symbolic expression and the creation of ethnic identity (Hanhorster, 2000).

Jacobs (1961) and Mumford had strong ideas about the physical factors conducive to diversity. Mumford believed that a healthy diversity required limits on size, density and area (1968). Jacobs stressed the importance of block size, concentration and mixed building age. She also emphasised the interrelated importance of use. Offices, factories, dwellings and other types of primary uses were essential for bringing people to a place, and secondary uses were essential for serving the people that came. Above all, Jacobs argued, there was a logic to the particular mix of uses that were most likely to succeed and produce a healthy diversity.

Christopher Alexander's *Pattern Language* (Alexander, Ishakawa, & Silverstein, 1977) was an extended exploration of the physical planning elements that support diverse cities, towns and neighbourhoods. Alexander's work analysed both the mixtures and the separations required to create an urban fabric that can sustain diversity. Patterns such as 'Mosaic of sub-cultures', 'Subculture boundary', 'Identifiable neighbourhood', 'Household mix' and 'Degrees of publicness' acknowledge that mixing different social groups in a compact area is not a simple matter. It requires both insight into social relationships and a

sophisticated palette of urban design alternatives. Alexander provided an empirical foundation for his patterns based upon the research available in the 1970s. New Urbanists have incorporated many of these patterns into built projects, but research is needed to examine the results and respond to emerging changes in the social geography and built form of 21st century cities.

Philip Nyden and colleagues (Nyden et al., 1997; Nyden, Lukehart, Maly, & Peterman, 1998) found a variety of physical factors contributing to 'stable diverse' neighbourhoods. Significant factors included whether they had 'attractive physical characteristics', access to public transportation and jobs, land use diversity (stores and restaurants), housing stock variety, proximity to downtown, or the existence of 'social seams' in the form of schools, parks or a strip of neighbourhood stores. Others have stressed the importance of a neighbourhood's 'institutional base', particularly religious institutions (Rose, 2000), as a way to promote 'strong cross-status ties in mixed-income neighbourhoods' (Clampet-Lundquist, 2004: 443). These relationships are not always straightforward. For example, while many agree that mixed uses—including public and quasi-public facilities and neighbourhood-level commercial enterprises—are essential for sustaining socially mixed communities (Myerson, 2001), finding the appropriate mix to support diversity can be problematic. As Goetz (1996) cautioned, 'the poor relate to [neighbourhood] amenities in ways fundamentally different from more affluent families.' Thus public transportation and affordable daycare are likely to be much more important to poor families (see also Bayer, 2000).

A variety of housing types in one location is an obvious way that physical form promotes social diversity. Mixing housing unit types can occur in two ways: new, mixed housing type developments, or the infilling of new types of development, either on vacant parcels or through the addition of larger homes or smaller units (over garages, over stores). In the latter case, forms associated with mixed housing include corner duplexes, walk-up apartments on back streets, smaller lots, and duplexes designed as single-family homes. Putting larger or more expensive housing in lower-income areas through demolition and replacement (so-called 'monster' houses in bungalow neighbourhoods), or by restoring housing previously divided into smaller apartments, are development approaches that work in reverse: higher-income housing in lower-income neighbourhoods (Lang & Danielsen, 2002).

A mix of lot types also promotes housing type mix, particularly smaller lots and larger lots in the same block

or at least in the same vicinity. Most often, platting in the US, especially post-World War II suburban development, has consisted of strict lot uniformity. Diverse areas in cities like Chicago, however, have a mix of platting arrangements—lot sizes, shapes and positioning relative to the street—and this has encouraged the mixing of unit sizes and types.

Density also has an effect on diversity. Jacobs preferred densities in the range of 100 dwellings to the acre, and anything significantly lower, she argued, was in danger of producing ‘gray areas’. High density and high ground coverage was to be relieved by frequent streets (created by small block size), and variation in building type would have the effect of increasing the diversity of both population and business enterprise. Jacobs argued, further, that this variation would be difficult to achieve wherever land coverage was low and density was high, factors characterising modern public housing projects.

Despite these calculations, diversity and density do not seem to be correlated in a direct, linear way. As [Pendall \(2000\)](#) explains, density exacerbates segregation by housing type and class because gentrification is more likely to occur in high density neighbourhoods where ‘proximity-related benefits’ increasingly enter ‘people’s utility functions’ ([Pendall & Caruthers, 2003: 547](#)). As higher-income groups attempt to move ‘back to the city’, valuing walking and access to amenities ([Hughes & Seneca, 2004](#)), enclaves may be formed, as opposed to places with income mix. While some have argued that low-density development increases choices for a wider range of socioeconomic groups ([Glaeser & Vigdor, 2003](#)), and low density areas have even been shown to be more diverse than the compact city in some cases ([Pendall & Caruthers, 2003](#)), low-density development may pose a significant problem for low-income people when it comes to the provision of neighbourhood-level facilities and access to jobs and urban services.

More research is needed on the role that civic spaces—the provision of an ample and well-designed ‘public realm’ ([Pendall, 2000](#))—can play in supporting diversity. While an impressive body of work exists documenting how people use public spaces and their importance in social life ([Carmona, Heath, Oc, & Tiesdell, 2003](#); [Gehl, 1987](#); [Lofland, 1998](#); [Whyte, 1980](#)), more studies could be targeted specifically at the use of streets, parks, plazas, commons and greens in diverse communities. Research on newly designed civic spaces (e.g., in New Urbanist communities) and monitoring of their use over time would also be extremely valuable.

Finally, plans for the physical development of diverse neighbourhoods could reflect this new knowledge about the relationship between urban design and diversity. Planners could build on a growing body of work in this area. For example, there are some very creative strategies that have been devised to bring neighbourhood residents together to work collectively and implement plans for improving neighbourhood public space. A recent publication by the Project for Public Spaces ([Walljasper, 2007](#)), is full of interesting ideas, like how to create ‘places to hang out’, how to ‘nurture pleasure and pizzazz’ and how to organise a neighbourhood event in nine simple steps. Strategies like these, devoted to bringing residents together to work collectively to strengthen neighbourhoods as places, are likely to be useful in the effort to stabilise and promote diverse neighbourhoods, even if extra effort is likely to be required to get a diverse population involved.

Another appropriate focus would be to suggest new types of regulatory codes. Diverse neighbourhoods need to simultaneously support homeownership and rental housing, integrate a range of housing types, densities and levels of affordability, and foster a mix of uses, services and facilities. Codes will be essential for making this diversity work. Part of the effort involves getting rid of excessive regulations, like exclusionary zoning and overbearing building codes. But it also involves reversing the rules by which social segregation occurred: allowing multi-family units where they have been excluded, and eliminating minimum lot sizes, maximum densities, minimum setbacks, and other rules that work to prevent housing type diversity. The diversity of uses needed also requires greater flexibility in codes, accompanied by some design control to ensure neighbourhood compatibility ([Parolek, Parolek, & Crawford, 2008](#)).

The physical designs that support diversity would probably be implemented through targeted public investment. In particular, diverse neighbourhoods need an infrastructure that supports positive social connection, and that means paying particular attention to the public realm. Parks, plazas, streets and other elements of the public realm sustain diversity by offering shared space, as opposed to places of privatised residential space. This stimulates informal, collective control and a sense of shared responsibility. Since diversity decreases distances between elements whose compatibility may be questioned, investment in the public realm may be essential for holding disparate elements together. If residents do not value the external context in which increased proximities occur, instead focusing on the

isolated value of the individual dwelling, social diversity may eventually lose support.

Similarly, sustaining mixed housing type in a diverse neighbourhood is dependent on strategic investment because diverse neighbourhoods are prone to gentrification and displacement pressures. Targeted public investment could be used to ensure that diverse neighbourhoods are not permitted to just appreciate beyond the means of middle and lower income groups. If diverse neighbourhoods are also to be well planned and serviced, there will need to be a political commitment to maintaining their social diversity.

Physical design that supports diversity may need to include strategies that increase the viability of mixed use, mixed income projects. Planners may need to lay out strategies for development support, from technical assistance to tax incentives and grant monies, to make it easier for developers and individuals in diverse neighbourhoods to combine funding in effective ways. If these strategies are presented in the context of a neighbourhood plan, diversity-sustaining development projects may engender greater support. Such plans could help ensure a balance between support for larger-scale development and funding for small, independently run businesses.

Above all, plans for the design of neighbourhoods that are socially diverse will require a shift in emphasis. There will need to be a focus on stability: how to keep a place diverse and prevent it from being taken over by one particular social group or one particular land use. In such cases, the goal of planning will be to encourage change that supports a stable heterogeneity, while discouraging change that undermines it. This will require constant monitoring and strategic thinking. Physical design strategies in support of a diverse neighbourhood run the risk that such efforts will undermine the very diversity planners and residents had hoped to protect.

4.2. Research questions

In the above paragraphs, we outlined a wide variety of ideas about the ability of planners to support, retain and create diverse urban places. We outlined the need for, and use of, continued research in four particular areas, including an overview of the relevance of work already done and the new strategies, policies and programmes planners are likely to require in their attempt to support places that are both compact and diverse. We now turn to summarising the above discussion by highlighting the key research questions related to each area.

4.2.1. Why are some existing urban places diverse?

We may be able to measure how socially diverse a neighbourhood is with some precision, but we do not understand why some places are more diverse than others. Is age, incremental growth, and slow transformation over time a *necessary* ingredient for social diversity in urban places? Are there documented examples of planned communities that were diverse from their inception? If so, were there particular social, political or economic forces that made it possible to initiate and sustain diversity in such places?

To what extent does the spatial geography of employment in metropolitan areas make it increasingly difficult to sustain diverse communities? Specifically, is diversity reduced where the region is divided up into separate clusters of high-income and low-income jobs, with limited spatial overlap? Can new communities be planned to include some of the employment diversity characteristic of older, inner-ring suburbs?

When demographic diversity is increased by infill projects on brownfields, greyfield malls, railroad yards, and other underused land parcels in older urban areas, does the demographic diversity as measured in census data translate into actual social interaction and community cohesion in everyday life? One of the complications of diversity research is understanding the difference between diversity that is statistical versus experiential.

It will be especially useful to find case studies of existing places that illuminate the impacts of gentrification on neighbourhood diversity, in the context of increasing pressures to live more compactly and sustainably. Where a reasonable balance between old and new residents has been achieved, what were the causes?

4.2.2. What policies and programmes are likely to promote diversity?

What are the policy implications of Putnam's (2007) recent research on the relationship between diversity and civic life? What follow-up research is needed to check the validity of his findings? How should Putnam's findings be interpreted with respect to placing a value on diverse neighbourhoods? What are the positive and negative effects of diversity? Even if diversity causes discomfort in the short run, is it a valid goal for the long run?

These questions are central because in the US it is especially hard to promote and sustain diversity programmatically—i.e., in comparison with European countries, social welfare and socialised housing is only weakly supported. This raises the question of whether

‘diversity’ has a different—and more negative—meaning for Americans, because so many critical supports for a decent quality of life (e.g., medical care, good schools, university education, retirement savings) are privatised, pitting individuals and social groups against one another, rather than encouraging a sense of shared responsibilities.

In light of these realities, what are the most effective policies for managing gentrification in order to avoid excessive displacement, so that a balance of old and new residents can be maintained? How can we distinguish benign gentrification from its harmful variations? What are the thresholds? Under what circumstances is it politically feasible to enact policies that limit or channel the forces of the real estate market in order to avoid wholesale neighbourhood transformations that eradicate diversity?

How important is the factor of *time* in pursuing diversity in urban communities? Is it often necessary for a community to pass through a period of conflict and tension before reaping the benefits of diversity? Is the time-consuming process of learning how to understand and appreciate differences essential?

4.2.3. *What planning processes are likely to promote diversity?*

What specific indicators of diversity should be used to guide neighbourhood planning? Do objective standards exist that can be incorporated into official planning processes? Exactly how can the preservation of diversity be defended as an explicit planning goal, separate from distributive equity and social justice?

While we already know a great deal about effective public participation methods in planning, what ‘extra steps’ are needed to incorporate diversity as a serious goal in neighbourhood planning processes? There is already a substantial literature on community-based planning, communicative planning, and planning for a just city. This literature deals with methods for including more groups, bringing in the chronically underrepresented, maintaining fair and open discourse, and rectifying power imbalances. But what elements are lacking in conventional efforts? What else needs to be done with a specific focus on creating stable diverse neighbourhoods?

With respect to creating neighbourhood plans, is the charrette process (compressed into a short period of time) suitable for dealing with diversity issues, which may involve deep-seated differences and conflicting worldviews? Should charrettes always be accompanied by a long-term process of neighbourhood organising, institution building (e.g., community development

corporations), and sustained support from municipal planners (e.g., a systematic neighbourhood planning programme)?

4.2.4. *How can we build new neighbourhoods, districts and towns that support diversity? What design patterns will work?*

We know the basics of designing for socially mixed environments, but we need to know more. Is it possible to design complexity into new land development projects so that they perform, at least to a significant extent, like diverse communities that have evolved slowly over time? What design and construction strategies might make this possible (e.g., using multiple builders and architects to avoid monotony, seamlessly blending in subsidised or public housing units, deliberate mixing of units at different price points within the same neighbourhood or block)? Can such attempts to emulate the diverse building types and streetscapes of older communities generate a measurable impact on social and economic diversity, or are the outcomes more aesthetic than substantive?

How should housing types be mixed to sustain social diversity? How much mixing is appropriate? Should types be mixed within blocks, between blocks, or in separate sub-areas of a new community? Is long-term diversity actually jeopardised when there is too much placing of people of diverse characteristics (age, income level, owner versus renter, etc.) in close proximity? Are different housing mix policies needed for suburban, inner-ring suburb, and inner-city neighbourhoods?

How important is the presence of high-quality, frequent, and safe public transportation for creating and maintaining diverse neighbourhoods? Has this factor been overlooked in research to date? What role can transit-oriented development (TOD) play in making it possible for a wide range of income groups to live in the same neighbourhood, while maintaining connections with regional employment and shopping opportunities?

4.3. *Conclusion*

The idea that places should be both compact and diverse may be asking the impossible—that urban dwellers use place as a connector rather than a divider. Essentially, residents of diverse neighbourhoods are being asked to reverse the usual association between place and difference, where attention to one has meant delimiting the other. They are being encouraged to have a heightened sense of place in a compact area and, at the same time, to have a more relaxed attitude about difference.

The strategies of working class neighbourhoods to distance themselves from the ghetto next door are illustrative of this paradox (Rieder, 1985). In Kefalas' (2003) study of the working-class 'Beltway' neighbourhood in Chicago, residents possessed a strong and distinctive sense of place that tended to separate Beltwayites from residents of poorer neighbourhoods nearby. Their strategy for maintaining the health of the neighbourhood 'relies on creating social and symbolic distances between themselves and the dispossessed' in an effort to 'deny their own marginality' (Kefalas, 2003: 155). Putnam's (2007) and Wilson and Taub's (2006) recent research, showing that certain measures of civic health are lower in more diverse communities, calls for careful interpretation, highlighting both the complexity of the topic and the need to question preconceptions.

As urban areas densify and diversify, neighbourhoods within them may need a special kind of attention. For planners, the situation presents special challenges to forming a unified vision of what the neighbourhood should be and how it should grow. It probably makes public participation even more essential, since the ability to take control of neighbourhood change may very well be the best strategy for sustaining diversity in compact areas. Because places that are struggling to be both compact and diverse are required to work through social complexity on a daily basis, it seems that planners could, at a minimum, ensure that there is a process in place for dealing with conflicts over issues having to do with the design and use of space (Harvey, 1996).

As Sennett has argued, embracing diversity in urban places requires not just a tolerance for diversity, but a tolerance for conflict (Sennett, 1970). In the context of neighbourhood, it may also require a recreated notion of community. If the basis for commonality is not linked to a common race, ethnicity, social class, occupation or stage in the life cycle, can it be based on common

space? Bellah, Madsen, Sullivan, Swidler, and Tipton (1996) argued that community is indicative of a withdrawal from social complexity and, admittedly, the ability to translate notions of community beyond nostalgia, conformity and control has been difficult to pull off. Planners will need to understand the possibilities and limitations of building community based on the overlapping spaces that diverse groups occupy. Planners may be in a position to help promote both the physical design required for diversity and the process needed for its shared management.

Recently, there has been a sense of idealism about diversity that has been reverberating throughout planning scholarship, albeit from different angles. Myers (2007), for example, writes about the need to recognise interdependencies and mutual self-interest among the growing 'immigrants and boomers' that will define metropolitan society in the coming decades. Fishman (2005) hopes for the 'reurbanism' of our cities into diverse, mixed-income neighbourhoods through a combination of what Jacobs called 'unslumming' and, if need be, a softer form of gentrification. Ellin's (2006) 'Integral urbanism' is defined by networks, relationships, connections and interdependencies that counteract separation and retreat. These are part of an emergent, sophisticated discourse about diversity that goes beyond what has been discussed before.

This may be the continuation of a quest for diversity that has always been part of the planning profession, from Garden Cities to British New Towns to New Urbanism. And there has always been recognition of the significant challenges it entails. It has always been difficult to translate ideals into planning policies, programmes and designs, moving from the rhetoric of 'communities of tolerated difference' to the provision of an actual context for them to grow and flourish. In the coming decades of increasing density and diversity, the issue will take on renewed urgency.

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