



How do compact, accessible, and walkable communities promote gender equality in spatial behavior?

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A B S T R A C T

Directing growth towards denser communities with mixed-use, accessible, and walkable neighborhood design has become an important strategy for promoting sustainability, but few studies have examined whether compact development strategies could help reduce within-household gender disparities in spatial behavior by increasing accessibility. We analyze spatial behavior of heterosexual married couples in Southern California based on the 2012 California Household Travel Survey and find that households living in areas with greater regional accessibility and neighborhood walkability have smaller, more centered, and more compact activity spaces overall compared to households in less compact areas, and that married pairs living in more accessible areas have greater equality in the size and centeredness of their activity spaces. We account for residential selection bias in our multivariate analysis and find that a ten unit increase in near-residence Walk Score was associated with a 12–18% decrease in activity space size, a 6–8% decrease in residential distancing, and a 12–13% increase in spatial concentration for both men and women. Men and women, however, had significantly different activity space behaviors regardless of their neighborhood type. Compared to women, men on average had larger activity spaces and conducted their activities farther from home. Overall, results support our hypothesis that compact development provides married couples greater flexibility in how they divide household out-of-home activities by making destinations more convenient and lowering the overall spatial fixity of these activities. Future research and planning efforts should carefully consider which aspects of compact, accessible development are most effective for a given local context.

1. Introduction

Sustainable development plans increasingly call for more compact, accessible, and walkable neighborhood design in order to reduce vehicle travel and associated greenhouse gas emissions. In California, Senate Bill 375 mandates regional planning organizations align their transportation plans with sustainable land use and development strategies to achieve this goal. In response, the Southern California Association of Governments' (SCAG's) recent plan directs nearly 50% of housing and employment growth between 2010 and 2040 into walkable and compact neighborhoods within a one-half mile walking distance from a well-served transit stop, or High Quality Transit Areas (HQTAs) (SCAG, 2016). These neighborhoods could encourage shorter driving trips and greater transit usage, walking, and cycling by clustering potential daily activity destinations near residential and work locations (Houston et al., 2015; Salon et al., 2012; Spears et al., 2016).

Could compact development also help lessen within-household gender disparities in spatial behavior by making destinations more

convenient, reducing travel time, and lowering the overall spatial and temporal fixity of activities? Available evidence suggests gender disparities in travel and activity patterns are influenced by urban form and development patterns. For instance, suburban sprawl can exacerbate gender disparities in daily household responsibilities and travel because segregated and dispersed land uses separate private and public realms and can constrain women to their immediate neighborhoods (Handy, 2006; Hayden, 2002). In contrast, New Urbanist neighborhood design could help counter the social isolation of women in suburbia by integrating pedestrian accessible mix-use centers (Fagan and Trudeau, 2014), and compact communities with denser land use and better transit service could help reduce the disproportionate chauffeuring responsibilities of women (Boarnet and Hsu, 2015).

This is the first study to our knowledge to assess whether compact development is associated with reduced gender disparities in spatial behavior by examining within-household differences in the daily activity spaces of married heterosexual partners in Southern California using the 2012 California Household Travel Survey (CHTS). We

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hypothesize that households living in more compact areas with greater regional accessibility or neighborhood walkability have smaller, more centered, and more compact activity spaces overall compared to households in less compact areas, and that married pairs living in more compact areas have greater equality in the size, centeredness, and compactness of their activity spaces. We first examine differences in these activity space measures across household regional accessibility and walkability levels for all men and women in the sample to assess the relative influence of these two built environmental measures after accounting for household and socio-demographic factors. Second, we more directly examine within-household differences between married pairs to examine factors associated with equality in activity space indicators between husband and wife pairs.

The remainder of the paper consists four sections. [Section 2](#) reviews the literature regarding the conceptualization of activity space, gender differences in spatial behavior, and the association between urban form and spatial behavior. [Section 3](#) describes the data and our analytical approach, and [Section 4](#) reports the results of our analysis. Lastly, [Section 5](#) discusses the analysis and implications for policy, planning, and future research.

2. Literature review

2.1. Conceptualizing activity space

Activity space can be conceptualized as a geographic surface of all locations or areas individuals visit while fulfilling needs and desires. Each individual has a unique set of daily activities, must organize them in time and space, and faces constraints including the ability to perform activities, needing to be at a given location at a specific time to meet others, and time-space restrictions imposed by authorities (Hägerstrand, 1970; Horton and Reynolds, 1971). Previous studies identify differences in spatial behavior across socio-demographic groups and suggest that activity space measures provide a useful proxy of social exclusion or segregation (Järv et al., 2014b; Tan et al., 2017; Wang et al., 2015). From this perspective, a larger, more dispersed activity space could be desirable because it could potentially provide marginalized individuals access to a greater range of potential social and economic interactions and opportunities (Crawford et al., 2014; Jones and Pebley, 2014; Sherman et al., 2005; Zenk et al., 2011).

Other studies stress the importance of promoting more compact communities with high local accessibility to nearby amenities that can provide access to amenities and reduce vehicle travel and associated environmental pollution (Chen and Akar, 2016; Ewing and Cervero, 2010; Manaugh and El-Geneidy, 2012). From this perspective, a smaller, less dispersed activity space is preferable because it reflects more localized travel patterns since household needs can be largely satisfied within the nearby environment. Both approaches emphasize the importance of understanding how an individual's activity space intersects with local and regional accessibility.

2.2. Gender differences in spatial behavior

The gender division of domestic labor and household out-of-home activities has a strong influence on the spatial behavior of women. For instance, employed women shoulder more household responsibilities in childcare and maintenance tasks, face greater temporal constraints, and have shorter commutes than men due to their temporal fixities (Hanson and Hanson, 1981; Johnston-Anumonwo, 1992; Presser, 1994; Turner and Niemeier, 1997). They remain primarily responsible for out-of-home household-serving activities and travel and these responsibilities represent an important part of the gender division of domestic labor (Kwan, 2000). The space-time requirements of these activities greatly influence the employment status and commuting distance of women, and the space-time rigidity of some out-of-home activities are a daily source of stress (Kwan, 1999a). Women, regardless of their employment

status, socioeconomic standing, and commuting distance, experience higher levels of spatial and temporal fixity compared to men, and the fixity of out-of-home activities such as passenger-serving trips may be the most important determinant of a person's activity-travel pattern (Kwan, 1999a).

The local residential environment also influences gender differences in spatial behavior. Hayden (2002) argues that housewives living in suburban areas tend to center their activities more in private spheres while their husbands conduct their lives in-between private realms and urban public spaces. Suburban development patterns can isolate women's public participation and burden employed women with second shift duty (Hayden, 1980; Little et al., 1988). That is, employed women take up the responsibility of unpaid household-related tasks after they complete their professional activities (Hochschild and Machung, 2012). Hayden (1980) and Pickup (1988) suggest a strategy to address gender inequality and advantage women who play dual roles in work and at home: enhancing land use mixing and surrounding opportunities (Hayden, 1980; Pickup, 1988). Recent studies extend this proposition by finding that compact mixed-use design, greater access to commercial establishments, and better transit service are associated with a more equitable household distribution of domestic labor and chauffeuring responsibilities (Boarnet and Hsu, 2015; Fagan and Trudeau, 2014).

Empirical studies of gender differences in spatial behavior, however, provide mixed results. Some indicate women have smaller activity spaces and lower accessibility to urban amenities than men (Fan and Khattak, 2008; Kwan, 1999b, 2000; Perchoux et al., 2014), but others find no significant difference in the size of activity spaces and access to amenities between men and women (Chen and Akar, 2016; Järv et al., 2014a, 2014b; Jones and Pebley, 2014; Zenk et al., 2011).

2.3. Urban form and spatial behavior

A growing body of empirical evidence provides insights into how features of urban environments influence accessibility and spatial behavior. Residents of more urbanized areas tend to have more compact activity spaces and to center their activity spaces on their residential neighborhoods (Buliung and Kanaroglou, 2006; Crawford et al., 2014; Harding et al., 2014; Perchoux et al., 2014). Likewise, suburban and sprawling development patterns are associated with larger activity spaces (Jones and Pebley, 2014; Schönfelder and Axhausen, 2003). These differences seem to reflect that urban residents have greater accessibility than suburban residents because of the dense road networks in the urban core (Crawford et al., 2014).

Existing studies also examine the influence of the “D” variables on spatial behavior, including density, destination accessibility, and design (Ewing and Cervero, 2010). Residents of dense areas have smaller activity spaces (Chen and Akar, 2016; Fan and Khattak, 2008; Tana et al., 2016) and activity spaces and activity-travel patterns become more compact with increasing destination accessibility and decreasing distance between home and workplace (Järv et al., 2014a; Manaugh and El-Geneidy, 2012; Sherman et al., 2005). In contrast, however, Tana et al. (2016) found that individual activity space in Beijing increases with the number of retail stores around an individual's home. In terms of street network design, Fan and Khattak (2008) found that activity spaces in the Greater Triangle area in North Carolina are smaller when street nodes are more dense and well connected (Fan and Khattak, 2008), but Tana et al. (2016) found in Chicago that activity spaces are smaller with decreased roadway density. Some of the differences observed across these studies could result from the use of simplified measures of urban form and a limited understanding of the associations between the “D” variables and spatial behaviors (Fan and Khattak, 2008; Harding et al., 2014; Shen et al., 2015; Tana et al., 2016).

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