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Chapter Title	21 Urban and Spatial Demography	
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Abstract	The spectacular growth of urban areas and the rise of large scale urban systems are prominent features of the contemporary spatial distribution of population. A century ago few individual countries were majority urban; in the past decade the world's population crossed that threshold and is trending toward even higher levels of urbanization. This chapter reviews the macro-level features of urban systems and the micro-level spatial patterns of land use and residential distributions within urban areas. It addresses macro-level questions such as: Why do cities exist?, Why are cities located where they are found?, Why do cities vary in size and direction and magnitude of growth?, Why are cities embedded in hierarchically organized systems? It also addresses micro-level questions such as: How does land use vary spatially within urban areas and why? and What are the patterns and determinants of differential residential distribution and segregation of social groups in urban space?	
Keywords (separated by '-')	Urban demography - Spatial demography - Urban ecology - Urban system - Central place - Urban land use - Residential segregation - Neighborhood change	

Urban and Spatial Demography

21

Mark Fossett and Amber R. Crowell

Introduction

The spatial distribution of populations has long been a central focus of demographic inquiry. Structured patterns in spatial distribution are evident from the highest levels of macro-spatial scale, e.g., global, national, and regional urban systems, to medium- and fine-grained patterns in metropolitan areas, e.g., central cities, suburbs, exurbs, rural hinterlands, neighborhoods, zoning areas, and voting districts. The task of documenting and explaining these patterns has occupied the attention of sociologists, economists, geographers, and regional scientists. Their efforts have established a body of knowledge that is impressive for its cumulative nature, rigorous theoretical underpinnings, and extensive evidentiary base.

Without question, the dominant feature of spatial distribution in the United States and other developed countries is the concentration of population in densely settled urban areas. Metropolitan centers contain the greatest share of the population in developed countries and exert influence over life in nonmetropolitan and rural areas as well as in urban areas. Increasingly, it is difficult to classify a significant portion of the population in a country such as the United States as non-urban in the sense of populations living in low-density, small scale communities that are largely self-sufficient in economic organization and substantially closed in terms of social organization. Instead, the daily rhythms of social and economic life of the vast majority of the U.S. population are fundamentally organized by, and integrated with, social and economic activity in metropolitan centers. Accordingly, this chapter focuses primarily on inter- and intra-metropolitan spatial distribution. We restrict the chapter to developed countries. We will not review the patterns and trends of urban and spatial distribution in developing countries. Such an endeavor could easily be the object of a separate chapter, given that the world passed the threshold of having a majority of the world's population residing in urban areas since the first edition of this *Handbook of Population* was first published in 2005. According to the United Nations (2018), in 2018 the world was 54% urban.

Conceptual Frameworks

Several theoretical frameworks inform general demographic understandings of urban and spatial patterns. Urban and regional economics, human and urban ecology, and urban geography can be characterized as shaping the traditional

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D. L. Poston, Jr. (ed.), *Handbook of Population*, https://doi.org/10.1007/978-3-030-10910-3_22

demographic perspectives on urban and spatial population patterns. In addition, a variety of "new" approaches including critical and political-economic perspectives and sociocultural and postmodern views are sometimes offered as alternatives competing with the traditional demographic perspectives. They are discussed here from the point of view that some critiques and insights associated with these perspectives warrant mention due to the history of engagement between traditional and new perspectives.

Urban Economics, Economic Geography, and Regional Science Perspectives

Urban economics, land economics, economic geography, and regional science apply the conceptual tools and theoretical methodology of economic analysis to derive implications for the spatial distribution of land use and population. Isard (1956, 1960, 1975) and Alonso (1964) provide statements on the spatial analysis of economic activity that serve to integrate earlier influential work in the field (Hoover 1948; Zipf 1949; Weber 1929; and Christaller 1933 [1966]). Cumulative theoretical advances continued through the 1960s and 1970s with important contributions by Muth (1969), Mills (1967, 1972), Henderson (1974), Thompson (1965), and Friedmann and Alonso (1964). Recently, important work includes theoretical and empirical studies focusing on the spatial aspects of the economy (Krugman 1991; Fujita 1989; Fujita et al. 1999; Black and Henderson 1999) and integrative reviews of the state of the field (Anas et al. 1998; Huriot and Thisse 2000; Fujita and Thisse 2002, 2013; Fujita and Krugman 2004; Henderson and Thisse 2004; Duranton et al. 2015).

Two important examples of the application of this perspective are central place theory and its implications for the spatial distribution of population with an urban system, and the theory of rents and its implications for the spatial distribution of economic actors within urban areas. The former builds on relatively simple assumptions about the costs associated with the movement of people, goods, and information in an idealized spatial domain to deduce patterns of population distribution into a cascading hierarchy of population centers arranged geometrically in space around central nodes. The latter also uses formal theoretical models to show that distinctive patterns of differentiated land use, economic activity, and population distribution emerge within urban areas based on the varying requirements of spatial actors and their differing ability to compete for spatial locations. Formulations such as the Alonso-Muth-Mills "bid rent" model of the monocentric city and the Krugman-Fujita-Thisse models of the new economic geography provide elegant descriptions of particular patterns. But more importantly, they provide rigorous foundations from which more refined models can be developed to account for more complex patterns such as polycentric urban land use patterns discussed in Fujita and Ogawa (1982), Fujita and Thisse (2013), and Duranton and Puga (2015).

Human and Urban Ecological Perspectives

Human ecology and its subfield of urban ecology have been the central perspectives informing the sociological understanding of population (Namboodiri 1988; Poston and Frisbie 1998, 2005), especially the dimension of spatial distribution (Berry and Kasarda 1977; Frisbie and Kasarda 1988). The classical form was set forth in the first half of the twentieth century in the writings of R. Park (1936a), Ernest Burgess (1925), and Roderick McKenzie (1924, 1926, 1927, 1933), along with other scholars who drew on and adapted concepts from evolutionary and ecological theory in biology. Subsequently, O. D. Duncan (1959, 1961, 1964), and most especially Amos Hawley (1944a, 1950), recast the perspective in its present neo-classical form.

The dominant theoretical vision has been enunciated in the writings of Hawley (1950, 1968, 1971, 1984, 1986) which outline a fundamentally materialistic view of human populations that focuses on macro-level social organization rooted in and shaped by "human sustenance relations." The scope of human ecology is intentionally restricted (Hawley 1950:73–74)

and employs a small set of carefully chosen assumptions and concepts to pursue testable propositions about macro-structural processes such as functional differentiation in human populations, spatial differentiation within urban systems, metropolitan expansion, and the emergence of hierarchy and subordinate-dominant relations in urban systems. The strategy of limiting attention to a small number of organizing principles has served the ecological perspective well by avoiding common problems, e.g., teleology, that plague some functionalist perspectives (Turner 1991). However, its narrow focus has prompted some critics to charge that it neglects important questions (Feagin 1998) and engages in technological reductionism and offers incomplete explanations of socio-spatial patterns (Gottdeiner and Hutchinson 2000). See another argument in Brown's Chap. 19 in this *Handbook of Population*.

The ecological perspective is compatible with regional and urban economic perspectives, so much so in fact that early proponents (McKenzie 1933; Hawley 1944a, 1950) took care to point out that ecological principles involve more than the application of economic analysis (Gibbs and Martin 1959). One distinction is the ecological view that human communities adapt to their environment as a collectivity, not as atomized calculating individuals. As Hawley notes, humans not only have the capacity for social affiliation and nonrational attachments to other individuals and groups, it is fundamental to their nature and is crucial to their survival. This impetus is expressed in social ties based on family, extended kinship, ethnicity, culture, and common interest. These rational and nonrational bases of sociality and affiliation give rise to group formation and social organization over and above what can be anticipated on the basis of narrowly circumscribed economic considerations. Thus, "the ecological viewpoint is that of individuals and groups seeking position in a developing system of relations" (Hawley 1950: 73). Significantly, group-level adaptation can give rise to group-based competition for dominance within ecological systems (Fossett and Cready 1998: 169–174; Hawley 1950: 209–221; Noel 1968; Hannan 1979).

In short, human ecology incorporates insights from urban and regional economics but directs theory and attention to a wider range of social phenomena. Ecologists give attention to the potential spatial implications of diversity in ethnic culture, social status, and the values, interests, preferences, and tastes associated with social groupings. And ecologists invoke notions of competition that subsume not only the dynamics of market processes but also inter-group competition and individual- and group-based behavior that occur outside the framework of markets, e.g., conflicts, discrimination, and protests.

From the 1930s through the 1960s and into the 1970s, the concerns of urban ecology were central not only to demographic perspectives on urban areas and urban systems but also to the broader field of urban sociology. By the 1980s and beyond, however, urban sociology increasingly directed attention to questions outside of the purview of the urban ecological perspective. The field of urban sociology fragmented in many directions giving greater attention to urban social problems, political-economic perspectives, and urban studies broadly construed. As things stand today, the urban ecological perspective is primarily reflected in the field of demography within sociology. In that area traditional ecological concerns are also joined by increasing attention to spatial analysis and spatial questions spurred at least in part by new developments in techniques and methods in geography. The resurgence in attention to space is reflected by statements characterizing demography as an inherently spatial science (Voss 2007; Weeks 2016), by recent integrative works on spatial demography (Howell et al. 2016; Logan 2016) and by new journals such as *Spatial Demography* that explicitly focuses on spatial-demographic issues.

Geography

A similar trajectory has been seen in geography where the contributions to understanding urban and spatial population patterns have changed over time. In the 1960s and 1970s a cadre of geographers heeded the call of Garrison (1959, 1960) and endeavored to refine and extend

economic and ecological perspectives guiding geographic understandings of urban and regional population distributions. Yeates (2001) notes this led to the emergence of a distinctive and influential Chicago School of urban geography. Like the earlier Chicago School of sociology, the Chicago School of urban geography was characterized by a coherent vision regarding theory, methodology, and an agenda for research. F. Be[illegible] was especially influential regarding geographic perspectives on population distribution both within and between urban regions and urban areas. He collaborated with Horton (Berry and Horton 1970) and later with Kasarda (Berry and Kasarda 1977) on major integrative statements. Other influential contributions from this era (Haggett 1965; Chorley and Haggett 1967; Abler et al. 1971; Bourne 1971; and Bourne and Simmons 1978) reflected a flowering of formal theoretical development and quantitative research. The impact of the work from this period was far reaching, but the discipline of geography, even more than sociology, fragmented in the 1970s and 1980s as critical and political economic perspectives exemplified by Harvey's *Social Justice and the City* (1973) deflected attention away from demographic perspectives on urban systems and spatial patterns (~~Johnston 2006~~).

In recent decades, the more influential contributions from geography have been in the areas of specialized methodologies, such as techniques of quantitative spatial analysis and modeling, the compilation of multidisciplinary geographic information system data bases, advances in techniques for manipulating and visually representing spatial data, and the analysis of data generated from aerial and satellite photography and remote sensing. These methods and techniques have become part of the standard toolkit used by demographic researchers in all disciplines, not just in geography (Howell et al. 2016). Additionally, geographers have made distinctive contributions focusing on spatial measures of segregation, in contrast to the aspatial approaches to measurement that have dominated the demographic literature (Wong 2016). Berry (2004) has reflected on the changing directions of the field from the 1960s to the present era noting that advances in techniques have been impressive, but that it more important than ever for application of advanced techniques to be guided by grounded spatial theory.

Consolidation of the Traditional Perspectives

It is fair to say that the greatest energy in development of theory focusing on urban areas and urban systems from traditional demographic perspectives is nowadays seen in urban and regional economics and regional science. The work in these fields is of course compatible with the urban ecological and geographic perspectives. But it is distinct for its strong emphasis on formal economic models that are steadily becoming less accessible to non-economists. Human ecological and urban ecological perspectives in sociology and geography have not advanced at the pace seen in urban economics and regional science in recent decades. But they continue to provide valuable insights that broaden the scope of urban and spatial demography.

Political Economic and Critical Perspectives

From the early decades of the twentieth century through at least the 1960s, urban sociology was dominated by the urban ecological perspective. This began to change in the 1970s, and by the 1980s the work of scholars drawing on political economic and critical perspectives was receiving equal or greater attention in journals and in urban sociology textbooks. Loosely coalescing around such works as Logan (1976, 1978), Logan and Molotch (1987), Gordon (1977, 1984), Hill (1977), Molotch (1976), Harvey (1973), Feagin (1985, 1988, 1998), Gottdeiner (1983, 1985), Gottdeiner and Feagin (1988), Castells (1977, 1985), Smith and Feagin (1987, 1995), Tabb and Sawyers (1984), Walton (1979, 1981, 1993), Scott (1988), and others, this perspective is heterogeneous and sometimes internally

contentious. Even today no dominant vision has integrated and consolidated the differing points of view as has occurred in urban and regional economics, regional science, and urban ecology.

Given the diversity of viewpoints it is sometimes easier to note what is not embraced. Most scholars and researchers in this tradition eschew the analytic models that undergird urban and regional economics and reject the functionalist underpinnings of ecology and economics, especially their reliance on notions of adaptation and equilibrium. They also tend to be skeptical of the importance that traditional demographic perspectives assign to technological change in structuring equilibrium arrangements in the spatial distribution of population. Some are more open to drawing on traditional demographic perspectives than others, e.g., Smith (1995), but in general, followers of these new perspectives studiously avoid crediting dra[illegible]g on the concepts and theoretical language of traditional demographic perspectives.

By way of a more positive identification, Jaret (1983: 499–503) notes those working in political economic and critical perspectives tend to view urban structure and processes as "shaped by and rooted in the capital accumulation process," a focus on class conflict and social inequality, and are guided by the hypothesis that urban and social problems reflect the "contradictions and limitations of capitalism" (1983: 499–503). These perspectives also give more explicit attention to the role of the state in urban patterns and the spatial distribution of population, although there is not complete agreement on the question of the degree to which the state is an autonomous actor or merely a reflection of capitalist interests.

Another defining characteristic of critical perspectives is that they direct attention to a different set of questions than traditional economic and ecological perspectives. Specifically, their main questions concern social inequality, concentration of power, uneven development, discrimination, and urban social problems. In many ways, critics' objections to traditional perspectives are rooted more in their dissatisfaction with the narrower range of questions selected for attention than with the specific theories and empirical findings they develop in pursuing them. It is also fair to say that traditional and critical perspectives differ with regard to the balance between advancing basic scientific knowledge grounded in formal theory and abstract models, in contrast to engaging debates on contemporary social problems.

A major insight offered by political economic and critical theorists is that there is more to urban and spatial population distributions than the impersonal machinations of laissez faire economics and the population dynamics of human and urban ecology. The state, powerful institutional actors, elites, and others with vested interests of various kinds can and do play roles in shaping spatial population distributions. Traditional demographic perspectives are not particularly well-equipped to pursue that insight and tend to focus attention on patterns expected when law, regulation, and strategic interventions by powerful actors exert limited or moderate influence. Deviations from these expectations are viewed as potentially interesting on a case-by-case basis, but they do not have general implications for urban and spatial patterns.

A key difference is that traditional perspectives set forth clear predictions regarding the implications of their theories for spatial distribution. In contrast, new perspectives do not generate or even in some cases seek to generate clear *a priori* expectations about spatial patterns. The insight that the state and powerful actors have the capacity to shape spatial patterns is hardly controversial. But to date, new perspectives have not offered compelling arguments that the actions of the state, institutional actors, and local elites consistently give rise to predictable, systematic spatial patterns that differ markedly from the broad forms predicted by traditional demographic perspectives. This is not surprising to since major deviations will potentially involve major costs and competitive disadvantage that are unlikely to be incurred for no good reason.

In sum, critical and political economic perspectives address gaps by investigating how powerful actors can exploit, manipulate, and distort spatial patterns predicted by traditional perspectives. They point out that spatial

distributions can be influenced by state decisions regarding the siting of military installations, universities, prisons, defense industries, dams, and other large-scale, public investments. Likewise, they additionally note that institutions and elites can use political power and subterfuge to influence spatial distributions by affecting such behaviors as the siting of airports, the development of harbors, the specific location of highway interchanges, tax subsidies to particular industries, incentives for downtown development projects, and so on. The impact on general spatial patterns is often modest. As a consequence, critical and political economic perspectives overreach when they suggest that insights from traditional economic and ecological perspectives are rendered obsolete. For example, developers, speculators, pro-growth elites, and other key actors in political economic processes are found everywhere and in principle could produce wide variation in urban and spatial patterns if these patterns were not structured by forces identified in traditional demographic perspectives. Instead, political-economic machinations notwithstanding, cities arise in particular locations, and grow and decline in ways that align closely with predictions of traditional demographic perspectives. This lends credence to Frisbie and Kasarda's (1988) suggestion that critics sometimes take basic population patterns that traditional perspectives predict well as "given" and direct their attention primarily to less fundamental patterns where other factors are more relevant.

Sociocultural and Postmodern Perspectives

Before the rise of critical and political economic perspectives, there was an earlier socio-cultural critique of economic and urban ecological theories. One of the most influential contributors to this view was Firey (1945, 1947) who showed that culture, symbolic meaning, and sentiment and emotional attachment shaped spatial patterns in the center of the city of Boston, an area where conventional perspectives would predict that the intensity of land use would be at its maximum. The key insight of the sociocultural perspective is that even in secular, market-oriented capitalist societies, the spatial arrangements of land use and population distributions are not determined solely by impersonal market forces and rational calculation. In societies where religion and tradition are especially powerful, the insight may be crucial, and understanding the cultural system may accordingly be fundamental for explaining land use and spatial patterns.

There are at least some parallels between the sociocultural perspective and the current perspective examining the city from a postmodern vantage point (Dear and Flusty 1998; Dear 2000; Soja 1997, 2000). Both views stress that urban form and spatial distributions are guided by cultural values independently of economic and ecological factors identified in traditional perspectives. However, where Firey's view points to the persistence of cultural values rooted in tradition and sentimental attachments to the past, postmodernist views point to an even wider range of cultural possibilities. This new view posits that increasing wealth and technological advancement are freeing spatial arrangements from the constraints of geography, technology, transportation costs, and the inertia of fixed capital investments, and they are also breaking down the importance of historically rooted sentiment and tradition. Consequently, an expanding array of discretionary cultural values may increasingly shape land use and spatial distribution and a wider array of arrangements is seen as possible.

While the core insight of these perspectives, namely, that spatial population arrangements can and sometimes are influenced by culture, symbolism, and sentiment, is valid, Guest (1984) is correct when he concludes that the sociocultural position, as well as postmodern views, can easily be overdrawn and do not necessarily call the insights of traditional demographic perspectives into question. The impacts of culture, tradition, and sentiment are often evident, but they are usually expressed in limited ways or at the margins and are not the dominant force shaping urban spatial patterns. So it remains premature to claim that spatial population arrangements have been liberated from the economic and ecological principles.

Most of the remaining discussion in this chapter will be directed to discussions of theory, methods, and research that fall squarely in the traditional demographic perspectives on urban and spatial distribution. For the purposes of answering basic demographic questions, insights from new and alternative perspectives tend, where valid and discernible, to be supplementary and complementary, not substitutive. Traditional demographic perspectives continue to be central for understanding urban and spatial population distributions.

The Success of Cities: Node and Hinterland

Cities are enormously successful social inventions. They dominate spatial population patterns because they confer adaptive advantages to their populations by greatly facilitating communication, social interaction, trade, economic production, and administration. From their earliest inception, cities were imbedded in broader macro-spatial systems. Fixed populations of any consequence must necessarily have extensive relationships with the outlying populations that sustain them with surplus food and resources. Thus, cities are never isolated entities; they always are linked in a division of labor with hinterlands. That is, the outlying regions are socially, economically, and often, but not necessarily, politically integrated with urban centers. City and hinterland thus form a coherent unit of social organization, a nodal-functional region that may be viewed as a relatively self-contained system.

When one views the burgeoning metropolitan areas of the present era, it is easy to lose sight of the fact that for most of human experience cities were hardly inevitable or enduring. Keyfitz (1965) points out that, while the capacity to generate a stable agricultural surplus is a precondition for cities to emerge, the potential for urbanization often went unrealized for long periods of time. Thus, cities were possible forms of social organization, but not inevitable. Where cities did arise and prosper, history shows that their persistence was precarious. It is sobering to contemplate that most ancient cities thrived for a time and then disappeared never to arise again. For this reason, demographic perspectives view the functional system of city and hinterland, merely as an empirical possibility, and do not take for granted the question of how organized populations adapt to their environment. This should dispel the charge that has been made that the economic and ecological theory holds a mystical view of functional systems that obscures human agency (Gottdeiner and Hutchinson 2000). The social relations binding node and hinterland into a functional system are not inevitable. History has shown that they may not cohere and, when they do, they may not necessarily endure. Thus, cities can decline as well as rise. It is good to bear this in mind in an era where the fate of more than half the population of the world is directly linked to cities and urban systems and concerns about climate change, clean water, and environmental degradation raise questions about current arrangements being sustainable for the long term.

Cities grow through two primary processes. One is expansion, the process whereby the influence of a particular urban center is incrementally extended over an increasingly large hinterland often including other urban centers. In expansion, new territories and populations are drawn into the network of social interactions and interdependencies, and they are directly and indirectly coordinated by the dominant urban center. At one extreme exemplified in the imperial city, the incorporation of outlying populations is brought about by political compulsion and force. Alternatively, incorporation may emerge out of mutual benefit through exchange and trade. Either can give rise to a functionally integrated spatial system.[1] Expansion generally proceeds until it

[1] As in theoretical models of biological ecology, the notion of functional relationship in urban ecology does not imply mutual and symmetric benefit. Thus the elements that comprise an ongoing, functionally integrated empirical system do not necessarily all benefit equally or influence each other symmetrically. Stable biological ecosystems include a wide range of relationships such as predator-prey relations and parasitism as well as direct and indirect mutual benefit.

reaches the limits of sustainable coordination which can vary with a number of factors including technologies of communication and transportation, the effectiveness and efficiency of social organization, and the nature of the relationships in the system (Hawley 1950; Kasarda 1972). For example, systems expanding through mutually beneficial trade may be more durable than systems expanding through imperial action. System expansion may be limited when the boundaries of other competing urban centers are reached.

The second way cities grow is by adopting more efficient technologies and/or modes of social organization within the full system, i.e., the node and the hinterland together, that increase productivity and with it the carrying capacity of the system. This permits the growth of the urban population through either migration from hinterland regions, or natural increase, or both. Over the long course of urbanization in world history, the steady increase in productivity and carrying capacity was the main factor that made it possible for cities to reach enormous proportions and contain ever larger fractions of regional, national, and global population.

Macrospatial Distribution

Cities do not arise in random locations, nor do all cities grow to the sky or to the same size. Cities differ in the activities that their populations engage in, and in the nature and degree of their interrelations with other cities. Cities are imbedded in regional, national, and global systems that are hierarchically structured. In urban systems, the relative positions of cities change over time. Some cities grow in relative size and influence, while others decline. These matters constitute the core concerns of economic and ecological theories explaining macro-spatial population distribution.

Central place theory, a crucial building block in traditional demographic perspectives dealing with the spatial distribution of population, is guided by the insight that spatial proximity reduces costs associated with communication, interaction, and exchange, and thus provides a powerful impetus for the emergence of population nodes. Formal models building on this premise yield a number of important predictions about how populations will be distributed and organized in space. Under a fixed set of communication and transport technologies, (1) population will coalesce into nodes serving as focal points for trade, communication, and political and economic administration of a surrounding spatial domain, (2) nodes will vary in population size and region of influence, (3) the size distribution of nodes will be regular and strongly negative, that is, smaller areas will be more common, and frequency will decline sharply with increasing size, (4) nodes will be functionally differentiated, with larger nodes having more coordinative functions and more extensive connections with other nodes in the system, (5) the spacing of nodes of a given size will be regular in relation to each other and in relation to the nodes of other sizes, and (6) nodes will be hierarchically organized with the node at the center being the largest and most influential. The development of this perspective has taken place over many decades. Reviews of central place theory (Berry and Horton 1970; Richardson 1969; Mulligan 1984; Fujita et al. 1999; Gabaix and Ioannides 2004; Ikeda et al. 2017) trace its intellectual foundations, identify the core assumptions of the perspective, and summarize the implications that flow from them. Recent developments in the emerging field of computational social science lend further support to the perspective by showing that implementing relatively simple principles in agent models will give rise to complex urban patterns consistent with central place theory (Batty 2005).

Central place theory is an idealization, and economists and ecologists are well aware that the assumptions of the theory and hence some of its predictions are not fully approximated in real urban systems. While empirical patterns often depart in important ways from the predictions of the theory, the theory is nevertheless highly influential because the conceptual framework has been shown to be extensible, and supplementary theories have been developed to deal with spatial

complications that arise when particular assumptions are not met.

For example, special location theory deals with the fact that resources of different types are not distributed evenly in space. This provides a basis for predicting deviations from the geometric arrangements of centers and subcenters expected in the central place system. It also provides a basis for predicting more extensive functional specialization among cities. Consider as an example the concentration of petrochemical industries in regions where oil and gas deposits are found. Break-in-transportation theory (Cooley 1894) deals with the fact that the cost of movement in space is not uniform for all goods or in all directions and leads to predictions that population nodes will arise where it is either necessary or cost-effective for movement of goods and people to shift from one mode of transportation to another. Theories focusing on factors such as the bounding effects of national borders, especially for small countries, and uneven historical development of regional economies and transportation infrastructure help account for the occurrence of primate cities and other departures from the size distribution of cities predicted by central place theory (Walters 1985).

In sum, central place theory offers a powerful basis for understanding macro-spatial population distributions. Scholars working within traditional demographic perspectives see it and associated theories as providing a rigorous foundation for understanding and interpreting macro-spatial population distributions.

Borchert's (1967) classic review of changes in the U.S. urban system over a long span of time illustrates how abstract, ahistorical theories of location and spatial distribution can guide a historically informed account of how changes in technology influenced the evolution of the urban system. He traces how different cities in the urban system rose or fell in rank position in the urban system following major changes in technologies for transporting people and goods. For example, the steady increase in the size of ocean-going ships conferred advantages to ports with natural deep-water harbors such as New York and San Francisco, and disadvantages to ports with shallow bays such as Charleston. Similarly, the emergence of rail and later, trucking and air transport technologies, substantially offset the advantages associated with proximity to a major navigable river or body of water. This made it possible for such inland cities as Kansas City, Denver, and Dallas-Fort Worth to rise in rank position in the urban system. Correspondingly, it contributed to long-term declines in relative rank for cities such as St. Louis and New Orleans whose position in the urban system had been substantially predicated on inland water transport technologies. Cottrell's (1951) classic study "Death by Dieselization" complements Borchert's research by documenting the consequences of technical change for communities at the lower end of the size distribution.

Significantly, the changes Borchert describes often occurred slowly over many decades. Naive consideration of ahistorical analytic models might suggest that time lags would be minimal. But more deft use of such models to understand empirical systems requires allowance for the significant inertia deriving from fixed capital investments and established social arrangements. These produce long lags in the fundamental restructuring of spatial distribution. Cities favored by new technologies may rise slowly, and cities put at a disadvantage by new technologies may drift slowly down the urban hierarchy. This means that the macro-spatial distribution of population at a particular point in time is rarely if ever in an equilibrium state. Nevertheless, the equilibrium arrangements predicted by the theory give a basis for understanding and anticipating patterns of change in population distribution.

Functional Specialization, Integration, and Hierarchy in Urban Systems

Cities are imbedded in regional, national, and global systems. These massive spatial systems are functionally integrated and hierarchically structured. Functional specialization is understood in terms of central place theory, special location theory, and break-in-transportation

theory and is extensively documented in studies of industry and labor force profiles of metropolitan areas that provide a basis for identifying a city's basic function. These range from hand-crafted typologies developed from inspections of distributions of location-quotients for industries in different areas (Alexandersson 1956; Harris 1943; Mayer 1959; Harris and Ullman 1945) to the use of statistical techniques such as factor analysis to identify city types (Hadden and Borgatta 1965; Berry and Horton 1970; Kass 1973). Different approaches yield slightly different typologies; for instance, cities may be restricted to being single-function cities, or multiple-function cities may be permitted. All sustain the conclusion that cities specialize in economic activities and are implicated in an expansive macro-spatial division of labor sometimes termed the horizontal dimension of the urban system.

The other key dimension, that is, the vertical dimension, reflects the fact that functions of influence, coordination, and control are not evenly distributed across cities in the system or within the nodal-functional system associated with a single city or metropolitan area. Taking the latter case first, cities compared to their hinterlands are more likely to be home to regional headquarters and the administrators and decision makers who work in them. They are located in urban centers so they can more easily coordinate with others in similar roles. This creates a powerful asymmetry in the functional relations between metropolis and hinterland, and the relation termed as ecological dominance obtains (McKenzie 1933; Bogue 1949; Hawley 1950). In many matters, the metropolis exerts great influence over social and economic life in smaller cities, towns, and villages in the hinterland, for instance, via controlling access to capital through spatially nested financial institutions overseen by headquarters in a national metropolis. The subdominant areas in the hinterland may have little choice but to accept asymmetric "terms of trade" because the metropolis mediates their access to the broader urban system. This example again highlights that the ecological notion of a functionally integrated system does not imply that the relationships in the system reflect equal influence and harmony of interest.[2]

Dominance attaches to key function, that is, the economic activity that is crucial to establishing the flow of sustenance, i.e., income, in the community (Hawley 1950, 1968; Meyer 1986). The key function is found in the specialized activity that marks the community's place on the horizontal dimension of the urban system, and it is in this area that a metropolis is most likely to be distinguished from other metropolitan areas. Galle (1963) shows that industries have higher concentrations of executive, administrative and technical staff in metropolitan areas where they represent the key function, sometimes called basic or city-building industries, than these same industries have in metropolitan areas where they do not represent the area's key function. In contrast, metropolitan areas tend to be relatively similar in the occupational profiles of their non-basic industries. Central place theory predicts that key functions follow the size of city with higher-order cities having a greater degree of specialization in metropolitan functions involving administration, coordination and control, and the flow and distribution of information, capital, and goods. Special location theory and break-in-transportation theory are also used to explain why lower-order cities specialize in particular key functions.

Dominance is a matter of degree, and there are many levels of hierarchy. All metropolitan areas perform metropolitan functions for their hinterlands, but the degree of specialization in these functions varies greatly. A subregional metropolis that exerts influence over a small hinterland may be nested under a regional metropolis that exerts influence over the subregional metropolis and, through it, indirect influence over its hinterland. The regional metropolis will itself be nested under a national metropolis and so on. The

[2] Smith (1995) notes that the distinction between ecological perspectives and critical and political economic perspectives in this area is not great. The difference often boils down to the fact that ecological theory, reflecting its intellectual roots in bio-ecology, uses relatively neutral terms such as dominant and subdominant when describing actors with varying degrees of influence and power.

key prediction emerging from central place theory is that functions of coordination and control are found in the greatest concentration in cities at the apex of the urban hierarchy, and so they exert tremendous direct influence over the entire urban system (Berry and Horton 1970; Berry and Kasarda 1977).

Early studies by McKenzie (1933) and Bogue (1949), and Vance and Sutker (1954) used relatively simple data and somewhat imprecise methods for assessing dominance and position within the urban hierarchy. Duncan and his colleagues (1960) drew on more extensive data and more exacting methods of measurement to establish the outline of a national urban hierarchy for the United States. Wanner (1977) drew on the data reduction capabilities of factor analysis to simultaneously place cities on the horizontal and vertical dimensions of the urban system. Eberstein and Frisbie (1982) and Eberstein and Galle (1984) established the relations of functional interdependence between metropolitan areas in regional and national systems based on commodity flow data documenting patterns of trade. And many different analyses drawing on various methodological approaches have documented patterns of persistence and change in national and regional metropolitan hierarchies (Duncan and Lieberson 1970; South and Poston 1980, 1982; Galle and Stern 1981).

In recent decades the study of urban systems has increasingly focused on global systems and regional systems at the world level. Studies informed by ecological theory and traditional demographic perspectives are prominent (Dogan and Kasarda 1988a, b; Lo and Yeung 1998; Meyer 1984, 1986; Kasarda and Crenshaw 1991; Bollen and Appold 1993; Kim and Shin 2002; London 1987; London and Smith 1988). Studies guided by political economic perspectives are equally numerous (Chase-Dunn 1984; Chase-Dunn and Hall 1993; Chase-Dunn et al. 2000; Chase-Dunn and Grimes 1995; Rossem 1996; Wallerstein 1974, 1980; Walton 1976; Timberlake 1985; King 1990; Smith and White 1992; Smith and Nemeth 1988). A smaller number of studies seek common ground and explicitly draw on both orientations (London 1987; London and Smith 1988; ~~Hudson 1987;~~ Smith 1995). Notable in this literature is that studies from different perspectives often use similar empirical measures to establish position in global urban systems. Research and debate in this area are ongoing (Alderson and Beckfield 2004, 2006; Taylor 2006), but space does not permit review of this burgeoning literature here in this chapter.

One area of controversy is the question of how interdependency and the macro-spatial division of labor relate to uneven development, economic restructuring and economic dislocation, dominance relations, and the spatial structuring of inequality. Ecologists posit that many consequences follow when population centers are drawn into a macro-spatial division of labor. The population center gains access to the productive efficiencies and possibilities for economic growth that are associated with specialization, a refined division of labor, and greater access to markets. At the same time, however, the population center loses autonomy and independence and is exposed to direct and indirect competition with other urban areas. This makes the population vulnerable to significant social and economic dislocations when ecological processes operate to bring about a balance or equilibrium between population and opportunities for living. Chief among these processes is population migration. It is presumed that, unless impeded, population in low-wage regions will flow toward high-wage regions. This underlies much of what we know about rural-to-urban migration and migration flows between regions and nations. Of course, the latter is much more highly restricted by institutional barriers such as national borders.

Another process outlined in the economic literature is filtering, in which industries commanding higher wages at a given time and location are likely to be redistributed from the initial spatial locations where they were spawned to new spatial locations. The classic example is when a high-wage, high-skill manufacturing industry undergoes incremental refinements such as routinization and mechanization of activities that eventually permit the use of less skilled labor. This combines with diffusion of technology and material culture making it likely that production

and employment in this sector of the economy to be redistributed from high-skill, high-wage areas to low-skill, low-wage areas resulting in job loss and wage declines in the origin region and new jobs and wage increases in the destination regions (Vernon 1966; Thompson 1965). One of the dynamics of globalization in the current era is that many obstacles that have historically impeded adjustments of this sort are falling at the same time that cities and nations are becoming more tightly integrated into a single global system. Consequently, both negative and positive consequences flowing from participation in the global system of cities, and nations, occur more often, and their impacts can reach dramatic proportions in ever shorter time frames.

Not surprisingly, traditional demographic perspectives emphasize the role of transportation and communication technologies in these processes. For example, the rise of the internet and cheap, high-speed telecommunications have had the effect of making the business services sector in high-wage regions vulnerable to macro-spatial competition for the first time in history. Thus, for example, high-tech jobs in computer programming and information technology support are filtering down the global urban hierarchy from high-wage incubator areas in the United States, such as the "Silicon Valley" region in California, to lower-wage, high-tech centers in India. Dramatic economic growth in high-tech cities in India is the flip side of economic dislocation and restructuring in U.S. counterparts. The general phenomenon has been seen throughout history, but the scale and pace of these transitions are unprecedented in the present era. The birth of high-wage, innovation-driven industries in core urban of the global system often can filter to the urban areas in the developing world within a span of years rather than decades. Additionally, filtering may bypass the traditional intermediate stops in the spatial economy. For example, jobs may move directly from high-tech core regions in the U.S. to developing regions, thus leap-frogging over low-wage metropolitan areas in the U.S. and second tier manufacturing countries.

The combination of interdependency and the increasing ease of movement of goods, information, capital, and labor have the capacity to produce major social and economic disruption and thus are frequently linked to important social problems. In the ecological view, this is a predictable consequence associated with economic growth and development. The fact that the consequences can be both beneficial and devastating for different urban areas highlights the need to better predict negative consequences so they can be managed or remediated more effectively.

Urban hierarchy theory predicts that innovation leading to new high-wage sectors are more likely to originate, and/or to be more fully exploited, in cities at the top of the urban hierarchy. Indeed, the process of filtering just described tends to put pressure on cities at the top of the urban hierarchy to continually facilitate or adopt innovation to maintain rank position (Carlino and Kerr 2015). This may be facilitated by correlates of large size such as economies of agglomeration and scale, concentration of research and development centers, and institutions of higher education. This introduces a spatial dimension to inequality with average wages declining from global to national to regional to subregional metropoli and eventually down to the lowest wages in the hinterlands of cities at the bottom of the urban hierarchy. Significantly, however, the same theory predicts that high-wage areas must continually innovate. In the long-run, filtering processes, that is, the diffusion of material culture, routinization and deskilling of high-wage production, and related processes, make these advantages available more broadly. This simultaneously reduces inequality while raising overall income and carrying capacity within the broader urban system.

Intraurban Spatial Distribution: Land Use and Population Density

A century ago, the intensity of land use in the typical American city followed a fairly basic pattern. The density of the combined residential and work-day population was greatest in and around a central core, usually termed the Central Business

District or CBD. Peak density and central density were usually the same. Intensity of land use fell with increasing distance from the CBD, declining with such rapidity that satisfactory mathematical descriptions necessarily drew on nonlinear, namely, negative exponential, functions that fall dramatically at first but then level out. Today, this pattern is not uncommon, but other significant patterns have emerged. Larger metropolitan areas and newer metropolitan areas today are typically characterized by multiple centers and subcenters, and the intensity of land use is highly variegated in space. Density gradients are flatter, and thus the disparity between central density and densities elsewhere is less pronounced. Density is patchier with peaks and valleys found throughout the metropolitan region. The changes are definitely real, but they can easily be exaggerated. Intensity of land use in real cities never conformed exactly to the mathematical ideal of a monocentric field in which density declined with distance from the center at a uniform rate in all directions. To the contrary, intensity of land use has always been marked by subcenters and patchiness, and these patterns are noted in the earliest efforts trying to account for spatial patterns of population distribution (Burgess 1925).

In contemporary cities spatial distribution may coalesce around single centers of extreme density, multiple centers of varying density in the fashion of center and subcenter, or multiple diffuse centers that create broad population domes. Theoretical models of increasing sophistication (Anas et al. 1998; Fujita and Ogawa 1982; Henderson and Thisse 2004; Huriot and Thisse 2000; Duranton and Puga 2015) set forth these possibilities. The cost of communication and transportation play a key role in these models. Monocentric cities with dense urban cores are expected when the time-costs of moving goods and people in space are high. In such circumstances, accessibility to the center of the city becomes an overriding factor in location decisions and promotes intense land use and high population densities at the center of the city. In the late nineteenth century, reliance on inflexible hub-and-spoke transportation systems, i.e., water and fixed rail, for moving people and goods over significant distances helped produce the typical spatial pattern in American cities. The state of construction technologies also figures in shaping population density by determining whether it is feasible to stack population and economic activity vertically in space as well as pack it in horizontally. A progression of innovations in this area over the late nineteenth and early twentieth century played a prominent role in promoting increases in peak densities in American cities.

Analytic models of the idealized monocentric city are instructive. So long as the costs associated with transportation and communication are nontrivial, competition for access causes centrally located land to be more valuable and thus to be developed more intensively. As Frisbie and Kasarda (1988) observe, the prediction from economic and ecological theory that intensity of land use will decline with distance from the city center is confirmed by numerous empirical studies documenting that density declines exponentially with distance from the city center for cities in a wide range of historical and cultural settings.[3] The slope of the density gradient is predicted to vary with the costs of communication and transportation; the higher the costs, the steeper the density gradient. This prediction also receives strong support in research showing that density gradients in cities have been declining over the past two centuries years and more as communication and transportation costs have been steadily declining (Clark 1951; Rees 1968; Winsborough 1961, 1963; Berry and Horton 1970; McDonald 1989; Glaeser and Kohlhase 2004). Holding the density gradient constant, the central density will be a positive function of overall city size.

The primary value of monocentric models is not that they yield an exact description of spatial patterns in contemporary urban areas, although they can serve as a passable first approximation

[3] Frisbie and Kasarda (1988) cite the work of Colin Clark (1951) who found that an exponential equation of the form $d_x = d_0 e^{bx}$, where d_x is density at distance "x", d_0 is the central density, e is base of the natural logarithms and b is the rate at which density changes with distance, provides a good fit in most applications and that b is estimated as negative in a wide range of historical and cultural settings.

for many purposes.[4] It is that they provide a framework from which to develop a rigorous understanding of the structuring principles of spatial distribution. Monocentric models rest on assumptions that are intentionally simplistic; actors have location needs that are qualitatively identical, i.e., they seek only centrality, space is uniform and undifferentiated, it is possible to move with equal ease in all directions, and the city has no history. Still, these models are a useful point of departure because they can be elaborated to accommodate a wide range of complexities found in contemporary urban form including, for example, polycentric cities (Duranton and Puga 2015).

Berry and Horton (1970) noted that the Mills-Muth bid-rent model of land use incorporates the insight that specialized actors with greater needs for centrality and/or greater ability pay for it will occupy the most intensely developed central portions of the city. Progressively distant rings will be used by actors with lesser demand for centrality and/or ability to pay. This predicts the familiar zonal progression from business district, to residential zones, to agricultural areas. Harris and Ullman (1945) noted that different actors have different location needs, and that some are complementary while others are at odds. This leads to expectations of multinucleation in which density distributions emanate not from a single point, but from multiple points and which cause further spatial differentiation in the composition of population at various points in the city.

Fujita and Ogawa (1982) and Fujita and Thisse (2013) extend the Muth-Mills framework to show how, depending on assumptions, it can explain a wide range of urban spatial forms, including monocentrism, polycentrism, and diffuse centers. Long ago Hurd (1903), and later Burgess (1925, 1927), noted that the ease, that is, the cost, of movement in space is not even but is distorted by axial and radial transportation arteries. Accordingly, Frisbie and Kasarda (1988) note that distance should be understood as a proxy for the time-costs of travel which obviously will vary with the spatial organization of the transportation system. This insight leads to several clear predictions: high-density corridors will arise around highways and commuter rail lines, subcenters of varying magnitude will arise at major intersections, and hollow spaces of less intense development will be found in between major transportation arteries (White 1987).

Finally, history and inertia also add texture and complexity to the spatial pattern of urban population distribution. When transportation and communication technologies improve, the development of outlying areas, suddenly made more feasible, will occur under the new set of conditions. In contrast, interior areas will change little in the short run since fixed capital investments in infrastructure, buildings, and housing stock cannot be easily rearranged. As a result, the spatial development of the city over time can be highly irregular. However, these variations in spatial patterns do not suggest that the logic of the underlying spatial processes is changing, but instead reflect that these processes are playing out in complicated ways under changing historical conditions.

The above paragraphs show that simple models of an idealized monocentric city can be readily extended to handle the complexity of modern cities with multinucleated urban fields, irregular density surfaces, and sprawling patchworks of suburban and exurban development. Significantly, all of the ideas introduced here are part and parcel of conventional demographic perspectives set forth in the classic literature (Burgess 1925; Harris and Ullman 1945; Hawley 1950, 1971, 1981; Hoyt 1939, 1971; Hurd 1903; Ulmann 1941; Ulmann and Harris 1970) that have been summarized repeatedly in authoritative reviews (Berry and Horton 1970; Berry and Kasarda 1977; Frisbie 1980a, b; Frisbie and Kasarda 1988) and updated and extended in contemporary treatments (Duranton and Puga 2015). Thus, conventional demographic perspectives provide a highly serviceable

[4] For example, the first author of this chapter conducted an analysis of spatial population distribution for the quintessential sprawling metropolis of Houston, presumably a prototype of the new urban form, and found that the simple negative exponential relationship between distance and population density accounts for more than half of the areal variation in population density.

framework for understanding intraurban spatial distributions for American cities of both past and present eras.

Frisbie and Kasarda (1988: 634) offered a similar conclusion some three decades ago noting that traditional demographic perspectives have endured criticism and stand as "the dominant (and, arguably, the only) general theory of urban form and process that has been generative of systematic, empirically verifiable models." Critics of these models often miss the key point that their value is found less in the specific patterns they predict, e.g., concentric zones, and sectors, but rather in their articulation of basic principles of spatial process that can be readily adapted for application to new realities and thus remain relevant to understanding spatial distributions of land use and population even today.

Critical and political economic theorists have sometimes characterized traditional demographic perspectives as examples of technological reductionism (Gottdeiner and Hutchinson 2000) for giving excessive weight to the impact that changes in communication and transportation technology have on spatial patterns of land use and population density. Reductionism is a goal of scientific inquiry so it is not in itself a point of concern to population specialists. Instead, for the critique to be telling, one must make the case that technological change is a minor factor in shaping long term trends in spatial patterns. But that case is hardly credible. In the past century the rise of auto and truck transport and modern technologies and infrastructure of telecommunications has had dramatic effects: reducing transport costs, increasing the possible distance between employment and residence, and undermining the scale economies of older transport technologies (Brueckner 2000; Brueckner and Fansler 1983; Glaeser and Kahn 2004; Glaeser and Kohlhase 2004).

The transition to decentralized transport systems organized around autos and trucks has been largely irresistible and is the dominant trend globally, not only in U.S. metropolitan areas. Focusing on the U.S., the transition to auto transport has generally reduced total commute and trip times and increased flexibility in trip scheduling and in the selection of origin and destination points (Gordon et al. 1991; Glaeser and Kahn 2004).[5] Economies associated with outlying development often reduce housing costs substantially (Glaeser and Kahn 2004) and thus provide powerful economic incentives for population decentralization, e.g., "sprawl." The economics of transporting goods via trucking versus fixed rail and water transport systems are equally if not more important in their impact on urban structure. Glaeser and Kohlhase (2004) estimate that the costs of transporting goods declined by approximately 90% over the past century.[6] They argue that this played a dominant role in cost calculations for business location decisions and helped fuel the decentralization of manufacturing, wholesaling, and retailing industries. Contemporary efforts to refine decentralized delivery systems and to develop autonomous vehicles and inexpensive drone delivery may yield similar game-changing transformations in the future.

The consequences for cities have been far-reaching over the past century. Cities in the United States have experienced dramatic transformation in the twentieth century wherein central cities shifted from being centers of production and distribution of goods to being centers of information and knowledge exchange, service provision, and corporate and government administration (Berry and Cohen 1973; Kasarda 1985; Frey and Speare 1988; Schwirian, Hankins, and Ventresca and colleagues (1990). With this trend, the value that residential actors attach to central location, that was already declining with steady reductions in the time-cost of travel, has diminished further since it derived primarily from

[5] Glaeser and Kahn (2004) report that in 2000 median total trip time nationwide was 24 min by car and 47 min by public transport. Much of total trip time for public transport involves getting to and from access points and waiting.

[6] These declining costs reflect multiple, technical changes and changes in business practices: improvements in transportation technology, reduction in the size and weight of goods, changes in the mix of goods; improvements in efficiency of shipping based on such evolving business practices, as just-in-time distribution, and the electronic monitoring of goods in transit.

benefits of proximity for access to jobs and shopping.

Theory and evidence supporting this view have steadily accumulated over decades (Schwirian et al. 1990; Edmonston and Guterbock 1984; Glaeser and Kahn 2004; Glaeser and Kohlhase 2004). What is needed to substantially refute it? Perspectives emphasizing factors other than technological change, e.g., economic interests of suburban developers, real estate interests, growth machine boosters, post-war state subsidization of home ownership, and racial dynamics, must overcome at least two hurdles to gain wider acceptance in demographic circles. First, they would have to provide a compelling alternative to the conventional interpretation of the long established association between declining time-costs of travel and declining density gradients in urban areas. Second, they would have to make the case that developers, speculators, pro-growth boosters, and others seeking to profit from trends in urban spatial distribution do not simply recognize and opportunistically exploit and "cash in" on changes driven by powerful economic and ecological forces, but instead generate massive spatial redistribution that otherwise would not have occurred.

In short, alternative views are faced with the task of first establishing credible baseline models of spatial redistribution expected based on economic and ecological principles operating in the absence of political-economic factors and then identifying how spatial redistribution deviated from these expectations and specifically in conjunction with changes in political-economic factors. So far, critics of traditional demographic perspectives rarely pursue this kind of analysis, and when they do the results are mixed.

A case in point is the body of research on white flight and suburbanization. In this literature the hypothesis that suburbanization and associated urban sprawl either had their origins in, or were substantially accelerated by, racial dynamics initially received support, but ultimately it was not found to be the important factor that critics of traditional demographic perspectives suggested (Frisbie and Kasarda 1988). Frey (1979) provides quantitative evidence consistent with the hypothesis, but also documents that conventional ecological variables are very powerful factors. Later research (Farley et al. 1980; Smock and Wilson 1991) indicates that analyses focusing on the 1970s tended to exaggerate racial effects by picking up short-term effects that were stronger than the long-term consequences. As additional research has accumulated, it is increasingly clear that, while racial dynamics are potentially relevant in select local areas at certain points in time, they are not the driving force in long-run trends in population deconcentration.

Views assigning greater important to racial dynamics in trends in population deconcentration encounter several major problems: decentralization and deconcentration are extremely broad based and are not limited to metropolitan areas with large non-white minority populations; the most highly decentralized cities are found in the fast-growing areas of the south and southwest which are characterized by the lowest overall levels of white-minority residential segregation; long-term decentralization is strongest for higher income groups (Margo 1992) but is observed for all status groups (Frey 1985); minority populations have been suburbanizing at high rates over several decades (Stahura 1986; Massey and Denton 1987; Schneider and Phelan 1993; Frey and Fielding 1995; Pfeiffer 2012; Frey 2015; Lacy 2016); and the general phenomenon of urban sprawl, i.e., spatial deconcentration, is global in scale and hardly limited to the U.S. (UN-HABITAT 2010).

Intraurban Spatial Distribution: Segregation of Social Groups

Sociologists writing in the early decades of the twentieth century advanced some of the earliest comprehensive theories pertaining to the segregation of population groups in urban areas (Burgess 1925, 1928; Cressey 1938; McKenzie 1926; Park 1936a). Their efforts gave rise to one of the richest empirical literatures in all of sociology. It remains vital today and is notable for its continuity and cumulative character. Briefly, the

descriptive literature evolved from neighborhood inventories, impressionist maps, and detailed social observations, common in the earlier years, to sophisticated quantitative assessments of segregation patterns based on increasingly refined indices and the multidimensional scaling of factorial ecology. The literature exploring process began with case studies of neighborhoods and expanded to include processual studies of succession and neighborhood change, comparative analyses of variation and change in segregation at the city-level, and most recently, investigations of the micro-level processes underlying aggregate segregation patterns.

While racial and ethnic segregation received the greatest amount of attention from the early urban ecologists, they studied segregation among all manner of social groupings. The writings of Park et al. (1925), Burgess (1925, 1928), Park (1926, 1936a, b); McKenzie (1924, 1926, 1933) and Cressey (1938) emphasized processes of congregation based on mutual attraction among members of the same group and also processes of separation rooted in competition between groups and/or aversion to co-residence. One central insight was that differences in such social characteristics as ethnicity, socioeconomic position, age, and stage in the life-cycle can give rise to social distance between population groups which in turn can exert influence groups differences in distribution in residential space. Or as R. Park (1925: 14) stated so succinctly almost 100 years ago, "Social relations are ... frequently and ... inevitably correlated with spatial relations ... Physical distances are, or seem to be, the indexes of social distances."

Another idea introduced was that differential means associated with intra- and inter-group inequality in socioeconomic status plays a major role in competition for higher-quality housing in spatially structured housing markets and serves to relegate lower economic classes and ethnic minority groups to older, centrally located, neighborhoods with lower quality housing and less desirable living conditions often involving disproportionate exposure to crime and other social problems.

The early urban ecologists also observed that city population growth, especially when fueled by the arrival of new groups, served to initiate cycles of invasion and succession in residential neighborhoods. In this historical era new immigrant/migrant groups typically had limited skills and resources and usually settled in low-income inner city areas out of necessity. Their arrival would then set off a chain reaction in which existing groups would be displaced outward into adjacent areas. As the process continued, the areas experiencing entry of new groups, i.e., invasion, would likely undergo succession, i.e., the incremental replacement of one population group with another. The repetition of this sequence for multiple new immigrant/migrant groups arriving over many decades combined with the coinciding emergence of later, i.e., 2nd, 3rd, and higher generations of existing groups created optimal conditions for a "ladder of immigrants" spatial assimilation sequence. The main features were that low-status immigrant groups residing in central city slums would, over a period of time and successive generations, acculturate, assimilate on socioeconomic characteristics, move outward into higher-status areas, and be replaced by a new, more recently arrived, low-status group.[7]

Massey (1985) outlines how theories of ethnic assimilation and the structure of U.S. urban areas in this era yield a model of spatial assimilation and also provides the basis for several specific predictions regarding the patterns of residential segregation by ethnicity and socioeconomic status. New minority groups initially have high social distance from existing groups triggered by cultural differences and low socioeconomic status, and heightened by competition for housing and jobs. Consequently, newly arriving groups are relegated to low-income central city neighborhoods, while established groups occupy more desirable neighborhoods in midtown and beyond. In the extreme, this predicts hyper-

[7] Importantly, this ladder of immigrants notion of spatial assimilation process is short-circuited if the arrival of new low-status groups ceases as was the situation after the Great Migration brought African Americans to Northern and Midwestern urban areas in large numbers in the 1910–1930 time period.

segregation from the dominant group, typically, the third generation WASPs. Hyper-segregation refers to high levels of segregation on multiple dimensions including uneven distribution, i.e., separation from higher status groups, social isolation in clustered homogeneous areas, concentration, i.e., crowding, and centralization. As new groups acculturate, spawn second and later generations, and assimilate on socioeconomic characteristics, they are better able to secure housing in higher-status areas both because they have the means to do so and because social distance moderates such that they may be more tolerated, and even accepted. With this, all dimensions of segregation are predicted to decline. Given enough time, the group gains increasing acceptance into primary relationships such as co-residence, friendship, and marriage with the majority population and come to be substantially spatially assimilated (Lieberson 1980; Lieberson and Waters 1988).

The core theoretical concepts from this early era of research, such as social distance, congregation, centralization, competition, invasion, succession, segregation, and spatial assimilation, remain central to this day to sociological efforts to describe and explain residential segregation and neighborhood change. Urban ecological theory identifies a wide variety of mechanisms that can give rise to segregation between social groups. These include socioeconomic inequality and economic competition; variation in needs or requirements; social distance, i.e., affinity/aversion, dynamics; cultural differentiation; and informal and institutional exclusion and discrimination. Significantly, these various mechanisms are not mutually exclusive; any one can be a sufficient cause of segregation; and they may operate in a wide variety of combinations. For analytic purposes it is useful to group them into demand side and supply side dynamics. The former produces segregation when systemic differences in preferences and/or differences in means lead groups to cluster in different areas of the city as they select and attain residential locations in urban housing markets. The latter produces segregation when the spatial choices available to lower status groups and ethnic minorities are restricted by discrimination and institutional barriers.

Demand Side Dynamics

The traditions of ecological theory that focus on demand side dynamics hypothesize that households of similar social position based on ethnicity, status position, and stage of the life cycle, will have low social distance from each other based on one or more of the following: shared interests, similar tastes, a common ethnic culture, a sense of mutual acceptance, and in-group solidarity. At one level, similar households are likely to select similar residential locations, and will thus tend to congregate in the same areas. Dissimilar households will tend to select different residential locations and live in different areas. At another level, low social distance may give rise to affinity for co-residence and attraction to in-group contact, and high social distance may give rise to aversion to co-residence and avoidance of out-group contact. For example, higher-status households and households from majority ethnic groups often have an aversion to co-residing with lower-status households and minority ethnic groups and seek to maintain spatial separation from them. They do so to demonstrate and consolidate their position in the status hierarchy by minimizing associations with low-status groups and maximizing associations with high-status groups.

Demand side effects of attraction and aversion between different types of households can interact with and be amplified by income segregation, status inequality and economic competition. Higher status households seek to live together and are able to do so because they are advantaged in economic competition for high-quality housing concentrated in desirable income-segregated neighborhoods (Duncan and Duncan 1955; Jargowsky 1996, 1997; White 1987). Lower status households and ethnic minority populations are disadvantaged in this competition and are disproportionately relegated to lower-quality housing in less desirable neighborhoods over and above any specific desire to reside with

co-ethnics or other households of similar social characteristics (Jargowsky 1996, 1997; Simkus 1978; Farley 1977).

Demand side dynamics operating in decentralized housing markets have the capacity to produce natural areas, that is, areas that are relatively homogeneous with respect to the social characteristics of their residents and that tend to maintain their character over time even as individual households in the neighborhood come and go. Disproportionate population homogeneity in neighborhoods gives rise to city-wide residential segregation, thus establishing a model by which segregation can arise out of uncoordinated, micro-level interactions without any necessary assistance from law or formal institutional practices.

If no other structuring principles are operating, the result would be a hodgepodge of different areas. But Burgess' concentric zone model (1925) posited that area stratification would emerge along a distance gradient resulting in a progression of concentric zones of increasing socioeconomic status. Hoyt's (1939) insights about sector-segmentation patterns for new high-status housing joined with Burgess' insights about the dynamics of urban growth to establish the idealized Burgess-Hoyt sectored-zone model. As the city grows, high-status groups tend to locate in newer, low-density, expensive housing added at the perimeter of the city, and lower-status groups tend to occupy older, depreciating housing stock in the interior of the city which is used more intensively by subdividing it or sharing it. Within status zones, population separates into ethnic sectors based on social distance. Processes of succession accompanying growth lead ethnic sectors to align across zones to yield the status-graduated ethnic wedges described by Hoyt (1939).

We will introduce here a [redacted] aside on the computational modeling of segregation dynamics. In the past two decades the new subfield of computational modeling of urban residential patterns has stimulated research on the processes and structures just described. Analytic and simulation models by non-ecologists (Schelling 1971a, b, 1972; Epstein and Axtell 1996; Krugman 1996; Young 1998; Zhang 2004a, b, 2011) lend formal theoretical support to the basic ecological insight that uncoordinated and unconstrained location decisions based on affinity for households of similar social characteristics, or aversion to others, can create stable segregation patterns in space that is featureless save for the characteristics of the households that reside in different locations. Studies using more complex computational models that implement the central elements of urban ecological theories of segregation have shown that complex patterns of segregation by race and socioeconomic status observed in real cities, for example, hyper-segregation of ethnic minority populations along sector-zone patterns, can arise from the unconstrained micro-level behavior of households (Fossett 2006a, 2011). A particular insight, and one that is counter-intuitive to many if not most non-demographers, is the demonstration of how residential preferences interact with ethnic demography in complex ways to generate outcomes not anticipated on the basis of discursive theory and informal reasoning (Fossett and Waren 2005; Fossett 2006a, 2011, 2017). For example, due to the surprising strength of weak minority preferences, the residential choices of a demographic minority group, defined as comprising around 10% of the population, with a moderate preference for same-group contact, say 50%, can produce more segregation than the residential choices of a demographic majority group comprising 90% of the population, with a higher preference for same-group contact, say 80%. This results because the implications of preferences for segregation are strongly conditioned by group size. The preferences of larger groups for substantial same-group contact often are compatible with even or random distribution, while weaker preferences held by smaller groups often cannot be met under uneven or random distribution.

Returning now to our general discussion, we note that it is intriguing that micro-level behavior in agent-based simulations can generate macro-level patterns of residential segregation that replicate major features of the Burgess-Hoyt model. Moreover, despite its relative simplicity, the

model has been found to provide reasonable descriptions of many U.S. urban areas in certain historical eras (Berry and Horton 1970; Rees 1968). However, as stressed in reviews by Hawley (1950), Schnore (1965), Berry and Horton (1970), Guest (1984), Berry and Kasarda (1977), and Frisbie and Kasarda (1988), the significance of the Burgess-Hoyt model is found not in its descriptive utility but rather in the fact that it provides an idealized model for predicting many patterns of urban spatial segregation from a small, but clear set of assumptions and theoretical principles.

Critics have raised concerns that the model applies only to industrial cities of a certain era in western societies. But this does not gainsay the crucial insight of the model which is that social distance and market dynamics operating in a particular urban form yield systematic patterns of residential segregation. One may investigate or even presume that the location decisions of high-status households, which along with sustained immigrant population growth drive the model, may differ across cultures or urban form; consider, for example, the location of high-status areas or the nature of urban transportation systems. But this only changes the specific expression of segregation; it does not negate the general expectation of systematic segregation.[8] Because critics often miss this last point and, more importantly because they have not offered any well-specified alternative model of segregation that generates testable predictions, the Burgess-Hoyt model continues to exert considerable influence on contemporary research on segregation.

One area where this is evident is the urban-ecological understanding of several well-known empirical regularities in minority segregation patterns. Massey and Denton (1988a) brought conceptual clarity to the theory of segregation measurement by identifying five dimensions of segregation, namely, uneven distribution, isolation, clustering, centralization, and concentration. These dimensions resonate with ecological theory and the Burgess-Hoyt model, and they provide a framework for predicting when minority groups will be subject to what Massey and Denton (1989) termed hyper-segregation, that is, the condition where a minority population simultaneously experiences high levels of segregation on several dimensions of segregation.

Park's notion of social distance based on ethnic culture and differences in socioeconomic status generates the expectation of greatest levels of segregation occurring between the high-status majority group in suburban neighborhoods and the lowest-status minority groups in poor central city ghettos. Groups of intermediate standing on social distance and socioeconomic status in comparison to the majority tend to be located in between and experience lower levels of segregation from the majority. Economic disadvantage and market processes relegate the lowest-status minority groups to the poorer, higher-density areas of the central city, thus promoting high levels of minority concentration and centralization. The process of ethnic succession under conditions of city growth similar to those posited by Hoyt (1939) promotes clustering, that is, the formation of larger regions of ethnic homogeneity spanning clusters of adjacent neighborhoods along status-graduated sectors. Based on this framework, hyper-segregation is to be expected in situations where minority-majority social distance is most pronounced, where minority-majority economic disparity is highest, and where urban spatial structure approximates the Burgess-Hoyt pattern.

In light of this, it is not surprising then, that Massey and Denton (1989) find that the hyper-segregation of African Americans, is especially common in the older, industrial metropolitan areas of the Midwest and Northeast where the Burgess-Hoyt model is most apt and where in many hyper-segregated areas, for instance, Cleveland, Detroit, and Milwaukee, African Americans were the last large minority group to arrive.

Hypersegregation does not appear to be not as common for Hispanic and Asian minority

[8] For example, if high-status groups consistently prefer central locations in the city, for whatever reason, the city will remain as segregated as before but the form will change to an inverted zonal pattern.

populations for several reasons. One is that they did not take on demographic importance at the national level until after 1970. Another is that social distance between non-Hispanic whites and Hispanic and Asian minorities is lower than the social distance between non-Hispanic whites and African Americans (Bobo and Zubrinsky 1996; Zubrinsky and Bobo 1996). Yet another is that social and spatial assimilation dynamics, which undercut hyper-segregation patterns, are stronger for Hispanics and Asians than for African Americans (Massey and Mullan 1984; Crowell and Fossett 2017). Even allowing for these considerations, hyper-segregation might still be predicted for select cities where Asian and Latino populations are substantial and consist primarily of low-status immigrants/migrants. However, these conditions are not observed very often. In the case of Asian-Americans, few cities have large Asian populations, and, moreover, in the contemporary era Asian immigrants on the whole are not of low socioeconomic status. In the case of Latinos, immigrants have historically settled disproportionately in cities where Latino population presence and spatial assimilation dynamics are already established.[9]

The Burgess-Hoyt framework also provides a basis for understanding the fact that minority settlement outside of the central city is disproportionately concentrated in older, inner-ring suburbs (Massey and Denton 1988b). The prediction that minorities will lag behind whites in suburbanization, and in neighborhood resources associated with suburbanization, flow directly from spatial assimilation theory and the Burgess-Hoyt model. The economically advantaged majority population will disproportionately reside in the newest outer ring suburbs. Following the progression originally documented for European ethnic groups in earlier research by Cressey (1938) and by Ford (1950), minorities undergoing spatial assimilation tend to move from central cities to older inner ring suburbs during the intermediate stages before full spatial assimilation is achieved. Since inner ring suburbs usually have lower standing on housing quality, area status, and exposure to social problems, suburbanizing minorities lag behind on these outcomes (Schwirian 1983). The lag is greater for African Americans since the spatial assimilation process for them is weaker than that seen decades ago for European immigrant groups and presently for Hispanic and Asian groups. Consequently, neighborhood change is more often in the form of succession rather than long-term integration (Aldrich 1975a, b).

Two important changes in recent decades suggest that the spatial assimilation dynamic for African Americans is strengthening. One is that the gradual emergence of a significant black middle class fulfills a necessary precondition for spatial assimilation. The other is a strong trend over several decades of movement of middle-class African Americans out of inner-city neighborhoods and into inner-ring suburban neighborhoods. These neighborhoods, while lower than outer ring suburbs in average status, provide significantly higher residential attainment outcomes and non-trivially higher levels of contact with majority households.

These trends represent a striking departure from earlier patterns and carry important implications for the spatial distribution of urban poverty. Massey and Denton (1993) and Jargowsky (1996, 1997) differ in their assessment of the relative importance of the two dynamics, but both agree that the combination of racial and class segregation visits extreme residential disadvantage to the poorest segments of minority populations. Again, the Burgess-Hoyt framework provides a lens for interpreting the emergence of persistent, concentrated inner-city poverty for poor African Americans (Massey and Eggers 1990; Massey 1990; Massey and Denton 1993; Jargowsky 1996, 1997; Quillian 2012). The emergence of a black middle class that is suburbanizing at a very rapid rate (Logan and Schneider 1984; Pattillo-McCoy 2000; Pattillo

[9] Recent decades have seen significant settlements of Hispanic immigrants in the so-called new destination areas, especially in medium- and smaller-size urban areas in the Midwest and South (Lichter and Johnson 2006, 2009). Researchers are now beginning to test the implications of urban-ecological theory for segregation and spatial assimilation in these communities (Fischer and Tienda 2006; Lichter et al. 2010; Hall 2013; Hall and Springfield 2014).

2005; Wiese 2004, 2006; Pfeiffer 2012; Frey 2015) has reduced co-residence of middle class African Americans with working class African Americans and increased co-residence of middle-class African Americans with non-Hispanic whites (Jargowsky 1997; Alba et al. 2000a, b; St. John and Clymer 2000; Freeman 2008; Pais et al. 2012).[10]

In a Burgess-Hoyt city, poor minorities will be centralized, concentrated, and socially isolated in poor inner city ghettos devoid of social resources with any of the following: increases in the severity of racial segregation, increases in the severity of class segregation, and increases in class segregation within the minority population. The first is slowly declining, but the latter two are increasing (Jargowsky 1996, 1997; Reardon and Bischoff 2011; Bischoff and Reardon 2013). If the overall poverty rate by group is constant, then one would expect that the number of underclass neighborhoods will increase, and that poor minority households will be increasingly concentrated in these neighborhoods where they will be subject to especially pronounced social problems.

Before turning to supply side factors in segregation patterns, it is useful to briefly mention the literatures associated with social area analysis, factorial ecology, and their contemporary counterparts. Influential studies of residential patterns by Shevky and Williams (1949), Bell (1953, 1955), and Shevky and Bell (1955) popularized the concept of the "social area," which is similar to the notion of the "natural area" in classical urban ecology and the "emergent neighborhood" in computational modeling. Studies in this tradition directed attention to the fact that socioeconomic status and ethnicity/race do not exhaust the bases of residential segregation. In particular, they note that segregation also tends to cohere along lines of family/life-cycle status (Guest 1977; Schwirian 1977). The early empirical studies of social area analysis used discrete classification methods to identify the prevalence of different neighborhood types. The goal of developing empirically grounded assessments of the primary axes of spatial differentiation in urban areas spawned a subsequent literature known as factorial ecology which used factor analysis, or closely related statistical methods, to identify empirically distinct dimensions of residential clustering in urban areas. Reviews of this literature (Berry and Horton 1970; Berry and Kasarda 1977; Hunter 1971, 1972) note that studies consistently found three primary dimensions of spatial differentiation in American cities, namely, ethnicity/race, socioeconomic position, and family/life-cycle. Other dimensions were sometimes found, but not consistently, and they rarely rival the first three in prevalence and distinctiveness.

The literatures on social area analysis and factorial ecology documented that the spatial differentiation of population in American cities is ubiquitous and tends to coalesce along a relatively small number of social characteristics. This empirical literature provided firm support to the widely accepted but previously somewhat imprecise notion that cities are complex spatial mosaics of subpopulations and subcultures. In recent decades, the empirical literature on spatial differentiation within cities has overwhelmingly focused on ethnic and socioeconomic segregation. But earlier studies established that, if one is motivated to investigate it, one can readily document segregation along the lines of age and stage in the family life cycle (Guest 1972, 1977; Cowgill 1978; Chevan 1982; Pampel and Choldin 1978; White 1987). The basic insight driving social area analysis and factorial ecology, that many social characteristics are implicated in

[10] Findings to the contrary are sometimes reported in studies that examine aggregate-level segregation index scores calculated for white and black households at the same income level. These results are substantially less trustworthy than results from location-attainment analyses because the index scores examined are subject to upward bias and instability for two reasons. First, the N's for the same-income comparisons are much smaller than those used in overall group comparisons. This promotes an upward bias in index scores (Winship 1977; Fossett 2017). Second, the population counts used to compute the index scores by income level are based on sample data, and the samples are getting smaller over time, for instance, changing from 1 in 6 in the 2000 decennial census to 1 in 20 in the American Community Survey after 2000. This tends to promote an instability in scores and further increases upward bias in scores especially after 2000 (Napierala and Denton 2017; Logan et al. 2018).

spatial patterns in urban areas, lives on. But much of the current empirical literature focusing on nuanced dimensions of the urban mosaic, such as gentrification of neighborhoods, gay and lesbian enclaves, and bohemian districts is based largely on ethnographic and historical case study methodology (Nyden et al. 1998; Abrahamson 1996; Anderson 1990; Eschbach et al. 1998). Notably, the segregation of gay and lesbian populations has received attention in quantitative research at both the micro-level across neighborhoods within urban areas (Poston et al. 2017) and at the macro-level across urban areas (Walther and Poston 2004; Cooke and Rapino 2007).

Other active contemporary research in this tradition uses new methods in geography and cartography to investigate the urban mosaic of identifiable social areas. An example is Spielman and Thill's (2008) use of the Kohonen Self-Organizing Map algorithm (SOM), a data-mining technique, in combination with spatially informed GIS databases containing detailed attribute information on areas of the city. This extends previous aspatial approaches by generating maps depicting "geodemographic" classifications based both on social similarity and geographic proximity. Like much of factorial ecology research, the new geodemographics literature focuses on social description rather than hypothesis testing. The methods have gained wide usage in applied work for purposes such as marketing, political outreach, and social policy (Harris et al. 2005). Longley (2012) and Goodchild (2010) note the potential for scientific contributions in this area, but two factors hold this back. One is that large georeferenced micro-level data sets containing a wide array of social and economic information on individuals and households are not generally available. Federal data of this type are governed by confidentiality restrictions. Private-sector "big data" of this type exist but are unavailable due to proprietary concerns and are of questionable value for scientific research due to "black box" data collection and measurement procedures. The second factor is that researchers tend to give more attention to race- and class-based segregation because of their more immediate relevance for stratification and life chances.

Supply Side Factors

Some have suggested that ecological theory does not acknowledge supply-side aspects of residential segregation including factors such as exclusion, discrimination, conflict, and intimidation and violence (Feagin 1998; Gottdeiner and Hutchinson 2000; Logan and Stearns 1981; Stearns and Logan 1986). In certain respects, this charge is off the mark.[11] Ecological theory has always recognized that social distance, aversion, and prejudice can lead to formal and informal dynamics of exclusion and discrimination on the part of high status groups and ethnic majority populations who seek to separate themselves from lower status populations and ethnic minority groups (Hawley 1944b, 1950; Hawley and Rock 1973; Berry 1979; Berry and Kasarda 1977; Fossett and Cready 1998). For example, Cressey's iconic study of ethnic succession in Chicago states that "[c]onflict may accompany invasion, varying in intensity with the cultural differences and prejudice of the groups involved. . . . But where marked prejudices exist and there is fear that the invading group will cause a serious loss in real estate values, violent opposition may develop" (Cressey 1938: 62–63). Both McKee (1993) and Fossett and Cready (1998) provide more recent examples of how ecological theory gives explicit attention to ethnic competition, discrimination, conflict, and violence.

Ecologically-oriented perspectives have directed considerable attention to predicting the conditions under which inter-ethnic contact and competition will involve discrimination and inequality (Heer 1959; Blalock 1956, 1957, 1959, 1967; Lieberson 1961a; Noel 1968; Barth and Noel 1972; Frisbie and Niedert 1977; Wilcox and Roof 1978; Hannan 1979; Nagel and Olzak

[11] Ironically, critics of classical ecology faulted it for placing too much emphasis on competition prompting Hawley (1950) to stress that ecological theory gave attention to symbiosis as well as to competition.

1982; Olzak and Nagel 1986; Fossett and Siebert 1996; Fossett and Kiecolt 1989; Burr et al. 1991; Quillian 1995). Conversely, a related literature seeks to understand what conditions may moderate discrimination, facilitate assimilation, and promote movement toward minority incorporation and the dissolution of group boundaries (Blalock 1959; Lieberson 1961b, 1963, 1980; Duncan and Lieberson 1959; Duncan and Duncan 1957; Burr et al. 1991). Studies in this tradition routinely explore questions of inequality and subordination as well as assimilation. Many explicitly pursue ecological theories of ethnically organized non-market and extra-legal competition, and protest, intimidation, and violence including lethal violence (Olzak and Nagel 1986; Beck and Tolnay 1990; Tolnay and Beck 1992; Tolnay et al. 1989; Corzine et al. 1983; Creech et al. 1989; Reed 1972).

An extensive antecedent literature of ecological studies of cities and metropolitan areas has investigated hypotheses regarding how racial-ethnic segregation and inequality may vary with inter-group competition, social distance and discrimination, all of which are argued to vary with factors such as group culture and immigration history, either early or recent, nonwhite status, and relative minority group size and growth (Hawley 1944b; Duncan and Lieberson 1959; Bahr and Gibbs 1967; Jiobu and Marshall 1971; Roof 1972; Marshall and Jiobu 1975; Lieberson 1980; Logan and Schneider 1984; Massey and Denton 1987; Farley and Frey 1994). These studies also routinely include predictor variables that index group differences on characteristics such as income, which are relevant for spatial assimilation processes. The past two decades have seen continuing contributions to this tradition of empirical investigations of the determinants of cross-community variation in segregation (Massey and Fischer 1999; Logan et al. 2004; Timberlake and Iceland 2007; Iceland and Scopilliti 2008; Logan and Stults 2011). Possibly, non-specialists may not recognize the centrality of ecological theories of discrimination in these studies. But it is clear on closer review. Predictor variables such as relative minority size, minority population growth, and ethnic diversity are hypothesized to directly affect racial competition, prejudice, and discrimination. Other predictor variables such as city growth rates, percentage of post Fair Housing Act housing, government and education sector presence, and armed forces presence are all hypothesized to moderate the intensity and impact of prejudice and discrimination.

Critics err if they claim that ecological theory does not give attention to dynamics pertaining to exclusion, discrimination, conflict, and intimidation and violence. But they are correct to say that studies informed by ecological-demographic perspectives do not see demand-side and supply-side theories as being mutually exclusive, and so give attention to social dynamics other than discrimination. Massey (1985) notes this is seen in early ecological studies of the experiences of European immigrant groups to industrial cities of the early twentieth century. This research tended to focus on spatial assimilation dynamics resulting from acculturation and social and economic assimilation across generations. It is also seen today in the attention that comparative analyses give to the potential role of minority-majority differences on income and poverty, and also on nativity, English-language ability, family structure, age, and other social and economic characteristics relevant to spatial assimilation theory.

Considering the potential role of these and other factors should not be seen as denying the potential relevance of discrimination. To the contrary, the presumption is that, where there is evidence of spatial assimilation taking place, assimilating groups are simultaneously encountering and overcoming substantial discrimination. And, where evidence of spatial assimilation is scant, discrimination is presumed to be a major, perhaps primary, impediment. This is readily evident in the extensive locational attainment literature which consistently reports that minority group residential outcomes are less than would be expected even after a large number of relevant individual-level characteristics have been taken into account (Alba and Logan 1991, 1993; South and Crowder 1997, 1998; Logan and Alba 1996; Alba et al. 2000a, b; Freeman 2010;

South et al. 2011; Pais et al. 2012). It is standard practice to argue that discrimination must be seen as near the top of plausible explanations for the remaining residual difference in residential attainments, and often it is judged to be the most important factor.

In comparison, alternative perspectives often leave themselves open to the criticism that they are too quick to dismiss the potential relevance of factors other than exclusionary discrimination. No single factor theory can account for the full complexity of segregation patterns observed in U.S. urban areas. Accordingly, zeal to highlight injustice should not be accepted as an excuse for over-simplification and lack of rigor in theorizing about segregation. Going forward, researchers influenced by ecological-demographic perspectives will continue to entertain the hypothesis that both demand-side and supply-side factors are relevant for creating and shaping segregation and will seek better ways to assess the pathways and relative contributions of different factors (Timberlake and Iceland 2007; Iceland and Sharp 2013; Iceland et al. 2013; Quillian 2002).

As will be discussed below, Fossett (2017) offers new methods of segregation analysis that will help in this task. Moreover, recent research using restricted census data is taking advantage of the opportunity (Fox 2014; Crowell and Fossett 2017, 2018). Fossett (2006a, b) also argues for more rigor in assessing and reasoning about the effects of preferences, discrimination, and other factors on segregation. For example, formal analyses (Schelling 1971a; Peyton 1998; Zhang 2004a, b, 2011) and analyses using agent-based computational modeling (Laurie and Jaggi 2003; Zhang 2004a, b, 2011; Fossett and Waren 2005; Fossett 2006a, 2011; Bruch and Mare 2006; Bernard and Willer 2007; van de Rijt et al. 2009; Yavaş 2018) both yield important, yet sometimes counterintuitive, findings regarding how preferences and ethnic demography interact in processes of residential sorting and neighborhood tipping. Thus, it clear that discursive argumentation is not adequate for exploring the implications of the theories.

Reflection on other general issues also is warranted. For example, if ecological-demographic theory is correct in positing that segregation has multiple sufficient causes, there is no basis for expecting major reductions in segregation if only one cause is reduced. Thus, one cannot necessarily take the persistence of segregation as compelling evidence that discrimination has not declined (Fossett 2006a, b). It also is useful to remember Lieberson's (1987) advice to distinguish between basic and superficial causes. If social distance sentiments regarding race and class are strong, these basic causes can produce race and class segregation in myriad ways. Reflecting on Lieberson, Massey (2005) cautions that one should not overestimate the likely impact of individual interventions aiming to counter the effects of an apparent cause of segregation, e.g., zoning, and restrictive covenants. The intervention may block one pathway to segregation but not reduce segregation overall if the force of the basic cause is redirected to bring about segregation via alternative pathways. Consistent with this argument, Lichter et al. (2015) review evidence that declines in white-black segregation at the neighborhood level within metropolitan areas have been offset by increases in white-black segregation at the place level.

Challenges and Opportunities

Many aspects of research on urban and spatial distributions certainly present difficult methodological challenges. In the area of interurban spatial patterns, the measurement and analysis of functional specialization, functional interdependence, and dominance, all crucial concepts in theories of urban system and hierarchy, have always been difficult to address. Measurement of functional specialization may range from the use of simple industry profiles and location quotients to using factor analysis or similar quantitative clustering or categorization methods to identify variation and dimensionality in functional specialization. Categorization based on industry profile and location quotients may be

seen as too simple and subjective, but complex structures on the other hand must be viewed cautiously based on concerns that results sometimes are not robust to model specification choices or small changes in samples. When developed with appropriate care, categorization schemes are generally viewed as serviceable especially in the cross section.

The closely linked notions of interdependence and dominance present even more difficult challenges since they involve measurements of communication, exchange, and coordination among multiple actors. Eberstein and Frisbie's (1982) analysis of commodity flow data provides an excellent example of how to establish interdependence empirically. Unfortunately, it is a demanding task to undertake. Thus, researchers often assume that interdependence between cities is a concomitant of functional specialization. Measuring dominance is also difficult since it rests not only on establishing the magnitude of linkages of communication, coordination, capital flow, and decision making, but also their directionality. Refinements include going beyond simpler measures, such as counting the number of headquarter offices by using network methods, to assess different aspects of city-level linkages between corporate headquarters and branch locations (Alderson and Beckfield 2004).

Improving measurements of functional specialization, interdependence, and dominance is hampered by the limitations of available data. If anything, the difficulties are worsening as studies of national and regional urban systems give way to broader studies of the global urban system. National urban systems are becoming less autonomous and increasingly must be understood in terms of their integration into the global system. Thus, more than ever before, the functions, interdependencies, and dominance relations associated with cities such as New York, Los Angeles, Miami, and Houston cannot be fully understood without considering each city's involvement in global and regional systems extending beyond the U.S. economy. Addressing this not only increases the scale of analysis in terms of the geographic scope and the number of cities, but it also brings with it complexities of reconciling data on urban systems drawn from many different sources.

Analyses of inter-metropolitan growth and decline has long been a staple of demographic studies of macro-spatial distribution. The rise of new perspectives in urban research has raised questions about inattention to potentially relevant political-economic factors. But relatively few researchers anchored in the perspective pursued the issue with systematic quantitative empirical analysis. Markusen (1985, 1987, 2006) provides examples of how new ideas can be pursued with analytic rigor, careful measurement, and quantitative assessments of relationships and effects. But, urban-demographic researchers are pragmatic and have been equally if not more likely to absorb and explore new hypotheses relevant for the understanding of spatial patterns. Kasarda and Crenshaw (1991) and Smith (1995) noted that efforts to blend insights from the different perspectives are challenging because the divide is not always easy to bridge, and a synthesis runs the risk of being seen on all sides as being neither fish nor fowl. But Kasarda's (1995) overview of the restructuring of the U.S. metropolitan system shows that, from the urban-demographic point of view, selective consideration of ideas emphasized in new perspectives can be fruitful.

A similar situation is found in the area of intra-urban spatial patterns, especially population deconcentration, where there may be opportunities to advance the field by drawing on new perspectives to selectively consider hypotheses that are amenable to being examined using analytic and quantitative approaches of traditional perspectives. In a less controversial area, the field has long been burdened by the problems of measuring the boundaries of metropolitan regions and the patterns of spatial distribution within these boundaries. Measurements of density, suburban-urban distribution, and related features of urban areas often are based on central city and metropolitan area boundaries that do not always correspond as closely as needed with nodal-functional notions of urban system. Standard approaches to city-suburb comparisons used by researchers from all perspectives have always been problematic, and the limitations of this

approach have if anything worsened as cities sprawl. The potential to perform more rigorous spatial analysis using public data on population and employment for small-scale geographies has not been fully exploited, and superior data available in restricted access research data centers holds considerable promise. As a result, it is now feasible to examine suburbanization and decentralization dynamics using approaches that draw on GIS techniques and advanced spatial analysis methods. Research innovations in this area could lead to significant improvements in assessing how absolute and relative densities for population and employment vary in space, and how the mix of land use and economic activity varies in space, and how urban fields are changing over time.

More easily than ever before, spatial density distributions can be modeled directly, and population deconcentration can be examined based on systematic, comparative measurements of density gradients, central or peak density, critical density, and other staples of the analytic framework advanced by traditional demographic perspectives on intra-urban spatial distribution. Hypotheses regarding polycentrism, declining density differentials between centers, subcenters, and the broader urban field can be explored using more systematic comparisons of how these vary over time and across areas. The literature is rife with inexact claims of new urban forms and new principles of spatial organization. To gain credence with demographic audiences, these claims will need to be supported by analysis establishing whether emerging spatial patterns truly reflect new spatial principles, or whether they can be satisfactorily understood within existing urban-demographic paradigms.

Spectacular advancements in the capabilities, ease of use, and cost effectiveness of geographic information systems (GIS) permit easier analysis of such complex variations in density patterns that traditional demographic perspectives predict, such as density corridors around transportation arteries, and subcenters around interchanges (Craig et al. 2016). Accordingly, analyses of population and employment deconcentration need not be limited to examining parameters of Colin Clark's (1951) negative exponential density-distance function though this relatively simple descriptive tool can be useful. GIS technology and methods make it possible to conceive of integrating political economic and traditional demographic perspectives in systematic empirical analyses that allow for direct assessments of relative explanatory power. For example, it is more feasible than ever to integrate spatial-referenced population data with political boundaries of various types and investigate how factors such as tax rates, zoning and land use regulation, ethnic composition of school districts, and political fragmentation are all linked with patterns and trends in population density and composition.

In the area of social differentiation in American urban areas, important methodological challenges need to be met on several fronts. One major problem is that it has become much more difficult to perform analysis of segregation involving smaller groups and subgroups using public data after 2000. As we mentioned in a footnote earlier in this chapter, this problem is due to the fact that after the 2000 decennial census, the large approximately 1 in 6 census long-form sample was replaced by the smaller approximately 1 in 20 sample of the American community survey. The issue is a simple one: index scores computed from samples are inherently biased upwards and in addition are more volatile, and the magnitude of these problems intensifies as sample size declines (Napierala and Denton 2017; Logan et al. 2018). As a result, analysis of trends in segregation by income, or segregation by race and income, or segregation by other characteristics not measured in the decennial short form, has become more difficult.

Fortunately, improvements in opportunities for analysis also are being made possible by advances in conceptualization, methodology, and available data. Several areas have already begun to enter a new era, and others are poised to do so. Research on residential segregation and spatial differentiation in the future will be distinguished from the past by a more detailed understanding and documentation of the linkages between individual-level processes and aggregate residential distributions. While the need for

improvements in this area are great in research focusing on both demand-side and supply-side theories of segregation, significant breakthroughs are more likely to come in research exploring demand-side dynamics because factors involved in individual choice dynamics are easier to measure and study than are the micro-dynamics of discrimination.

Over the past two decades, multiple innovations have extended the capabilities of research investigating residential segregation. One is the enhancement of such large-scale national surveys as the Panel Survey of Income Dynamics, the Annual Housing Survey, and special census micro-data files with contextual data that enable researchers to conduct micro-level analyses investigating the determinants of residential outcomes at low levels of geography (Massey and Denton 1985; South and Crowder 1997, 1998; Crowder 2000; Alba et al. 2000a, b; Freeman 2010; South et al. 2011; Pais et al. 2012; Quillian 2015). Major benefits have been gained from research using these approaches and resources, but this line of research also encounters frustrating limitations. One is that the data cannot sustain in-depth analysis of residential attainments in individual metropolitan areas, and by extension, also cannot sustain comparative analysis of a large set of metropolitan areas. The creative methods outlined by Alba and Logan (1992, 1993) combine public data at the aggregate-level and micro-data to permit the individual-level analysis of locational attainments in individual metropolitan areas. The approach can sustain micro-level analysis in individual metropolitan areas, and thus the comparison of location attainment processes across multiple metropolitan areas. Unfortunately, the lack of detail in tabulations for low-level census geography significantly severely constrains both the options for group comparisons and the options for specifying the micro model.

New developments in data availability and in methods for segregation measurement and analysis can overcome the problems just noted. On data availability, the last decade has seen a major expansion in the Census Bureau-managed Federal Statistical Research Data Center (FSRDC) network which at this time now has 30 locations around the country and will expand further in years to come. FSRDCs give researchers access to restricted-access versions of micro-data files from the decennial census and the American Community Surveys that contain low-level geography not available in public versions. These data permit maximum flexibility for spatial population analysis including estimating micro-level attainment models for individual metropolitan areas.

Conducting analysis in FSRDCs also can bring partial relief to the problems associated with analysis drawing on tabulations based on ACS samples. First, ACS samples are larger in the FSRDC environment. Second, location attainment analysis can in some cases be improved by using 100% decennial data to develop neighborhood-level dependent variables, thus eliminating one source of volatility in ACS-based analyses.

The Integrated Public Use Microdata Samples (IPUMS) project (Ruggles et al. 2018) is bringing forward resources that already are transforming research on historical patterns of spatial distribution of populations in U.S. urban areas. The IPUMS project is producing full (100%) count files created from original manuscript records of censuses from 1940 and earlier that now are in the public domain. The data are no longer subject to federal confidentiality guidelines and so in principle can provide researchers access to much more detailed information on individuals and households including lower-level spatial geography. Variables for lower-level geography often are restricted for non-confidentiality reasons, but academic researchers can seek permission to use these data under certain circumstances.[12]

Another limitation of location attainment analysis is that it has not been possible to easily move from micro-level findings regarding attainment processes to macro-level implications for city-

[12] Funding support for creating the files comes from Ancestry.com, a firm specializing in geneology research support services. Consequently, access to low-level geography and certain other information is restricted to protect the company's business interests. Academic researchers can contact IPUMS to apply for access to restricted 1940 data.

level segregation. Some useful new developments have recently occurred on this front. A methodological study by Fossett (2017) has introduced a new "difference of means" framework for measuring segregation. It recasts all widely used measures of uneven distribution as simple group differences of means ($\bar{Y}_1 - \bar{Y}_2$) on individual residential attainments (y) scored from ethnic composition of area of residence (p). The new framework gives researchers the ability to investigate micro-level processes that produce segregation as measured by standard indices. Relatedly, it also gives researchers the ability to unpack city-level segregation by first estimating individual-level segregation attainment models separately for the groups in the comparison and then applying conventional standardization and decomposition techniques (Althauser and Wigler 1972; Jones and Kelley 1984) in the manner routinely used in studies of group differences on income, education, and other attainment outcomes.

Studies by Fox (2014) and Crowell and Fossett (2018) have applied the new methods in empirical analyses investigating White-Latino segregation in six major metropolitan areas. They estimated micro-level location attainment analyses separately for non-Hispanic (NH) Whites and Latinos in each city and then used standardization and decomposition techniques to quantitatively unpack the value of the segregation index score for each city. Specifically, they established what portion of the score can be attributed to the consequences of race, i.e., Latino group membership, and what portion can be attributed to Latino's having deficits on characteristics that promote spatial assimilation and co-residence with Whites, e.g., income, education, U.S. birth, English language proficiency, and other characteristics. The studies document that a spatial assimilation process wherein acculturation and socioeconomic assimilation bring greater residential contact with non-Hispanic Whites is clearly evident for Latinos and provides quantitative assessments of the relative importance different social characteristics play in that process. This research also documents that race, i.e., group membership, has large effects on segregation-determining residential outcomes, net of controls for social characteristics at the micro level. These effects can be interpreted as indirect measures of discrimination, and they have been shown to vary in magnitude across cities. The analysis thus suggests that White-Latino segregation may decline in the future as acculturation and socioeconomic assimilation proceed for Latinos but will remain substantial for decades to come due to ongoing discrimination.

The framework also provides superior options for investigating cross-community variation in segregation. Fossett (2017) establishes that conventional index scores for communities are exactly mathematically equivalent to the effect of race, i.e., group membership, in a pooled, i.e., both groups combined, micro-level attainment model for the community. He also establishes that expanding the micro-level model specification to include community characteristics allows researchers to exactly replicate findings from aggregate-level regressions investigating cross-community variation in segregation index scores. Specifically, effects of community characteristics in aggregate regressions can be exactly replicated in contextual models that assess how the individual-level effect of group membership, i.e., race, varies across communities. Researchers who wish to do so can additionally refine and extend community-level segregation analysis by doing the following: (a) incorporating individual-level controls for such social and economic characteristics as education, income, English-language ability, and nativity, and (b) using multi-level modeling procedures to assess the effects of community-level factors in a more statistically satisfactory manner.

Significantly, these new possibilities allow segregation research to draw on the same modeling approaches that have been used to study cross-community variation in racial disparities in income, health, and other stratification outcomes. Equally important, the new options for analysis eliminate the need for researchers to resort to using the highly questionable practice of controlling for the effects of group differences on social and economic characteristics at the aggregate level (Fossett 1988, 2017; Fossett and Crowell 2018).

These new options can be attractive, but they are not a panacea. Studies using restricted census data in FSRDCs have high dollar costs because FSRDCs are expensive to operate. They also have high overhead costs because, first, all analysis must be conducted in an FSRDC secure computing lab, and, second, all aspects of the project must be conducted under stringent protocols for working with restricted-access federal data. These impediments make many forms of segregation analysis more difficult to conduct and out of the reach of researchers at institutions without FSRDC access. Conditions for using IPUMS restricted historical census files are less demanding but not trivial. Of course, analyses based solely on census data will have all of the usual limitations associated with relying on measures developed from census materials.

The over-riding problem facing supply-side theories of segregation is the chasm between the ability to identify micro-level processes of discrimination and other constraints on housing choice and the ability to develop defensible quantitative estimates of the impact of these constraints on city-level segregation measures. The existence of past and ongoing discrimination is clear. Large scale audit studies (Yinger 1995; Turner et al. 2002, 2013), while not beyond criticism (Heckman and Siegelman 1993), are generally viewed as persuasive. Unfortunately, they are not able to estimate the quantitative effects of discrimination on minority location attainments or aggregate residential distributions.

Observers who conclude that the quantitative impacts of discrimination account for large amounts of observed segregation must rest their conclusions on assumptions and indirect inferences that can be difficult to evaluate or verify. The problem is not that the hypothesis is implausible; the problem is that defensible quantitative assessments are not easy. At one end of the spectrum, Butters (1993), Thernstrom and Thernstrom (1997), and Patterson (1997) argue that in many cities, minority families with sufficient means now experience relatively modest constraints on their location choices by historical standards and can generally settle where they wish with little realistic concern of being subject to intimidation or violence. At the other end of the spectrum, Fischer (2008: 477) notes that "despite the multiplicity of barriers they faced, determined members of the Black middle class [have been] slowly forging their presence in the suburbs." Going forward the hypothesis is made more plausible by the rising importance of low-cost digital tools for housing search and aggressive national-level, online mortgage-lending vendors which are likely to diminish the role of local realtors and lenders. Whether minority households would be welcomed and accepted into the social life of neighborhoods is another question. But this is a separate phenomenon distinct from the virulent exclusionary practices of earlier eras.[13] Debate and controversy are likely to continue in this area until better linkages between measures of the incidence of discrimination and aggregate-level segregation patterns can be developed.

One methodology that may help in this regard is computer simulation and computational modeling. Studies using simulation methodology and computational methods to explore segregation dynamics were relatively rare before 2000 (Schelling 1971a, b, 1972; Young 1998; Krugman 1996; Epstein and Axtell 1996; Freeman and Sunshine 1970). But there has been a decided upturn in both the number and sophistication of simulation studies in the last decade (Laurie and Jaggi 2003; Fossett 2006a, 2011; Fossett and Waren 2005; Clark and Fossett 2008; Zhang 2004a, b, 2011). The familiarity with and the use of computational methods are much greater in many other fields, but they are gaining greater attention in the social sciences generally, and in demography specifically (Bruch and Atwell 2013). AU5

Guided by the "generative science" dictum "if you know it, you can grow it" (Epstein and Axtell 1996; Epstein 2006), computational models can be used to conduct experiments exploring processes that defy representation in mathematically

[13] It also is less asymmetric. That is, it is conventional to assume that the most important constraints on housing choice are asymmetric; minority options are constrained, majority options are not. Whether local community reception will make households will feel safe, accepted, and welcome in a given neighborhood is less asymmetric.

tractable analytic models.[14] They can address some of the limitations that researchers encounter in research using observational data by giving researchers the ability to manipulate independent variables under strictly controlled conditions and investigate model behavior over theoretically interesting ranges and combinations of parameter settings that do not occur in "nature." At a minimum, demonstrations that complex patterns observed in the real world can be produced by implementing hypothesized principles in computational models serve to refute claims that the hypotheses are implausible. Similarly, the failure of reasonable modeling efforts to support predictions regarding hypothesized processes and influential factors can cast doubt on prevailing discursive theory. The very act of building a computational model is valuable in that it requires concepts and theories to be stated precisely, and this can highlight ambiguities in discursive theory.[15]

At present, the main contributions have been in the area of exploring the possible consequences of hypothesized micro-level social processes. Given the existing gulf between studies of micro-level process and accurately assessing quantitative implications for macro-level segregation patterns, this is not without value. But simulation models will have to advance considerably before they could be used to make quantitative assessments of the impact of discrimination or other factors on segregation outcomes in the real world. Demographers are perhaps more likely than others to lead the way in taking advantage of these emerging methods because they are more open to using modeling frameworks to investigate urban patterns.

Future Prospects

Our discussions in this chapter have been guided primarily by traditional demographic perspectives regarding urban and spatial distributions. This is likely to resonate with most readers of this *Handbook of Population*. But it is disappointing to observe that these perspectives receive less attention now than in the past in undergraduate textbooks on urban sociology and urban geography and in many journals focusing on urban issues. Some have argued that this is because the traditional demographic-ecological paradigm experienced a crisis and was supplanted (Hutchinson 1993; Feagin 1998; Gottdeiner and Hutchinson 2000). We disagree. True paradigm shifts occur when a new perspective can effectively answer the questions addressed by the prior paradigm and in addition answer new questions the prior paradigm could not. This has not happened in research on urban and spatial population distributions. Research on urban areas has indeed expanded to consider questions beyond those considered by traditional demographic perspectives. But new urban perspectives have not provided compelling new answers to such fundamental questions as why do cities exist, why are they are located where they are, why do they vary in function and size, why are they organized in hierarchical networks with spatially patterned relationships, and why do some prosper and grow while others stagnate and wither. Answers rooted in traditional demographic perspectives continue to hold sway in these and related domains. In sociology, geography, and urban planning, new perspectives have carved out a new conversation space that focuses on a different set of questions and, for better or for worse, does not engage traditional population perspectives. Population specialists in these fields have seen the questions that motivate their research and the answers they develop become compartmentalized, not supplanted. Moreover, critical and political economic perspectives have

[14] Unfortunately, while this phrase is too clever to be our invention, we cannot identify the exact origin. It is a concise paraphrase of related statements such as the following "We interpret the question, 'can you explain it' as asking 'can you grow it?'" (Epstein and Axtell 1996: 177) and "if you didn't grow it, you didn't explain it" (Epstein 2006: 51).

[15] For example, discursive theory often draws strong distinctions between preferences based on positive affinity for same-group presence and negative aversion to out-group presence. In computational models these will produce identical residential choices and cannot be assessed independently in simple representations.

made lesser inroads in economics and regional science where traditional economic-ecological-demographic perspectives continue to dominate.[16] The shame from the demographer's perspective is that in many fields, insights from traditional population perspectives are not being considered even in areas where these perspectives would seem to be highly relevant.

What then are the points of departure between the traditional and the new perspectives on urban and spatial patterns? Also, are there realistic opportunities for a meeting of minds in the near future? The answer to the second question unfortunately has not changed from the answer I wrote almost 15 years ago in the version of this chapter that was included in the first edition of this *Handbook of Population*. If they existed before, opportunities for constructive dialogue were not seized and prospects for engagement and synthesis in the near term are no better now than before. Several points of fundamental difference between the traditional and new perspectives contribute to this situation.

Problem Selection and Research Agenda

Researchers steeped in critical and political-economic perspectives address different questions and emphasize different issues than do researchers subscribing to traditional economic, ecological, and demographic perspectives. In many ways, the critics parted ways with traditional perspectives because they wished to pursue a substantially different research agenda. While no field ever sees complete consensus on the issue of which problems should receive attention, the cleavages here are greater than is usual. This is especially true with regard to views about the appropriate balance to strike between goals of pursuing the basic science questions versus questions focusing more directly on contemporary social problems.

Differences in Research Practices

There is considerable heterogeneity in research design and method of analysis in both perspectives and a significant overlap across perspectives. That said, there also are clear general differences in methodological practice between the traditional and new perspectives. Demographic researchers are more likely to undertake quantitative analyses using data from censuses and surveys, particularly those with large samples. Critical and political economic researchers are more likely to conduct in-depth studies involving a small number of cases. Even when researchers from the two perspectives use similar methods, the differences are evident. Researchers drawing on traditional perspectives tend to view case studies as valuable for exploratory inquiries to generate hypotheses about patterns and dynamics that when possible will be tested more rigorously in quantitative studies using large, representative samples and sophisticated techniques of multivariate analysis. In contrast, scholars working within the so-called critical or political economic frameworks are more willing to draw strong causal inferences and broad conclusions from the case studies. Some rarely use any other methodology.

Approaches to Conceptualization and Measurement

Proponents of traditional perspectives are more likely than the proponents of the so-called critical perspectives to strive for abstract conceptualization and technical measurement strategies that are compatible with formal approaches to theory development and construction. The critical and political economic urban researchers are more inclined to draw on concepts that are naturalistic and simultaneously more evocative and less precise.

[16] To the contrary, in urban economics and the subfield of economic geography traditional economic and ecological perspectives seem to be enjoying a renaissance of sorts.

Formulation and Appreciation of Formal Models

Researchers drawing on traditional demographic perspectives generally hold formal theory and abstract models in higher regard than the proponents of other perspectives. Economists, regional scientists, and urban ecologists often subscribe to the view that sound assessments of causal effects must be situated in well-understood baseline models. They believe that it is difficult to develop rigorous conclusions in the absence of such models. This leads them to be skeptical of strong conclusions developed from discursive theory. In contrast, many researchers working within the critical and political economic perspectives subscribe to a decidedly different view of theory. They rarely strive to develop formal models, are often skeptical of such models, and express concerns that they may be simplistic and ahistorical.

Approaches to Standards of Evidence and the Philosophy of Science

Traditional researchers frequently subscribe to goals of developing nomothetic explanations and evaluating theories against evidence emulating practices used in the natural sciences. New perspective researchers are a heterogeneous group, but many, perhaps most, are ambivalent at best toward traditional science approaches and the goal of nomothetic explanation based on general principles. This ambivalence undergirds the skepticism that many of them have of formal theory and quantitative models. It also leads many to place a lower priority on the task of developing clear empirical predictions from their theories and pursuing a sustained program of assessing these predictions.

Orientation and Relevance to Social Policy

Ironically, while critical theorists often criticize traditional perspectives for prioritizing basic science research over giving attention to redressing inequality and urban social problems, a strong case can be made that traditional perspectives often provide a sounder footing for developing social polity to achieve desired goals. Effective social interventions must be rooted in predictive science that can provide a rigorous basis for anticipating the full range of consequences that might flow from the interventions and what would happen in their absence. Thus, Yeates (2001) has argued that one of the legacies of the Chicago School of urban geography is that planners and regulators can pursue normative goals, such as preserving historic downtowns, maintaining traditional neighborhoods, moderating residential segregation, stemming inner-city decline, promoting affordable housing, and managing sprawl by using tools and strategies that derive in part from the theories and models of traditional spatial perspectives. Logan and Zhou (1989) have advanced a similar view from a grounding in political-economy perspectives. Markusen (2003) also argues that, for research and theory in new perspectives to be relevant for policy, evocative, "fuzzy" concepts must be replaced by more precise formulations, and analysis must adopt more demanding standards of evidence for establishing causal linkages in complex systems.

The Future Directions of Traditional and New Perspectives

The future direction of traditional perspectives dealing with urban and spatial population distribution is relatively easy to forecast. Driven by long-range, basic science goals, research in traditional demographic perspectives will continue to pursue questions that have long guided the literature. They include the following: Why do cities exist? Why do cities serve as home to an ever

increasing fraction of the worlds' population? Why are cities found in particular locations? Why do cities vary in size? How do they come to be functionally differentiated and linked together in a complex system of hierarchically-organized, ever-changing interdependencies? What are the patterns of their internal form, and how and why do these change over time? In pursuing these questions researchers working within traditional perspectives will continue on a trajectory established over a century of cumulative inquiry. They will refine general models of urban areas and urban systems and will assess these models by pursuing systematic programs of rigorous empirical research.

New perspectives have sometimes played a useful role in calling attention to gaps and limitations in traditional perspectives, stimulating refinements and consideration of interesting new questions (Yeates 2001; Clark 2001; Markusen 2003). But, as bifurcation in the field of urban theory and research has steadily progressed, the points of productive engagement are fewer and more scattered. The traditional perspectives have been flexible, durable, and resilient in the face of sustained criticism. And the insights from new perspectives have sparked less fundamental change than critics of traditional perspectives imagined and anticipated. In part, this occurred because researchers drawing on traditional perspectives tend to be pragmatic and are not averse to refining and extending their models to address problems identified by critiques. Thus, when it is useful, new variables stimulated by critiques from the political economy perspective are simply incorporated into analyses either as control variables or as variables of primary interest.

If anything, the engagement of the new perspective with, and their impact on, urban and spatial demography has diminished in the past decade or two. One reason for this is that the bifurcation of urban research has led to greater compartmentalization of traditional and new perspectives. Another reason is that new perspectives have as yet failed to coalesce into a single, theoretically coherent, alternative framework. To influence traditional demographic perspectives, it is not enough for new perspectives to note that there is more to urban and spatial patterns than traditional perspectives can fully explain. New perspectives must establish that they can account for both the patterns of urban and spatial distribution that have been explained well by traditional perspectives, and also for the important patterns that resist explanation by traditional perspectives alone. This has not happened. Critics have underestimated the adaptability and resiliency of traditional perspectives. Moreover, and perhaps more importantly, the proponents of alternative perspectives have been mostly content to change the subject and to carve out new conversations and lines of inquiry, rather than trying to develop compelling explanations for the urban and spatial demographic patterns that have received so much attention from demographers, ecologists, economists, and regional scientists who draw on traditional perspectives.

It is hard to say for certain if important opportunities for more productive engagement and synthesis have been missed, or whether in fact there was never enough common ground to overcome the obstacles to engagement. In any event, the die is cast regarding the future of research in this area. Theory and research guided by traditional demographic perspectives on urban and spatial population distribution will continue to develop and thrive. The center of gravity for these perspectives has continued to move away from sociology, geography and urban planning, where increasing attention is directed to questions addressed by new perspectives, and into urban and regional economics and regional science. Demographers and population specialists have always drawn on theory and research across multiple disciplines, so this is not a major change for them. But it does raise concerns that sociologists, geographers, and urban planners may in general have less familiarity with the models and insights of traditional demographic perspectives.

AU6

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