TYPE AND LOCATION OF SEATING ON PEDESTRIAN STREETS AND INFLUENCE ON DURATION OF STAY

A Thesis

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by

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Abstract

In designing for long-lasting outdoor activities, a space's seating options and edge condition have been posited to have notable effects on staying behaviors. Danish architect Jan Gehl and American planner William H. Whyte concluded from their experiences observing public spaces that style of seating and relationship to the space's edges have notable impacts on whether one chooses to sit down and how long they will stay once seated. Although these principles resonate with many, they have in fact received little careful and systematic evaluation. This study combined theories from prior informal observation of human preference regarding seating type and location and validated each with empirical evidence. Researchers conducted a naturalistic observation study over the course of eight days in March 2012, observing an opportunistic sample of 124 people. Results indicated that higher-quality seating type was associated with a longer duration of stay at a significant level. Duration of stay was not found to be impacted at a significant level by edge relationship, however, this may have been a result of a limited sample size. Opportunities for further research are outlined in hopes that we may continue to develop our understanding of these concepts, informing the design of livelier spaces and cities.

Biographical Sketch

Stefana Scinta earned her Bachelors of Science in Design and Environmental Analysis in 2011 from Cornell University. As a Masters candidate in Human Environment Relations, Stefana studied under her advisor Professor Gary Evans to design and execute the study upon which this thesis is based.

Upon completion of her master's coursework, Stefana began working as a Workplace Design Analyst in the Washington, DC office of HOK. She now serves as a Senior Workplace Strategist in the Washington, DC office of CallisonRTKL.

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Chapter 1: Introduction and Literature Review

1.1 Purpose for Research

The quality of a public space is often judged based on its popularity in terms of level of activity and visitor density. Successful public spaces are lively, and become so by attracting large quantities of visitors. These metrics are not only influenced by the geographical context of the space but also by the physical elements within it. Danish architect Jan Gehl and American planner William H. Whyte are widely credited with the development of the major theories regarding the physical character, dimensions, and elements of public space in relation to use and behavior and, in doing so, sparking public interest in the design of urban public spaces.

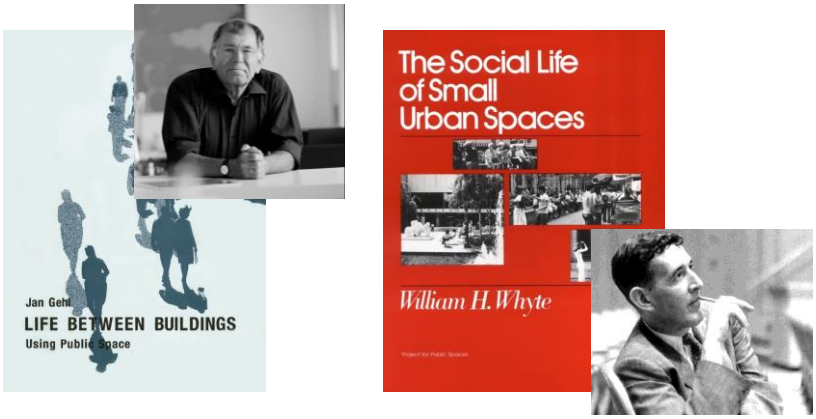


Figure 1.1: Jan Gehl and William Whyte; pioneers of public space research

Both Gehl and Whyte write that the most successful spaces not only attract people but also retain them. In addition to quantity of visitors, equally significant is the amount of time users spend in a space (Gehl, 2010, p. 71). In his 1987 book *Life Between Buildings*, Gehl writes that high levels of activity can be stimulated not only by ensuring that many people uses the space, but also by encouraging longer individual stays (p. 77). He concludes that when people are encouraged to stay in the space longer, a

modest number of people and events can grow to a substantial activity level.

In designing for long-lasting outdoor activities, a space's seating options and edge condition have been theorized to have notable effects on staying behaviors. Both Gehl and Whyte concluded from their experience observing public spaces that style of seating and relationship to the space's edges have notable impacts on whether one chooses to sit down and how long they will stay once seated. In many cases, these observations have provided the basis for recommendations about how to reinforce staying opportunities in public spaces.

Although these principles resonate with many, they have in fact received little careful and systematic evaluation. This study aims to combine theories from prior informal observation of human preference regarding seating type and location, validating each with empirical evidence and offering ideas for future research.

1.2 Public Space

1.2.1 Defining Public Space

While the terminology surrounding public space is varied, the literature shows some fundamental distinctions between space types. Open urban spaces primarily comprising soft material landscapes are typically referred to as "parks," while those with hard material landscapes may have a wider variety of labels including "public squares," or "plazas" (Morris, 1979). Even beyond these labels, many more specific typologies exist, such as markets, streets, playgrounds, greenways, and parkways (Carr, Francis, Rivlin, Stone, 1992, p. 84). Public space can also be "found space" that was not explicitly designed to support staying activities (Carr et al., 1992, p. 109). This thesis focuses on the elements that facilitate

staying in pedestrian streets: hardscaped public spaces with a notable physical delineation in the form of hard edges. Lynch (1960) refers to such spaces as “activity condensers,” due to their clear and well defined structure provided by high density buildings or streets. These spaces bring people together for passive enjoyment (Jackson, 1985, p. 16) and, if well designed, provide a good setting for the study of human behavior.

1.2.2 The Role of Public Space in Cities

Public welfare has always been a primary motivation for creating or improving public space (Carr et al., 1992, p. 10), and many city planners, urban designers, environmental psychologists, and city residents recognize the importance of high quality public space within an urban setting. By providing opportunities for people to meet their neighbors in safe, inviting places, urban public spaces can help to support social cohesion or a strong sense of community within a neighborhood (Francis et al., 2012, p. 401-409). A city’s public spaces facilitate many other aspects of human functioning in addition to human exchange and interaction (Carr et al., 1992, p. 3, p.136). In addition to offering us an opportunity for contact, they help us understand the social environment, gather inspiration, and fulfill our inherent need for stimulation (Gehl, 1987, p. 21). For some, public space is a destination; for others, it is a retreat from someplace else (Carr et al., 1992, p. 91).

Public spaces have the capability of advancing a city in myriad ways, among them spurring economic growth (Greco, 2010). Gehl (1987) indicates that if a space makes walking, standing, seeing, hearing, and talking attractive, this in itself is an important quality. In addition, such spaces provide a basis for a broad spectrum of additional activities capable of benefitting large portions of a population (p. 131).

1.2.3 Principles of Public Space Design

Environmental psychologists have long demonstrated that the built environment can impact human behavior (Canter, 1977). The design of an environment can have a fundamental impact on how people feel within and interact with it, affecting whether or not the space is used. While not the first to study human behavior in public spaces, sociologist William H. Whyte's 1971 book, *The Social Life of Small Urban Spaces*, is widely credited with sparking awareness of and interest in the quality of public space in urban settings. Along with findings from other social scientists, planners, and designers, his direct observations of successful and unsuccessful spaces in New York City served as the basis for many urban public space design guidelines.

In *Life Between Buildings*, Gehl (1987) defines three types of outdoor activities (p. 9). Most activities fall into two of these categories; "necessary" activities (mandatory actions such as going to work or running errands), which are performed under all conditions, or "optional" activities (voluntary actions such as taking a walk or sitting in the sun), which are performed only under favorable exterior conditions. He indicates that when outdoor areas are of poor quality, only necessary activities will occur. However, when outdoor areas are of high quality, a wide range of optional activities will also occur, increasing the overall variety of activities being performed. Gehl also identifies a third "social" category of activity, for which the other two categories serve as a prerequisite. These are activities that require the presence of others, such as children playing, or parents conversing. Social activity also includes passive contact, or the simple act of seeing and hearing other people. Gehl deems social activities as "resultant activities" as they are nearly always an evolution from an activity that was necessary or optional. In order to attract all three types of activity, a space must be of an extremely high quality.

Figure 1.2. The Highline in New York City; a high quality space where social activity is constant

While a variety of definitive lists and guidelines have been developed over time by researchers, planners, designers, and municipalities outlining what characteristics make a space successful, the literature on this topic shows certain recurring themes. Some of these attributes are qualitative and must be experienced; others are quantitative and measurable. The following qualities (either inherent or by design) have been repeatedly found as indicators of lively, successful spaces.

The Presence of People

William Whyte summarizes this effect most succinctly by writing "what attracts people the most, it would appear, is other people" (1980, p.19). The majority of research, observation, and investigation identify the presence and number of people as the most important indicator of and prerequisite for a successful space (Whyte, 2007, p. 353). Researchers have found that human activity is the greatest object of interest in most spaces (Gehl, 1987, p.29). In addition to acting as the main attractor to public space, the presence of people is the most important (and arguably only) prerequisite for social interaction, which spaces may help or hinder based on the way they are designed. According to Cattell et al., the greater the number of activities supported by a space, the greater the chance for unplanned

social interaction to occur amongst people with varied background and interests (Cattell, Dines, Gesler, Curtis, 2008). Most importantly, once achieved, the attraction of people is a self-reinforcing process. Gehl (2010) summarizes this effect: "something happens because something happens because something happens" (p. 65).

Accessibility

Research points to a space's accessibility as a major predictor of its use, typically categorizing access as physical, visual, or symbolic.

Physical access deals with the space's objective accessibility in terms of whether the space is available to the public and does not exclude populations including the elderly, people in wheelchairs, or those pushing strollers. Successful spaces boast clear and defined entrances that invite users into the space.

 They are well connected to paths of circulation including adjacent streets and support a high level of pedestrian movement (Whyte, 1980, Carr et al., 1992 p.144).

Visual access is an equally important element in ensuring that people feel free to enter the space (Carr et al., 1992, p. 144; Gehl, 1987, p. 113). Greenbie (1981) writes that, in terms of the relationship between social behavior and urban environment, the "surprise effect," or inability to see what is happening within a space before entering it is the most important factor to avoid when planning a public space. Spaces should be designed to facilitate and showcase human activity in order to attract more people. Sightlines are important not only to make people aware of the space (Whyte, 1987) but also as an element of safety. By having the ability to easily see into the space from the outside, potential users know they can enter safely and be welcomed (Carr et al. 1992, p. 144). In addition to providing a feeling of safety for those already in the space, high visual access also affords more and better options to see

other people, initially attracting them to the space and then fostering a longer duration of stay once they arrive.

The third type of access is symbolic access, which involves the presence of cues indicating who is and is not welcome in the space (Carr et al. 1992, p. 149). These cues, typically perceived as either intimidating or comforting, can take the form of people or design elements that affect who may enter a public space. As an example, Carr (1992) writes that the clearest example of symbolic access are "gatekeepers," or security guards located near the entry points who subtly or conspicuously control those coming in to the space. However, while security guards ensure a sense of safety, they can also inhibit use by implying that a site may be dangerous (Carr et al. 1992, p.150). As an alternative to guards, nonhuman factors can also indicate intended access. Oscar Newman's theory of defensible space (1972) calls for symbolic or environmental barriers such as limited entrance points, visibility to people, and signage to help define the space and exclude potentially threatening outsiders.

Varied Destinations, Activities, and Attractions

Another effective method of attracting users to a space is through provision of a substantial variety of attractions or destinations within or adjacent to the space. Jane Jacobs (1961) writes that it is not necessarily the space itself that creates a vibrant place, but the place's surroundings. Spaces that have the greatest number of activities taking place at once, attract the most people due to their ability to support a variety of interests and give people the opportunity to move from one activity to the next (Demerath et al., 2003, p. 20). While varied destinations give people a reason to visit, an interesting issue in need of scrutiny is whether or not the function between public space variety and user preference is linear in terms of an optimum level of stimulation. Too much variety runs the risk of appearing chaotic and confusing, likely diminishing the attractiveness of a space. A large body of

research indicates, for example, that moderately complex physical settings are preferred over those that are too simple or too complex (Nasar, 1988; Stamps, 2005).

Similarly, Jan Gehl (1987) notes the importance of public spaces not only offering opportunities for walking and sitting, but also opportunities to act, things to do, and activities to be involved in (p. 120). He categorizes different types of engagement as "passive" or "active," each of which are important to the success of a space (Carr et al., 1992, p. 120). Active engagement describes direct experiences with a place and the people within it (for example, socializing with friends), and is facilitated by providing areas for conversation or for children to play (Carr et al., 1992, p. 122). Conversely, passive engagement refers to activities that are space-dependent but do not involve interaction, the best example of which is people watching other people. Along with many other social scientists and designers who have studied public space, William Whyte (1980, 1988) identified "people watching" as the most popular activity in downtown plazas and other small urban spaces.

Comfort

Physical and psychological comfort are basic needs which must be considered in the design of a public space (Carr et al., 1992, p. 92). For physical comfort, it is important to provide a variety of comfortable seating options (Carr et al. 1992, p. 94). Seating should not only provide physical comfort, but psychological and social comfort that stems from offering users choice and control over where they may rest (Whyte, 1980, p. 28).

Many researchers note the relationship between environmental conditions such as sun, shade, or wind and a space's usage (Burden, 1977). Protection from these elements must be considered based on a particular location's climate (Carr et al. 1992; Gehl, 2010; Francis, 1987). Careful consideration must be

taken when creating these “microclimates” within a public space. In some cases, researchers have found that undesirable conditions are created by the structures that should offer protection from them. For example, Bosselman et al. (1984, 1987) studied the effect of wind and shade created by tall buildings in San Francisco, noting that higher wind levels led to higher required temperatures for people to use the space, even when wind levels were not causing discomfort.

While a great number (and perhaps the majority) of public space users seek liveliness and engagement within a city’s public spaces, many also view retreat or relaxation as a reason to visit public urban space (Carr et al., 1992, p. 104). This type of comfort can be achieved by providing good visual access coupled with some modicum of visual refuge, in addition to natural features such as water, trees, and other greenery (Nager, et. al., 1976).

Safety

Research has shown that safety is the most frequently reported barrier to public space use (Francis, 1987). In this context, it is important to note that actual and perceived safety can play an equally important role. Gehl (2010) notes that it is the *feeling* of risk and uncertainty, rather than actual statistical risk that plays the decisive role in whether users choose to use a space (p. 173).

While physical features such as adequate lighting, protection from vehicular traffic, and visual access into the site can increase real and perceived safety levels (Carr et al., 1992, p. 96), the greatest impact on safety and security in a public space comes from a high level of sustained activity, or “eyes on the street” (Jacobs, 1961). When examining the relationship between activity level and degree of safety and security on a street, Jane Jacobs (1961) wrote that a well-used city street is apt to be safe, while a deserted city street is apt to be unsafe (p. 34). Research has shown that the effect of “street watching”

has a measurable impact on accidents (Gehl, 1987, p. 171), and as a result, Jacobs' concept has become part of the core vocabulary of city planning terminology (Gehl, 2010, p.97).

Women, the elderly, the disabled, and minorities are particularly sensitive to perceived safety in a public space (Luymes et al., 1995, p.39). Whyte reports that the most popular and comfortable public spaces he and his team observed in New York always had a high proportion of women, writing that "if a plaza has a markedly lower than average proportion of women, something is wrong" (1980, p. 18).

Summary

While programming and management strategies can enhance the use of a dull space, the location and physical features of the space will endure indefinitely, continually impacting how a space is used. While poor quality spaces will support necessary activities, only high quality spaces will facilitate the optional and social activities that make a space successful and long lasting. As such, another reason to rigorously evaluate the contribution of design parameters to public space usage is to offer evidence for the value of investment in design amenities in spaces that support more use.

1.3 Edge Conditions

There are a variety of environmental features that can support or hinder a space's use by the public. Spatial edges and the environmental conditions they create have the ability to influence staying behavior in a public space.

1.3.1 Edges in the Context of the City

While this thesis focuses on edges as they relate to human behavior in public spaces, it is important to

first note the relationship between edge quality and city life generally. When discussing edges in the context of the city, Lynch (1960) notes that edge elements are a critical organizing feature and help to hold together generalized areas (p. 47). Gehl (2010) also discusses the line at which building meets city. He praises "soft edges," or building facades where many shops, displays, varied openings, and non-uniform facades with varied planes or protrusions create visual interest and provide a reason to slow down and engage with the environment (p. 75). Conversely, "hard edges" are perceived as cold and uninviting. Examples of hard edges are commonly found along commercial ground floors that are windowless or otherwise closed off, forcing pedestrians to walk along long sections of solid material.

Soft edges influence attractiveness and activity patterns in cities by providing a human scale at human eye level. People are interested in a space with soft edges, which offer more opportunities for sitting or for small groups of people to linger with one another. These favorable conditions tend to dictate whether the journey along a path is enjoyable. Gehl's investigation reveals a direct connection between soft edges and lively cities (2010).

1.3.2 Edges in Public Space

Alexander (1977) identifies two "fundamentally different kinds of outdoor space," labeling them "negative" and "positive" (p. 518). Negative space is shapeless and unplanned, for example, the leftover land that surrounds a building on its site. Conversely, positive space is clearly defined, and its shape is as important and thoughtfully planned as the shapes of the buildings that surround it. In such spaces, well-defined edges serve to limit the visual field and define individual space (Gehl, 2010, p.75).

Soft and interesting edges, particularly those with textured facades, niches or ledges, offer much in terms of "staying psychology" (Gehl, 2010, p. 139). Observations of behavioral patterns and types of

interaction along the edges of a space suggest that when edges "fail," a space will never be lively (Alexander, 1977).

The importance of high quality edges in public space has to do with the effect these edges have on staying behaviors. Gehl (1987) writes that the most popular zones for staying are found along the facades of a space or in the transitional zone between one space and the next, where a user has the opportunity to view both spaces at the same time" (p. 149). Preferred stopping zones are found along the borders of the space or at the edges of a space within a space. Lynch (1960) writes that edges have a habit of pulling residents together by attracting them to itself (p. 47).

1.3.3 Edge-seeking

When describing the general tendency for people to stick to walls in nearly every setting, Gehl (2010) writes that "life grows from the edge in towards the middle" (p. 75). When an edge is not available, people will choose to stay near other objects instead. Outdoors, these could be lampposts, poles, or planters. Indoors, they might be furniture, corners, columns or niches within the edge zone.

There are several theories associated with people's attraction to edges. Research has shown that people tend to stick close to edges whenever possible both to help regulate distance between themselves and others (Hall, 1990), and to keep tight control over personal territory (Newman, 1966). If a person is to sit down outdoors, it is less likely that they will do so if the only options are exposed in the middle of an open space. Instead, people typically search for something to put their back against that will provide them comfort through partial enclosure and shelter (Alexander, 1977, p. 521). French (1978) writes that people feel comfortable only at the edges of a space because they offer psychological protection by providing users with the sense of intimacy that our psychology requires. Many theories

surrounding comfort on the periphery of a space are rooted in Appleton's "prospect-refuge theory," which states that human aesthetic taste is based on satisfying the instinctive desires for opportunity (prospect) and safety (refuge) (1975).

Edges provide protection, both real and perceived. At the edge of a space, one is less exposed, out of the way, and personal territory is limited to a semicircle in front of the individual, whose back is protected (Hall, 1990). Edges are also where one often finds shade from awnings, colonnades, or recessed entrances, without losing views into the space (Gehl 1987, p.151). This phenomenon is not limited to urban parks and squares. A 1968 study by Sociologist Derk de Jonge found that restaurant seats anchored against a wall and with a clear view of the room were consistently the most preferred seats in the room (Gehl, 2010).

In addition to providing a feeling of safety and security, edges are where people watch other people. Studies have shown that benches with a clear view of nearby activities are more often used than benches with less or no view of others (Gehl, 1987, p.27). Research on seating in central squares show this trend; benches with a view of the space's major pedestrian routes are usually used most, while benches oriented away toward more static views are used less frequently.

1.4 Seating

Another common theme in the literature surrounds the importance of seating in public spaces. When planning environments with the goal of encouraging staying behavior, provision of places to sit is perhaps the most important parameter for the liveliness of a public space (Whyte, 1980).

1.4.1 The Importance of Seating

In *Life Between Buildings*, Gehl writes that "to improve the quality of public environments in any given area by simple means, create more and better opportunities for seating." He states that there is no reason for people to stay in a space unless there is somewhere to sit. Good opportunities for sitting pave the way for myriad other activities that enliven public spaces such as resting, reading, eating, or watching other people. Gehl argues that activities requiring seating are so vital to the success of the space that the presence or lack of good seating options should be considered a preeminent factor in evaluating the quality of the public environment. (Gehl, 1987, p. 155). Conditions for walking and bicycling in a city space is important; however, these factors alone will not make a space successful. Instead, conditions must be adequately designed to facilitate long-lasting activity. In short, people must be invited to sit down.

1.4.2 Measuring Seating Quality

While Whyte's premise that "people tend to sit most where there are places to sit" (1980, p. 28) seems self-evident, research shows that staying behaviors are measurably impacted both positively and negatively not only by seating quantity but also by the quality of seating in a space. In conjunction with a 1990 study of city quality in the center of Stockholm, Gehl (1990) developed a four point scale to assess seating quality, the results of which showed a clear connection between quality of seating (in terms of view, microclimate, space placement, and edge relationship) and increased use.

Unsurprisingly given our understanding of peoples' enjoyment of watching other people, Gehl (1987) writes that the dominant factor in choosing a place to sit is the opportunity to see events taking place within the space (p. 159). Seating comfort also plays a large role in determining which seats people chose and how long they will stay. Gehl (1987, 2010) breaks down seating into two categories according

to their comfort, calling them primary and secondary. Primary seating consists of proper furniture with backs and arms, typically benches and chairs. Secondary seating consists of objects or ledges that are not necessarily meant for sitting, but are places where people might informally or spontaneously sit to rest or observe their surroundings. This type of seating can vary widely and include low walls, planters, pedestals, or steps, which tend to be particularly attractive as they double as good lookout points. Gehl includes backless benches in secondary seating, writing that they do not facilitate staying in the same way a bench with a back does (2010, p. 144). Both Gehl and Whyte praise movable seating, which provides the user with increased control and the ability to increase or decrease visual access and visual exposure.

When planning seating options in public spaces, designers and researchers suggest placing some primary and many secondary seating choices. A benefit of this allocation ratio is that the space will not look empty when few people are in it. Gehl writes that there is "a sense of abandon found with many empty chairs and benches" (1987, p. 162).

Because different user groups have different requirements in terms of seating options, designers and planners should provide a wide variety of multipurpose city furnishings (or "sitting landscapes", as Gehl refers to them), to accommodate the greatest diversity of people. While young people are often comfortable sitting on any surface and thus tend to dominate a space's secondary seating (Gehl 2010 p.143), adults and the elderly are more particular about where to sit. Gehl (2010) suggests that if urban planners want to provide urban space for everyone, it is particularly important to offer good seating for older people, as younger people will always find a place to sit.

1.5 Research Questions, Hypotheses, and Contribution to the Field

Given what we know about the relation between staying activities and the success of public space, it is critical that we continue to study these variables in controlled, more methodically rigorous ways. Successful public spaces are key to the vibrancy of a city, and in order for a public space to be successful it must continuously attract and retain visitors. Research points to sustained activity as the most important indicator of a lively space. While activity level is in part resultant of the number of visitors in a space, Gehl, Whyte, and others emphasize the importance of activity duration, writing that spaces with sustained activity levels often achieve them through encouragement of longer individual stays. Researchers go on to indicate that the best way to increase individual duration is through provision of more and better opportunities for seating. Research points to seating type and edge condition as measurements of seating quality, indicating that these two factors have the ability to positively impact the attraction and retention required to sustain a high level of activity.

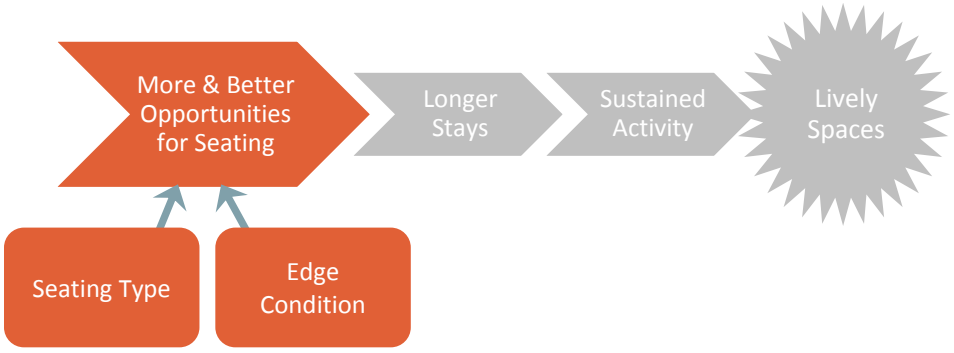


Figure 1.3. Relationship between seating type, edge condition, and space's activity level

Provision of seating along with thoughtfully designed edge conditions provide the feeling of comfort and safety that users require in order to stay in a space, making them two of the most impactful environmental features in a public space. Knowing this, it comes as no surprise that the literature often addresses the combination of seating and edges in the context of increasing staying activities. Research

argues that seating should always be planned with psychological inclinations in mind; other words, it should be near the edge of a space or in an area that offers a similar feeling of intimacy and security (Gehl, 1987, p. 159). Informal investigations and observations have continually found that high quality seating along facades, walls, or other spatial boundaries are preferred to seating located in the middle of a space (Gehl 1987 p.157).

While these informal theories resonate with many, it is critical that we study the relationships systematically in order to test each theory and strengthen the surrounding body of knowledge. Thus, this study aims to combine theories from prior informal observation, validate each with data, and answer two primary research questions:

- Do the type and location of seating on a pedestrian street affect a visitor's duration of stay?
- Do seating and edge design interact to mutually reinforce each other?

Another reason to more systematically analyze seating and edge design and behavior in public spaces is to carefully sample settings. Just as the methodological care, quality of observation, and careful measurement of variables of interest adds rigor to our knowledge base, the systematic sampling of settings and the people in them is necessary for more unbiased results.

Chapter 2: Methods

2.1 Study Design

The study was a naturalistic observation to test whether the type and location of seating affect a person's duration of stay.

Sample variables included subjects' seat location in relation to environmental edges (edge-anchored or non-edge-anchored), and type of seating (primary, backless primary, or secondary). For the purpose of this study, primary seating includes furniture with backs, backless primary seating includes benches with no backs, and secondary seating includes objects or ledges that are not necessarily meant for sitting. Edge-anchored seating was either along the exterior edge of the space or an interior edge created by a vertical plane whereby the back of a seated person was protected. An illustration is provided in Figure 2.1 to demonstrate environmental edges and in Figure 2.2 to demonstrate type of seating. Several factors were controlled for either methodologically or through statistical methods. Age was controlled for by sampling only individuals who clearly appeared over the age of twenty. Observations took place on weekdays and weekends and between 12pm and 5pm. Observation only occurred when the ambient temperature exceeded 65 degrees and with no precipitation. Additional variables are included in analyses as described in the Results section below.

Figure 2.1. Environmental Edges

Seating along exterior edge

Seating along interior edge

Figure 2.2. Seating Type

Primary Seating

Backless Primary Seating

Secondary Seating

To test inter-observer reliability, edge condition and seating type of each individual seat within the observation boundaries were identified, confirmed via Q sort and coded prior to observation. Q sort participants were ten university students with an understanding of the categorization criteria. Analysis showed a correlation of .90 regarding seating type and a correlation of .82 regarding edge condition.

A notable element of the Q sort design was the use of photos of the actual observation sites instead of generic images illustrative of seating variables of interest. By using images of the actual configurations to be observed, the exercise served not only to measure reliability, but to minimize observer error since the coding of seating type and edge condition were derived from group scores and thus not subject to individual variability in interpretation. Seating arrangements were coded prior to observation, ensuring

consistent seating coding across observers.

While many of the additional variables included in the study were nominal and not typically subject to observer bias, (for example, duration of stay, group size, or gender), efforts were made to ensure that variables requiring observer judgement were discussed and clarified prior to observation. Although these detailed parameters left few opportunities for subjective measurement, inter-observer reliability was calculated using the photos from the seat identification Q sort. Regarding seating type, analysis showed an inter-observer correlation of .83 and 88% agreement; regarding edge condition, analysis showed a correlation of .79 and 94% agreement.

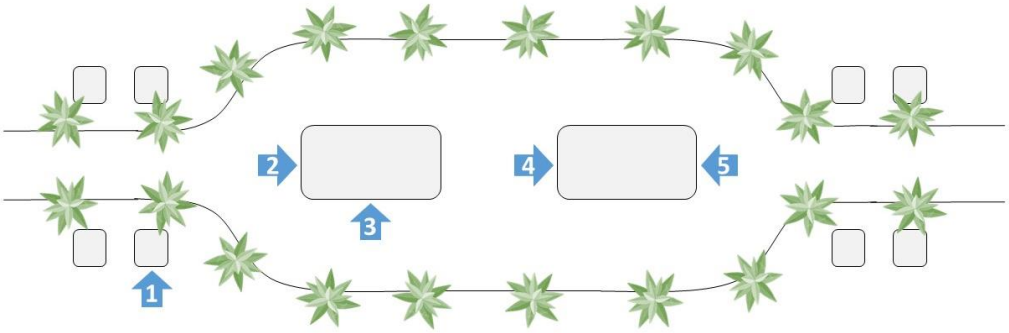
2.2 Participants

An opportunistic sample of 124 people was observed during the course of the study. Participants were chosen based on location such that any person appearing over the age of 20 who sat down within the observation boundary was observed.

2.3 Setting

Following a survey of popular pedestrian streets in the United States, two sites near Los Angeles, California were selected; the first was Third Street Promenade, a pedestrian-only retail thoroughfare in downtown Santa Monica, CA, and the second was a smaller but equally active pedestrian site in Manhattan Beach, CA (see Figures 2.3 and 2.4 for site diagrams and photographs). Seating types within each site were confirmed through the Q-sort analysis as discussed in the "design" portion of this section.

Figure 2.3. Third Street Promenade: Site Diagram



Site Diagram with labeled views

Site Overview

View 1

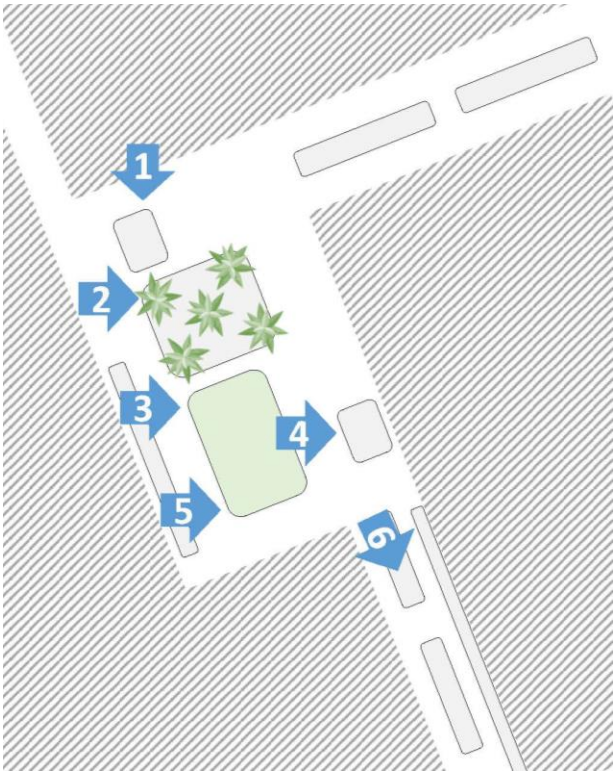
View 2

View 3

View 4

View 5

Figure 2.4. Manhattan Beach: Site Diagram and Views



Site Diagram with labeled views

Site Overview 1

Site Overview 2

View 1

View 2

View 3

View 4

View 5

View 6

These types included a combination of primary, backless primary, and secondary seating positioned along the space's edges as well as in the center (Gehl, 1987; Whyte, 1980; Hall, 1990). Sites were divided into observation zones such that each zone offered access to a different combination of seating options.

In addition to an appropriate variety of seating, each site was vetted based on previous research regarding the environmental features present in a "high-quality" public space. These criteria included but were not limited to: good visibility into the space (Whyte, 1980), presence of natural elements such as trees and water (Whyte, 1980; Jacobs, 1961), defined and active borders (Alexander, 1977), continuous and diverse uses (Jacobs, 1961), nearby food and amenities (Whyte, 1980) and a perception of safety based on the presence of other people (Jacobs, 1961). Both sites were pedestrian oriented with no vehicle access. This was done in order to create a research design that combined the realism and richness of an actual setting but also partially controlled for other variables that might also affect pedestrian behaviors in the public space.

Observations took place over the course of eight days in March, 2012.

2.4 Dependent Measures

Duration of stay was measured in minutes and seconds, beginning when a subject sat down and ending when the subject arose from the seat.

2.5 Procedure

In order to collect data as thoroughly and accurately as possible, each site was split into observation "zones," each containing a variety of seating arrangements. By subdividing the site into smaller

observation boundaries, observers were able to record all activity within each zone as it occurred, eliminating the need for subject selection and risk of selection bias.

Researchers observed subjects without intervention and recorded each variable on a standardized form (see Appendix A - Research Instrument). A stopwatch was continuously running for the duration of each observation period. The stopwatch time was recorded when each subject sat down and rose up; these values were later subtracted from one another to determine duration of stay.

Chapter 3: Results

The data set was analyzed using ordinary least squared (OLS) regression where the dependent variable is duration of stay, measured in minutes. The analysis controlled for day of week, environmental conditions, group dynamic (defined as single, pair, or group), group gender composition (defined as male-dominated, female-dominated, or neutral), group size, and presence of sunlight.

In order to first study the variables of interest, separate models were run in which one of the variables - either type of seating or edge condition - was excluded. This provided an opportunity to understand each variable's individual relationship to duration of stay.

Table 3.1. Summary statistics - Model 1 (seating type)

Source	SS	df	MS
Model	4528.46013	11	411.678194
Residual	15615.7657	112	139.426479
Total	20144.2258	123	163.774194

Number of obs	= 124
F(11, 112)	= 2.95
Prob > F	= 0.0018
R-squared	= 0.2248
Adj R-squared	= 0.1487
Root MSE	= 11.808

Duration	Coef.	Std. Err.	t	P>|t|	Beta
backless_p~y	-9.750038	4.278884	-2.28	0.025	-.3347257
secondary	-16.42626	4.632598	-3.55	0.001	-.5849857
Sun	-8.336027	5.22847	-1.59	0.114	-.3269702
Shade	-6.954193	6.5551	-1.06	0.291	-.1415568
Sun_Shade	-3.596852	4.884108	-0.74	0.463	-.135023
Single	-9.067814	4.373761	-2.07	0.040	-.3545613
Pair	-7.568083	4.687934	-1.61	0.109	-.2892192
female_maj~y	-3.827481	3.594943	-1.06	0.289	-.1421211
male_major~y	.1847823	3.758122	0.05	0.961	.0072488
zone	7.315059	4.44175	1.65	0.102	.2851265
day	1.264623	.8675445	1.46	0.148	.1997556
_cons	17.06129	8.2528	2.07	0.041	.

In the first model, backless primary and secondary seating were associated with decreased duration of stay relative to primary seating and were statistically significant. (Table 3.1). Individuals who were

seated alone were also found to have a statistically significant shorter duration of stay relative to groups of three or more individuals.

Table 3.2. Summary Statistics for Model 2 (edge condition)

Source	SS	df	MS		
Model	3290.36737	10	329.036737	Number of obs =	124
Residual	16853.8584	113	149.14919	F(10, 113) =	2.21
				Prob > F =	0.0222
Total	20144.2258	123	163.774194	R-squared =	0.1633
				Adj R-squared =	0.0893
				Root MSE =	12.213

Duration	Coef.	Std. Err.	t	P>|t|	Beta
Edge_Anchor	-6.499527	3.457551	-1.88	0.063	-.2463326
Sun	-2.923672	5.259429	-0.56	0.579	-.1146774
Shade	-.9895204	6.426644	-0.15	0.878	-.0201423
Sun_Shade	1.485553	4.847713	0.31	0.760	.0557665
Single	-8.796544	4.525379	-1.94	0.054	-.3439543
Pair	-6.121423	4.82641	-1.27	0.207	-.2339342
female_maj~y	-.6772176	3.611046	-0.19	0.852	-.0251463
male_major~y	1.833215	3.884913	0.47	0.638	.0719149
zone	-8.198029	2.929349	-2.80	0.006	-.3195429
day	1.003805	.922231	1.09	0.279	.1585578
_cons	31.35361	8.538258	3.67	0.000	.

In the second model, no relationship was found at a significant level between edge condition and duration of stay. In this model, individuals seated alone were no longer found to have a significantly shorter duration of stay relative to groups.

Table 3.3. Summary Statistics - Model 3 (all variables)

Source	SS	df	MS
Model	4811.71833	12	400.976528
Residual	15332.5075	111	138.130698
Total	20144.2258	123	163.774194

Number of obs	= 124
F(12, 111)	= 2.90
Prob > F	= 0.0016
R-squared	= 0.2389
Adj R-squared	= 0.1566
Root MSE	= 11.753

Duration	Coef.	Std. Err.	t	P>|t|	Beta
backless_p~y	-11.29069	4.392741	-2.57	0.011	-.3876172
secondary	-15.2147	4.687998	-3.25	0.002	-.5418386
Edge_Anchor	-5.475375	3.823559	-1.43	0.155	-.2075171
Sun	-7.426286	5.24275	-1.42	0.159	-.2912868
Shade	-6.89035	6.524721	-1.06	0.293	-.1402573
Sun_Shade	-3.121278	4.87269	-0.64	0.523	-.1171703
Single	-9.41638	4.360189	-2.16	0.033	-.3681906
Pair	-7.599076	4.666149	-1.63	0.106	-.2904036
female_maj~y	-3.559564	3.583087	-0.99	0.323	-.1321729
male_major~y	.7526908	3.761582	0.20	0.842	.0295272
zone	4.616607	4.8059	0.96	0.339	.1799462
day	1.711276	.9181091	1.86	0.065	.2703075
_cons	22.35287	9.007237	2.48	0.015	.

The third model combined the two variables of interest in order to examine the independent relationship of each environmental variable with seating duration. In this model, average duration of stay for all subjects was 10 minutes. Subjects' average duration of stay in primary seating was 13.82 minutes, in backless primary seating was 7.77 minutes, and in secondary seating was 5.70 minutes.

The regression analysis indicates that backless primary and secondary seating were associated with shorter duration times and were statistically significant at a .05 level. Edge-anchored seats had an average duration of 8.67 minutes while non edge-anchored seats had an average duration of 10.52 minutes. Non edge-anchored seating however, was not found to be associated with longer duration at a significant level.

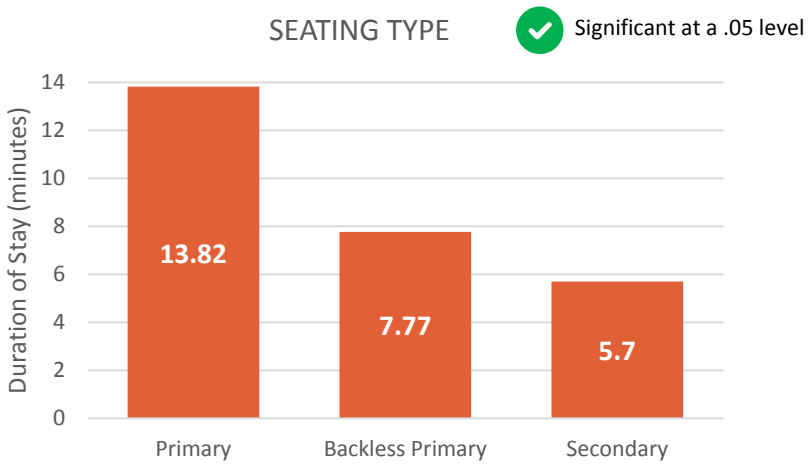


Figure 3.1. Average duration of stay by seating type

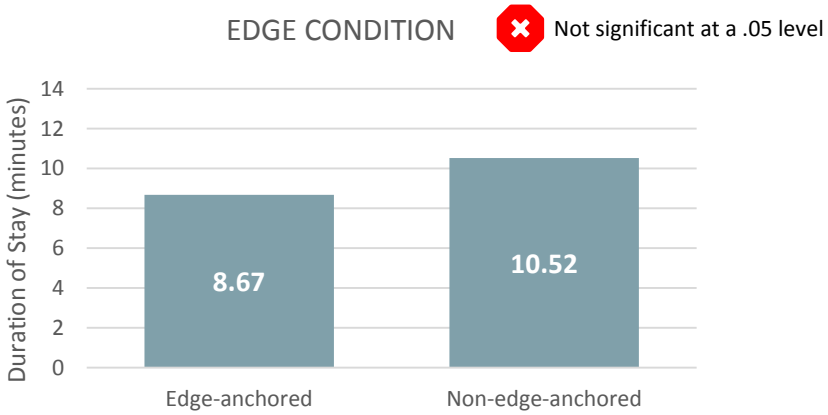


Figure 3.1. Average duration of stay by edge condition (not found to be significant)

Duration of stay for single people was found to be nearly 9.5 minutes shorter as compared to groups of three or more and statistically significant. Pairs were associated with a duration time that was 7.5 minutes less compared to groups; however, this was not found to be significant.

Finally, sun exposure was found to be associated with a duration time that was 10 minutes shorter than overcast and was significant at a .05 level.

In addition to the main effects of the two principal environmental variables, type of seating and edge condition, we also examined the interaction between these two variables on duration of stay. The interaction analysis did not provide any evidence that the combination of seating type and edge condition impact duration of stay.

Robustness check:

A robustness check did not indicate a difference on variables of interest based on day of week or time of day. The model was run using various iterations of the control variables (for example, single versus non-single, sun versus non-sun) and the results were consistent with the results presented here.

Chapter 4: Discussion

4.1 Discussion

The results of this study support the hypothesis that type of seating impacts duration of stay. Backless primary seating (benches without backs) was found to be associated with a nearly 11 minute shorter duration relative to primary seating (proper furniture with backs and, in some cases, arms). In addition, secondary seating (objects that are not necessarily intended to be seating such as steps or planters) was associated with a nearly 15 minute shorter duration relative to primary seating. Moreover each of these associations remain significant when controlling for the other, indicating that each of these environmental factors has an independent relationship with seating duration.

While the nearly three minute difference in duration of stay based on edge condition was not found to be statistically significant (see Table 3), this may have been due to the limited number of edge-anchored seats available to subjects. The typical design of pedestrian streets is such that the majority of the space's edge is occupied by retail storefronts. Because edge-anchored seating would partially obscure retail windows or building entrances, seating was primarily located in the middle of each site. A larger sample size or additional sites may be necessary to study this relationship. More generally, it is worth mentioning that many behavioral studies of design often miss the fact that lack of variance in a particular setting characteristic can lead to underestimation of impacts. For example, the vast majority of studies on residential density or crowding have taken place within the United States. However, it is quite rare to have any households with more than two people per room; a level of density that is well below average in households throughout the third world.

Day of the week was a variable that was measured but had no influence on edge or seating type on seating duration A robustness check did not indicate a difference on variables of interest based on day of week or time of day; significance was not affected when these were included.

The model also showed that single people had a notably shorter duration time relative to groups of three or more.

4.2 Study Limitations

While this study was successful in systematically evaluating existing theories surrounding seating preference in public spaces, it was not without limitations. While the study partially controlled for variables that might affect pedestrian behaviors, for instance, vehicular access, these "controls" are not as literal as a study performed within a lab, thus are subject to the possibility of confounding variables covarying with either seating type or edge. In addition, observations were conducted on a small scale in terms of number of subjects and locations, and with uncontrolled biases in relation to age, gender, social class, or ethnicity indicate that the study may lack a representative sample. An R squared value of .24 indicates the likelihood that the model is not capturing the full extent of the relationships being studied. As a result, these findings may lack the ability to be generalized to a wider society.

Because previous research on seating preference has depended almost entirely on qualitative data gathered via observation and interview. This study was designed to more rigorously evaluate environmental characteristics and seating duration in a more objective manner. While this approach provided an effective way to test existing principles without the risk of subject reactivity, additional insight may have been lost and conclusions incorrectly drawn. As with any naturalistic observation, it is likely that additional undetected variables were at play unbeknownst to observers and may have

affected the outcome of the study. These could include preference for a particular view, posture, or adjacency, among countless other possibilities.

4.3 Opportunities for Further Research

This model may be used as a starting point for further testing of principles surrounding use of public space. At a basic level, future researchers may observe subjects at any location which fits the criteria outlined in the discussion of this study's methodology. Variables may be added or eliminated based on specific research questions. Researchers may choose to use the existing design of the study to observe a larger subject pool, increasing the representativeness of the study outcome and enabling investigation of personal variables such as culture or age that may impact outcomes. For instance, observation of a younger demographic may produce a different outcome than an older one due in part to their ability to perch on stoops or steps for long periods of time without experiencing physical discomfort. In addition, cultural or environmental factors may dictate what type and duration of seated activity is appropriate or comfortable.

The study did not definitively address the choice of seating; only the duration once a seat had been chosen. Further research might enhance this model by measuring initial seating choice based on options available, providing researchers an opportunity to validate the informal observations surrounding seating choice and preference. The results of such a study would help to uncover what type of seating, if any, encourages a person to sit down, a critical first step in attracting and retaining visitors in public spaces.

Future research might consider the use of interview or other qualitative data gathering techniques to help researchers uncover additional relevant variables. These variables and their relationships can later

be measured and confirmed via quantitative data collection and analysis. The combination of these two types of data gathering would produce results that are validated at the intersection of qualitative and quantitative research. As a result, a more comprehensive picture may be revealed.

Chapter 5: Conclusion

When planning environments with the goal of encouraging staying behavior, provision of places to sit is perhaps the most important parameter for the liveliness of a public space (Whyte, 1980). Gehl (1987, 2010) breaks down seating into two major categories according to their comfort, calling them primary and secondary. Primary seating consists of proper furniture with backs and arms, typically benches and chairs. Secondary seating consists of objects or ledges that are not necessarily meant for sitting, but are places where people might informally or spontaneously sit to rest or observe their surroundings. Gehl positing that a backless bench is no better than a step or a planter. He describes the joining of all three to create the "sitting landscapes" visible in successful public spaces. He writes that there is no reason for people to stay in a space unless there is somewhere to sit. The results of this study support this theory; duration of stay increased with better seating quality.

Similarly, researchers have observed particular behavioral patterns and types of interaction along the edges of a space. These observations consistently show that when edges "fail," a space will never be lively (Alexander, 1977). Research posits that people tend to stick close to edges whenever possible and in a vast variety of settings. Although there was a marked difference in duration of stay in relation to edge condition, this theory was not supported at a significant level. However, this may have been a result of the study's limitations.

Each of the theories discussed above have merit and, to varying degrees, have influenced guidelines surrounding good urban design. It is important to continue to produce empirical evidence to test these claims. Through validation of these theories and development of ideas for future research, we may more fully understand human preference surrounding regarding seating type and location.

Gehl (2010) writes that staying activities can often be used not only as a measuring stick for the quality of a space, but for the quality of the city that encompasses it. By methodically studying the relationship between urban environments and human behavior, city planners, urban designers, and environmental psychologists may continue to sharpen our understanding of how to create public space that enhances public life. Through a greater understanding of these concepts, we may further inform the design of livelier spaces and, in turn, livelier cities.

Appendix A: Research Instrument

1. Location Manhattan Beach (1) 3rd St Promenade (2) *SID* _____

2. Day of week M (1) T (2) W (3) Th (4) F (5) Sa (6) Su (7)

3. Time of day _____ am pm (use 24hr, round to 15)

4a. Group Dynamic single (1) pair (2) group (3)

4b *gender* F (1) M (2) MF (3) MM (4) FF (5) MFM (6) MFF (7)

5. Duration of stay Stopwatch time sit down _____

Stopwatch time stand up _____

Duration *(calculate)* _____

6. Seating type *(predetermined)* 1f 1e 1 2
2f 2e 3 4
3f 3e 5 6

7. Sun exposure sun (1) shade (2) mixed (3) overcast (3)

8. Activity

Choose activity based on hierarchy shown here.

Eating/drinking (1)
Conversing (2)
Individual activity WITH technology (3)
Individual activity WITHOUT technology (4)

9. Temperature _____

Additional notes on reverse? Y / N

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