THE WINTER LIFE OF SMALL URBAN SPACES

IN NEW YORK CITY

by

SHAOGANG LI

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1997 APRIL 29th	David Chapin
Date	Chair of Examining Committee
4-29-97	Kay Deaux
Date	Executive Officer

David Chapin

Lee Rivlin

Gary Winkel

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

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Advisor: Professor David Chapin

The purpose of this study is to get an in-depth understanding of how people use outdoor urban spaces in winter, how their behaviors change with the variation of climatic conditions, and what factors are significant in predicting the "use density" of an urban space in different seasonal periods.

This study has employed a multi-method approach which combines qualitative field observations and quantitative analyses. Six midtown Manhattan urban spaces were chosen as the settings for either continuous or instant observations. Behavior mapping, field notes, photographing and users' interview were used as the methods of data collection. Thirty-two midtown and downtown urban spaces were taken as the settings for users' counts. The number of people sitting, standing and passing were recorded. The counts were conducted three times a day during lunch hours for 15 days at each space. Both the observations and the counts were conducted from mid-October through winter till the end of next March. The results of the qualitative and quantitative analyses revealed the following:

The temperature around 40° F represents a special seasonal period (the sub-marginal period) independent of both winter and the marginal seasons in influencing users' behaviors

and their perception of and attitudes to the climatic environment.

Climatic variables played very different roles in predicting the "use density" of an urban space in different seasonal periods. They were not significant in winter but very significant in marginal seasons and somewhat in between in sub-marginal periods.

Passing within an urban space and the necessary activities which generate passing are the most significant elements in predicting "use density" and the "holding power"of the space, especially in winter.

In all, ideal micro-climatic conditions are not the reasons for people to come to and stay in an urban space in winter. Their actual role is to make the thermal environment less stressful for those already in the space. It was activities, necessary or optional, programmed or spontaneous, that attracted people to stay in winter.

To my beloved wife Li Zhou.

Without her understanding, support and help

I would have never finished this dissertation

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CHAPTER I

INTRODUCTION

A harmonious relationship with the natural environment is essential to human existence. Climate, as a basic element of the natural environment, is one of the significant modifiers of the built environment. The more extreme the climate is, the more necessary it becomes for built forms to respond to it. Throughout history, the common characteristic that can be seen in vernacular architecture of different cultures is that, to a great extent, it corresponds to the local climate.

In the industrial age, particularly after World War II, the rapid economic and industrial growth enabled people to build artificial environments totally independent of external climatic conditions. The result is that the correspondence between climate and the built environment began to be ignored from two aspects. First, urban vocabularies and grammar which originated in southern climates (especially the Mediterranean area) were imported into northern climates (e.g. axial vistas, public squares, open spaces, treed allees, and broad boulevards, etc.), without being recognized for their inappropriateness for the northern settlements which must endure harsh and lengthy winters (Pressman & Epic, 1986). Second, the growth in numbers of totally sealed, air conditioned, and artificially lighted buildings mushroomed all over the world, especially during the 1950s and 1960s, as a result of industrialization coupled with the modern architectural movement.

The development and combination of two intellectual movements --- the human rights movement and the environmental movement at the end of 1960s and the beginning of 1970s increased people's awareness of the value, dignity, and health of human beings, and of the deterioration of human environments. People began to recognize that humans are the most important elements in the world, that only fair treatment to all people can lead to political and social stability, and that the destruction of human environments along with the development of technology and unregulated mass industrial production can no longer continue. The negative effects of long hours' of living and working in sealed, artificial environments have also caused more and more concern. The energy crisis of 1973 ended the age of almost unlimited cheap energy. People began to explore energy conservation, energy alternatives, and renewable energy sources. In North America, the winter city movement in the late 1970s emerged exactly against such a historical background, although its pioneering activities can be traced back to the early 1950s, when Ralph Erskine, a British-born Swedish architect, took into account the cold climate, ice and snow, and the lengthy winter night, etc. in his design projects. The establishment of the Canada-based "Livable Winter Cities Association" in 1984 is a milestone. The consequent Winter Cities Forums have aroused global interest and concern focused on issues, ideas, and practices in northern settlements with the aim of making them more livable year round, particularly during the winter. Now, winter cities environment and development studies have become a very active multi-disciplinary domain and the results of these studies have begun to be reflected in urban policy statements and design concepts.

What is a winter city? Actually, there is no universal definition. Rogers (1980, p. 21) defines it as "a place where the average January temperature is 32° F (0° C) or colder". Winter Cities Forum agreed with this but added: "generally located above 45 degree north latitude" (Smith, 1986; p. ii). Pressman (1988b, p. 21) changed " average January temperature " into "average maximum daytime temperature" and also added: "for a period of approximately two months or longer". Obviously, his definition is the most comprehensive. Based on Rogers' definition, New York City can be regarded as a winter city (with an average January temperature of 30.5°F), but according to the definition of Pressman or Winter Cities Forum, it cannot. In my research, I define New York City as a "city with a mild winter". It represents a group of cities with similar winter climatic conditions. In fact, even a mild winter brings urban residents harsh living conditions: greatly decreased mobility of both pedestrians and vehicles caused by ice and snow and a corresponding high rate of traffic accidents; depression and behavioral change for some people caused by the reduction of sunlight density and duration; reduction of socially oriented activities because of low temperature and less mobility, etc. (Persinger, 1988; Terman, 1988)

> Despite all these inconveniences to human well-being and the concomitant social risks, architects, planners, and policy analysts still insist on orienting their design and development policies toward the brief summer season, especially with regard to public outdoor spaces and parks (Pressman, 1987, p. 60).

There is much literature on different aspects of small urban spaces. However, the literature related to the public life of outdoor urban spaces in winter is very rare. The purpose of my research is to explore, in depth, the users' behavior patterns in outdoor urban spaces in winter and how they change with climatic conditions, and the relationship between these behavior patterns and the physical characteristics of outdoor urban spaces, in order to draw implications for the planning, design, and management of small urban spaces to encourage winter public life in these spaces, and consequently, to improve the quality of life in winter cities.

A. Human Responses to Winter Conditions

In order to create a better fit between human requirements and the corresponding built environment and to optimize human well-being in winter, it is essential to understand people's physiological, psychological and social responses to cold climatic conditions.

1. Physiological Responses

Humans have a thermoregulatory system that is capable of adapting to cold climate conditions by increasing the rate of heat production (calorigenesis) and by reducing the rate of heat loss (Pressman, 1990/91; Sohar, 1982). Though the exposure to moderate cold is not sufficiently long in duration to enhance calorigenesis (Leblanc, 1975), even a slight increase of heat production can suppress the immune system, and this will result in a greater incidence of colds, flu and viral infections during winter (Persinger, 1988).

Humans exhibit two other important physiological responses to cold climate. Firstly, habituation allows people to withstand cold for a short period by limiting discomfort sensations such as shivering. People habituate themselves to cold through repeated exposure. For example, fishermen in cold climates can immerse their hands in near freezing water with minimal pain due to habituation (Leblanc, 1975; Pressman, 1990/91). Secondly, acclimatization allows individuals to find a better balance in their thermoregulatory system over a period of days or weeks in response to changes in environmental factors (Folk, 1981; Pressman 1990/91). Pressman holds that adaptation is not a significant physiological response while habituation and acclimatization are (Pressman, 1990/91).

The danger of hypothermia is greatly increased in winter due to pervasive low temperatures. The newborn, because of their imperfect thermoregulatory system, and the elderly, because of their higher skin conductance and lower resting temperatures, are especially at risk (Pressman, 1990/91; Robertshaw, 1982). If an individual's body temperature has fallen to about ninety-four degrees, he speaks as if drunk:

> ... then he starts falling and losing visual acuity ---certainly he is no longer capable of functioning well. By ninety-two degrees, he pays no attention to where he's going or what he's doing. For some reason, he suddenly begins shedding his clothes, ... perhaps the person experiences a sensation of flush in the groin --- the body's last effort to develop heat (Mills, cited in Gallagher, 1993, p. 66).

Sun and wind are regarded as two important weather factors which have significant effects on human physiology. Research on the evaluation of the comfort of people working outdoors in Antarctica has shown that skin temperature is lower on overcast days than on sunny days with the same ambient air temperature. As the windchill increases, the comfort rating drops (Budd, 1974). Therefore, it appears that outdoor human comfort is maximized in cold climate conditions when there is sunlight and low windchill, and low ambient air temperature appears to be generally tolerable as long as the body is well insulated (Pressman, 1990/91).

2. Psychological Responses

The main theoretical interpretation of psychological responses to winter conditions is that winter causes a downward shift in the ratio of positive to negative psychological stimuli. (Persinger, 1988) This happens due to four main factors. First, there is an increase in the duration of the negative stimuli, namely, stressful events related to extremes in cold, snow and wind factors. Second, the reduced variety in color, sound, and smell in nature makes people suffer from perceptual monotony. Third, there is a reduction of readily available recreational facilities for most people, and the consequence of this coerced hypoactivity leads to a lowered mood and general depression. Fourth, the repeated presentation of the same aversive stimuli contribute to anxiety. People have an overwhelming urge to escape from their involuntary confinement (Persinger, 1988; Pressman, 1990/91).

a. Seasonal Affective Disorder (SAD)

SAD is a psychological condition that is directly related to winter climate conditions. Sufferers of SAD experience depression and other symptoms, such as poor sleep, fatigue, melancholy and weight gain, etc. SAD is caused by changes in photo-periodicity (the day-night cycle) in winter as the duration and density of sunlight is reduced in high latitude (Wurman & Wurman, 1989). Terman's study (1988) shows that, in the New York City area, nearly half of the population undergoes some kind of negative behavior change related to winter climate. Phototherapy is the major treatment for SAD patients. Pressman (1990/91) suggests that enough outdoor activities and adequate natural lighting for indoor working and living environment are essential for ordinary people to avoid SAD.

b. Winter environmental stress and coping strategies

Cold climate, as an ambient stressor, shares certain characteristics with other ambient stressors: chronic, negative, intractable, non-urgent and perceptible (Campbell, 1983). However, it does have its positive aspects: the beauty of the landscape after a snowfall, the enjoyment of winter sports, and the economic benefits brought about by winter carnivals, etc.. It is these positive aspects that make a cold climate different from other ambient stressors such as air pollution, noise, and traffic congestion.

In coping with environmental stress, two major types of strategies have been identified: problem-focused coping and emotion-focused coping. The former involves dealing directly with the source of stress to reduce its aversive impacts whereas the latter alters the individual's response or emotional reaction to the negative situation (Evans & Cohen, 1987; Lazarus, cited in Holahan, 1982). Correspondingly, two fundamental approaches have evolved in northern cities to cope with the cold climate. One is to offer maximum protection by means of advanced technology to create artificial environments which are free from the undesired weather, such as the "indoor cities", "underground cities", and "skyway cities" in North America. The other is to try to not overprotect people from nature by having cities highly integrated with the natural environment and letting people experience the seasonal changes (Gehl, 1990; Gutheim, 1979; Pressman, 1987, 1988a). Copenhagen seems to be a model of the second approach. The first approach has been criticized by researchers from various aspects (Boddy, 1992; Culjat & Erskine, 1983; Gutheim, 1979; Hall, cited in Zrudlo, 1972; Pressman & Zepic, 1986, Pressman, 1988a; Whyte, 1988). However, the information that the Copenhagen model conveys seems not very positive either. Instead of encouraging people to enjoy winter, it simply asks people to "endure the winter in order to have a really enjoyable summer" (Gehl, 1990, p. 28). According to some researchers, there should be a third solution: an optimum balance between protection against the worst parts of the cold climate and exposure to the beneficial aspects of it (Culjat & Erskine, 1983; Gehl, 1990; Pressman & Zepic, 1986). However, in reality, it is difficult to find examples to illustrate how this could be done at a city scale (Gehl, 1990; Pressman & Epic, 1986).

c. Personal control

At the individual level, Lynch (1981) suggests that the "fit" between a person and an environment is enhanced by a person's ability to directly control or modify the environment. Francis (1989) also holds that users' control is an important dimension of the quality of public spaces. Personal control has been found to be an important mediating variable which reduces the negative psychological effects of environmental stress (Evans & Cohen, 1984). Personal control over environmental stressors can be divided into three types: "behavioral control"---the availability of a response that can directly modify a threatening event; "cognitive control" --- the way an individual interprets a threatening situation; and "decisional control" --- the range of choices available to an individual (Averill, cited in Holahan, 1982). The "officious displays" Nash (1981, 1983) describes refer to the exaggerated gestures in communicating official messages about what the person is doing and feeling outdoors on bitterly cold days. These "officious displays" reflect people's anxiety caused by the cold and the long time waiting for a bus (craning to look for the bus every few minutes, pacing up and down) and also their efforts to keep themselves warm (jumping up and down, blowing on their mittens or gloves). All these are actually the expressions of "behavioral control" mechanism over the stress of cold. The "festive attitude" and the "disdain of bitter cold" (Nash, 1981, 1983) can be classified as examples of "cognitive control". Pressman (1988b, 24) argues that "one should have a choice of being outdoors or withdrawing into warm protected recesses either inside buildings themselves or in 'urban pockets' which trap the sun". This can be considered a strategy of providing people with the opportunity of "decisional control" in coping with the stress of cold climate.

d. Environmental attitudes toward winter

"Environmental attitudes are people's favorable or unfavorable feelings toward some features of the physical environment or toward an issue that pertains to the physical environment" (Holahan, 1982). As to winter climate, some people actively challenge and enjoy it; some passively endure it, waiting for the arrival of spring, and some even temporarily escape from it by going south for sunlight. Attitudes are learned and changed over time, and direct personal experience is the most fundamental factor in attitude formation (Oskamp, 1991). To encourage laymen to change their attitude toward winter, policy makers, planners and designers, and activity organizers must change their attitudes first. They usually insist on orienting their emphasis toward the brief summer. This kind of attitude disregards the inconveniences to human well-being and the concomitant social risks caused by winter climatic conditions, thus should be changed and replaced by a "year-round" perspective with the emphasis on winter.

3. Social Responses

Winter has a profound impact on people's social relationships and social activities. Based on the few studies that do exist, Pressman (1990/91) emphasizes that social activities are very different in winter than in summer, and that social activities in winter can be improved through a variety of planning and design strategies.

a. Closeness and togetherness---physical & social distance in people

The feeling of closeness to other people is an important psychological factor in cold weather. When it is too warm, one wants others to keep a distance so that one can stay cool. This has been supported by animal studies: "as it grew colder, a whole bunch of piglets got closer and closer until they ended up in a little pile in the middle. When it got warmer, they dispersed more and more until they were separated from each other to the maximum degree allowed by the stall" (Wehr, cited in Gallagher, 1993, 65). Although the actual social behavior is quite different, a similar kind of phenomenon has also been observed in humans: a group of people waiting for a bus on an exposed sidewalk bunched together seeking protection behind each other's bodies in cold wind and driving snow. It seems that the cold wind changed the response to the spatial pattern with respect to other persons (Culjat & Erskine, 1983). Winter also makes people more sociable when they need to keep warm. In pre-industrialized Alaska, doors were never locked because somebody might want to come in and warm up when the host was gone. Even today, in cold winter when a car has a mechanical breakdown, or a family gets into trouble, everybody will help. "Against the severe climate, human cooperation becomes a spontaneous imperative" (Gutheim, 1979, p. 113).

b. A democratizing context

Winter is a democratizing context. "social status means nothing if your car won't start, no matter if it is a BMW or a Jaguar" (Feldman, cited in Gallagher, 1993, 8). In cold winter, social norms tend to be suspended, and public space seems to become democratized. Nash's (1983, p. 31) study shows examples such as:

*Allowing bus waiters to stand inside buildings (often blocking doorways) relaxation of enforcement of the "no alcoholic beverages" law in parks
*Late night practices of driving cars in such open spaces as parks, golf courses and school yards
*A tolerance of the flagrant use of cul de sacs and parking lots by couples seeking 'in city' places to park
*Uncharacteristic leniency of the police in their use of crowd control techniques

At the massively attended funeral of a prominent politician, an officer on duty said: "If they choose to be out in this cold, they deserve to get a close look" (Nash, 1983, p. 31).

Overall, Nash suggests that urban public space usage and policies should allow for increased individual freedom in definitions of territoriality.

c. Reduction of social activity

There is a significant reduction in the use of outdoor urban space in winter (Li 1991, 1994; Nash, 1981, 1983) for two reasons: first, it is often difficult to travel because of snow and ice; second, people often feel uncomfortable spending much time outdoors in winter and many will not, unless absolutely necessary (Pressman, 1990/91).

d. Alcoholic consumption

In winter, some segments of the population engage in almost any behavior to counter the aversive experience caused by harsh weather. Alcoholic consumption is a typical avoidance response, especially in northern climates, which creates serious social problems (Persinger, 1988).

e. Homelessness

Homelessness has become a very serious social problem in North American cities including winter cities. For various reasons, many homeless people would rather live on the street and in open spaces, even in bitter cold, than go to government-provided shelters. For several years, the New York City Police Department had to take homeless people into shelters by force in order to protect them from freezing to death on the streets at night. Indoor social spaces are often a major refuge for the homeless and poor in winter. However, many shopping malls and even incentive plazas, adopted the policy of evicting them. According to some writers, the municipality should insist that the presence of these people be tolerated based on minimum standards of behavior (Pressman, 1990/91; RUDAT, 1986; Whyte, 1980,1988).

People's social responses to cold climatic conditions tell us that the uses of urban public spaces change with the seasons and have a multiple set of definitions depending on the season and specific weather conditions. So, " planners and designers would better serve the year-round needs of the public by creating adaptive public urban spaces that can respond to seasonal change in both social activity and behavioral response" (Pressman, 1990/91, p. 769).

4. Winter and Culture

There is no doubt that climate, as one of the most basic parts of human's everyday life environment, has a significant influence on human behavior and culture (including the built forms). Under some very harsh climatic conditions, climate may function as a significant modifier, but hardly a determinant.

a. Climate, behavior, and culture

The relationship among environment (including climate), behavior and culture is a very complicated one.

Environmental or climatic determinists hold that the physical environment determines behavior and is the sole cause of cultural change. Not only different cultural patterns, but also personal and racial traits, people's energy and health, and even the development of "high civilization" are all related to the specific characteristics of the natural environment including climate (Huntington, 1951; Markham, 1947 cited in Culjat, 1975).

On the other hand, cultural determinists argue that:

> the environment never determines behavior, and has rarely had a significant effect on physiology and heredity. Mostly, it is culture that comes to intervene ... Different groups living in similar environments may have very different behavior, because the effects of their environments are filtered through their culture (Feldman, cited in Gallagher, 1993, p. 46).

The difference between Anglo-Canadian and French-Canadian cultures regarding winter seems to be a good example of this. Generally, Anglo-Canadian culture tends to deny the existence of winter, fights it whenever possible or, escapes from it, whereas French-Canadian culture is less reluctant to deny the "winter fact", but rather accepts it as an integral part of the cultural framework even though "Mother France" is located in a more temperate climate (Pressman, 1988c).

Cultural ecologists consider the culture-environment relationship as a dynamic process: the formation of cultural patterns is the result of coping with certain environmental situations. Culture can change the physical environment and the new setting in turn influences the culture. This is a process of ongoing cultural-ecological adaptation. The role of the environment in forming culture is seen as always significant, sometimes formative, but never narrowly a determining factor (Hammond, 1971). The cultural ecologist perspective can reflect the complicated relationship among environment (climate), behavior and culture more comprehensively. Now it is generally accepted that environments, including climatic conditions, may not determine behavior or culture but can significantly affect people's behavior, the structure of personality and even the characteristics of culture. Cultural changes depend on a multitude of interrelated factors. Climate, as a basic element of the physical environment, can be regarded as one of the modifiers (Culjat, 1975; Gallagher, 1993; Pressman, 1988b, 1989b, 1993).

b. Climate, built forms and culture

Rapoport (1970) examines vernacular building types and thus establishes that house form is a result of a whole range of cultural-social factors in the broadest meaning of these terms. Climate modifies cultural patterns and, as a result, generates the need for shelter (Rapoport, 1970). Pressman (1993) recognizes that the way of life, beliefs, identity and all other cultural-social factors together may be more powerful than climatic ones in the creation of the built environment. However, he argues that climate can act either as a determining or a modifying element in architectural design and town development, depending on the harshness of climate conditions (Pressman, 1988a).

The issue we are facing is that climatic factors have been ignored for too long and as a result, there has been a destruction both of cultural traditions and regionalism in design (Pressman, 1993). What we need now is a climate-sensitive perspective to provide meaningful developments which are not only functionally but also emotionally satisfying. This is the task that confronts planners, designers and policy makers of winter cities.

c. The perception of winter

Winter reminds people of cold, ice and snow, and the metaphor of death, whereas spring means warm, melting, awakening and rebirth. Recently, a TV soap opera entitled "Get Out of Winter" was shown in China. It is about the economic reform in a northern Chinese city which undergoes the most difficult stage (Metaphor--winter) and creates a hopeful situation (Metaphor--spring). The theme song is as follows:

The winter sky is foggy
The winter ground is freezingly still
The winter trees are naked
The winter sun is suffocated

The winter night is pitch-dark
The winter wind is bitterly cold
The winter birds don't want to fly out of nests
The winter green dream is buried into the frozen earth
Get out of winter
Get out of winter
Get out of the invisible enclosure of cold
To pick up the first rays of the spring morning sun (Shanxi TV Station, China, 1993)

Similar metaphors can be easily found in any northern culture, even in the songs of Eskimos (Pressman, 1988c).

The unpleasant events portrayed by the media give winter a negative image. In 1993/1994, New Yorkers experienced a terrible winter. There were 16 winter storms one after another adding to a total of more than 50 inches of snow. The media, especially television news, did "add fuel to the flames." Reports about winter storms were consistently negative: highways closed, cars breaking down and colliding, and power interrupted, etc. People interviewed by TV reporters generally responded that they were fed-up and wanted to go out of town to Florida or Hawaii. Such a negative portrayal by the media toward winter must influence residents a great deal.

However, winter does have its positive aspects. One of the greatest joys of living in the North is seasonal change. This provides a psychologically significant experience of nature, life, experiential meaning, and helps people develop fresh insight (Culjat, 1975; Gehl, 1990; Pressman, 1988c). A.Y. Jackson, one of the Celebrated "Group of seven" landscape artists, proudly spoke out with respect to the northern landscape:

> In summer it was green, raw greens all in a tangle; in autumn it flamed with red and gold; in winter it was wrapped in a blanket of dazzling snow; and in springtime it roared with running waters and surged with new life; and our artists were advised to go to Europe and paint smelly canals (Jackson, cited in Pressman, 1988c, p. 6).

Even the cold part of the year has its positive elements:

> Snow and ice, especially in combination with sun, are great activity generators, and the beauty of a winter landscape is different but certainly in no way inferior to that of other seasons (Culjat, 1975, p. 69).

In every northern culture, it is not difficult to find paintings, poetry and other artistic work describing and lauding the beauty of winter landscapes and people's positive response to it:

> Thou wonderful medley of frost and of fire
> How fair to view thou and wondrously dire
> Thy flames grant us vigour, thy frosts strength afford us
> (Thorarensen, cited in Pressman, 1988c, p.9)

All these suggest that the negative perception of winter can be changed, if our attitudes are shifted away from a negative one toward a positive one. A healthier balance between technology, nature and culture should be developed in order to ensure that urban culture evolves in a direction whereby human physiological and psychological well-being is optimized (Pressman, 1988c, 1990/91).

B. Public life and small urban spaces

Historically, urban public spaces made significant contributions to the life of urban dwellers. However, their significance and their role in making public life have long been ignored since the automobile age.

> It is only recently, when cities all over the world were threatened by the loss of the public realm, that the subject has been rediscovered by scholars, political leaders and professionals in Europe and North America (Lennard & Lennard, 1995, p. 83).

Public life has been changing and so have been its settings--- public spaces. However, small urban spaces still play a significant role with respect to the shaping of urban public life, and of the appearance and identity of the city or the neighborhood.

1. Public life

Public life refers to all kinds of activities happening in public space in the presence of other human beings (Gehl, 1987; Lennard & Lennard, 1984). It is a forum, a group action, a school for social learning, and it is where strangers meet on common ground (Brill, 1989a). It is a kind of regular, voluntary, informal and spontaneous gathering beyond the realm of home and work place (Bach & Pressman, 1992).

a. The need for public life

City dwellers seem to have a desire, a basic need for diversity, sociability and community made possible in public (Lennard & Lennard, 1984, 1995). Since people socialize in the privacy of their homes more and more, there is a yearning among them for public life, even if it is just a brief downtown lunch hour (Cooper Marcus & Francis, 1990). Lindheim (1985) argues that those who are out of connection and lack meaningful social contact with others are most susceptible to sickness resulting from multiple stress conditions. Carr, Francis, Rivlin, and Stone (1992) hold that a healthy life contains a balance of private and public experiences and that people need to engage in each domain. So, public life in public space is considered to be desirable for people and good for society.

b. The function of public life

Being in public spaces with others, to see, to hear, and to receive impulses from others can be either a passive or an active experience. The difference between active experience and the experience of being a passive observer of other people's experience on TV, video, or the movies, is that in public space, the individual self is present, most definitely participating (Gehl, 1987).

The basic function of public life in public space is to bring people together. While this is sometimes a generator of stress, it also offers opportunities to be with others in a relaxed and undemanding way, to get relief from urban stresses, and to set the stage for diverse activities and social contacts in the urban environment (Bach & Pressman, 1992; Carr, et al., 1992; Gehl, 1987; Lennard & Lennard, 1987). During this process, people exchange information, learn from each other through observation, conversation, and participation, etc. (Carr, et al., 1992; Gehl, 1987; Lennard & Lennard, 1987). Public life also performs important social-integrative functions in the course of daily life that can bind people together. Through daily coming and going in public life, the experience of knowing others and being known by others can establish continuity, a sense of maintaining already established contacts, and confirm community membership (Carr. et al., 1992; Gehl, 1987; Lennard & Lennard, 1987). In public life, people can also choose to experience another group's culture, customs, and ways of thinking, which facilitates cultural understanding, cross-cultural communication and cultural integration (e.g. the Asian Day, or the St. Patrick Day Celebration in New York City). Outdoor public life has a particular significance to winter city dwellers, since frequent contact with daylight can reduce winter depression (Pressman, 1990/91).

c. Forces shaping public life

There are many factors which influence the public-private balance and shape public life. Culture, technology, the physical structure of places, the nature of the community, its size and heterogeneity, the social, political and economical system, the economics of the public-private balance, and natural features all affect public life to some degree either positively or negatively.

Climate and topology as well can act as significant constraints on both the existence of our outdoor public life and the nature of the settings that develop.

> Public life is generally more pronounced in warm areas, ... however, there are public places in Canadian cities that are more heavily used in winter than some California public spaces in summer. Climate thus enters as a part of the story, but does not offer a full explanation. The existence of successful public places is also dependent on social and political milieus supportive of an active public life (Carr, et al., 1992, p. 26).

d. Resurgence or decline of public life

Lofland (1973), Melville (1955), and Sennett (1979) hold that there has been a substantial decline and loss of public life and the balance in our society is shifting strongly toward the security and pleasures of private life. However, others argue that the decline and loss of public life has been greatly exaggerated (Lennard & Lennard, 1984), and life in public spaces has increased remarkably (Bach & Pressman, 1992; Cooper Marcus & Francis, 1990 Gehl, 1987; Lennard & Lennard, 1984, 1995; Whyte, 1980, 1988). Brill (1989) points out that, rather than a decline, there is a transformation of public life both in the United States and Europe into new forms of association and communication that do not depend on primary relationships in traditional public spaces. This transformation, he argues, has taken three hundred years and will continue into the future. Carr et al. (1992) argue that the seemingly contradictory trends, the decline of older forms of public life and the resurgence of public space, may be complementary.

The diversification of public space types and their corresponding public life forms and settings have positive and negative influence on public life. There is also evidence showing that with the redevelopment of older traditional urban spaces, there is an observed increase in those using downtown urban spaces, such as the renovated Bryant Park in New York City.

e. Commercial activities and public life

Carr et al. (1992) point out that, since World War II, successful new public spaces have often had commercial purposes. Now there is a nationwide movement to provide good-quality, low-cost produce in towns and cities. One of the recent developments is that all across the country, farmers' markets are returning, springing up in city parks, plazas, pedestrian malls, parking lots, barricaded streets, county fair grounds and courthouse squares (Sommer, 1989). Farmers' markets attract many shoppers who might otherwise not travel to the central cities. As a result, there is a reported sales increase by the nearby merchants and the improvement of the infrastructures in the immediate area by government (Tyburczy & Sommer, 1983).

Flea markets are another uses of public space with commercial functions which combine affordable merchandise and a carnival spirit to draw crowds (Carr et al., 1992). It has also become more and more popular in the United States.

A recent development is the so-called festival marketplace, a kind of in-town shopping centre with an emphasis on boutiques, food and entertainment, such as South Street Seaport in New York City and Harbor Place in Baltimore, which support a new form of public life that has been identified as recreational shopping (Carr et al., 1992). These commercial clients are replacing government agencies in sponsoring these, from some people's point of view, highly successful spaces (Cooper Marcus & Francis, 1990).

Since more and more people are coming to cities, spending more and more time and money there, and enjoying each other in the process, shopping has become one of the important developments leading to a livelier and richer urban public life (Gehl, 1990), helping to revitalize downtown. Buying and selling goods are basic human activities which are not dependent upon climatic conditions, although extremely bad weather influences shopping negatively. It belongs to the category of necessary activities. For winter urban spaces, one of the most effective methods to attract more potential users to come and stay is to introduce commercial activities into these spaces.

2. Small urban spaces

In this research, "small urban space" refers mainly to outdoor plazas (e.g. Seagram Plaza, General Motors Plaza), mini parks (e.g. Paley Park), and small squares (e.g. Herald Square), etc., as described in the work of William Whyte (1980).

a. Incentive zoning and contemporary plazas

In the past few decades, many urban plazas in the United States have been built as a result of "incentive zoning" which is a part of large effort to improve the physical environment of deteriorating central-cities in hope of keeping people in or attracting them to the downtown. In 1961, New York City enacted a zoning resolution that gave developers an additional floor area bonus for providing plazas at the street level. Cities across the nation adopted similar plaza legislation and thus plazas have become a familiar urban feature

(Barnett, 1974; Halpern, 1978; Whyte, 1980). However, most of these plazas have not served as the good public spaces as they were supposed to be . Whyte argues that if a developer is benefiting from the provision of a plaza, it ought to be a place in which people will want to spend time. He has done much to sensitize designers to users' needs and desires. His work also led to the amendment of the New York City Zoning Resolution in 1975. The amendment requires that plazas be accessible to the public, and lays down specific guidelines for ensuring that they will.

b. Low use of plazas

Use, or popularity, is a dimension often employed to measure the success of an open space. Whyte (1980) argues that the use of an open space is a critical ingredient of success. Many of the plazas that exist today are used very little. People try to explain this phenomenon from different perspectives. Linday (1978) and Whyte (1980) demonstrate that low use is attributed to the lack of adequate seating. Chidister (1986a) holds that the relationship between seating and plaza use is moderate and does not imply causality. He argues that the location of a plaza and its urban context play a very important role. Joardar (1977) emphasizes the importance of physical characteristics in a plaza's success and suggests that the lack of visual diversity contributes to low use. Jenson (1979) argues that the problem of low use is cultural, technological, and endemic, anchored in the way we live and not amendable to an easy solution. We can see that the factors which influence people's use of plazas are very complicated, and low use cannot be accounted for by any single factor.

c. Needs in small urban spaces

Human needs have long been neglected in public space design and management.

Many public spaces are the result of the will of designers, their clients, and space managers, and do not address people's needs or the ways that public space can function to serve these needs. Carr et al. (1992) classified five categories of needs in public space: comfort, relaxation, passive and active engagement with the environment, and discovery. They argue that places that do not meet people's needs will be under-used and thus unsuccessful.

Comfort is a basic need including physical, social and psychological comfort. Physical comfort involves the thermal comfort (micro-climate conditions) of urban spaces such as sun exposure and relief, wind prevention (Bosselmann, 1983; Pihlak, 1983; Matus, 1988), etc. Seating is considered to contribute to physical, social, and psychological comfort. The available seating space, its layout, the movability and the material used for seating represent an important aspect of a successful urban space (Linday, 1978; Whyte, 1980). The scale of a space (Ashihara, 1983; Gehl, 1987), the closeness and openness, the dependability of a space (Alexander, et al 1977; Hu, 1982; Li, 1984) all contribute to the psychological comfort of urban spaces.

A sense of security is a major aspect of the social and psychological comfort of a space (Carr et al., 1992). Whyte (1980) points out that if a plaza has a remarkably lower than average proportion of women, something must be wrong with the space. Franck & Paxson (1989) have documented that attention to features that reduce threats to safety is likely to increase comfort in public spaces.

People also need to relax. Carr et al. (1992) hold that relaxation is a more developed state with body and mind at ease, and a sense of psychological comfort may be a prerequisite for relaxation. Natural elements, such as trees, lawns, and especially water, contribute a great deal in offering retreat and relaxation (Nager & Wentworth, 1976; Burden, 1977). Not all spaces should be designed and managed to provide relaxation. Some spaces should provide opportunities for liveliness, and passive or active engagement with the city and its people (Carr et al, 1992), for some people to seek physical and social challenges, such as watching others, interacting with others, shopping, participating in street life, vigorous encounters, etc. Opportunities for new experiences, new vistas that excite, educate and delight also need to be provided in some places to support discovery.

Usefulness of a space provides a simple explanation of its success. However, needs alone are not a sufficient reason to explain the vitality of a space. Some other qualities either constrain or facilitate open space experiences.

d. Public control of public space

People's right to control the use and enjoyment of public places is a very important dimension of public space quality. Lynch (1981) proposes five forms of spatial control: presence, use and action, appropriation, modification, and deposition. This suggests that spatial control, or its absence, has strong psychological consequences, contributing to anxiety, satisfaction, and pride. Following Lynch's framework, Francis (1989, p. 158) develops a preliminary definition of it:

> “control is the ability of an individual or group to gain access to, utilize, influence, gain ownership over, and attach meaning to a public place”.

He also holds that the attachment of meaning or users' connections to a place is an important dimension of successful public spaces, and the central focus on use as a measure of satisfaction simply ignores this deep attachment.

However, the control of public spaces has both active and negative effects. For example, claiming ownership of a space can either serve to invite people into a space by communicating a sense of caring and responsibility or to deny other individuals or groups' right to access to and use the space (Carr, et al., 1992; Francis, Cashdan & Paxson, 1984; Francis, 1989). So there should be an open and democratic process in terms of making, managing and changing public places involving the exchange of ideas by individuals and groups with diverse interests.

e. The interiorization of public spaces

The interiorization process of public space is reflected in two aspects: first, as incentive plazas, atria and galleries are replacing open spaces at the street level in new office developments for the purpose of letting the owners get more private control over the use of these spaces (Carr et al. 1992); second, in many North American cities, downtown areas are being interiorized often with government subsidization, and the results are (a). "indoor cities" (e.g. the Eaton Centre in Toronto and the West Edmonton Mall); (b). "skyway cities" (e.g. the skyway systems in Minneapolis and Calgary); and (c). "underground cities" (e.g. the underground concourses in Toronto and Montreal). One of the main justifications for these developments is the avoidance of extremes of climate: escaping the blazing summer sun or the blustery winter wind (Boddy, 1992). In fact, they have solved the climate problem, but at the same time, they have also succeeded in taking away the joys of the good days and simply changed four season cities into one season cities. (Gehl, 1992). Sandrisser (1985) argues that nature is characterized by change, and that this is what stimulates us, and this is a fundamental reason why landscape is so important to human well-being. It is well accepted that in order to maintain normal functioning and development, some stress is needed and a complete lack of stress will lead to degeneration of human beings (Hall, cited in Zrudlo, 1972; Haralson, cited in Culjat, 1975; Saegert, 1976; Seley, 1969). Nash (1987) also points out sharply that depression is less a consequence of winter but more a consequence of staying inside.

As social arenas, the indoor spaces work poorly. People cannot duplicate the nature of the outdoor natural environment, and it is also impossible to duplicate the social interactions generated by outdoor environments. These indoor spaces are not places for people to hang around, to relax, to exchange viewpoints (Boddy, 1992; Culjat & Erskine, 1983; Gehl, 1990).

The indoor spaces have absorbed street public life and the commercial activities into their domains and left the streets to automobiles and poor pedestrians. They supposedly remedy downtown problems. However, the result is the further degradation of the amenity, safety and environmental conditions of the public domain (Boddy, 1992; Brill, 1989; Erskine, 1964; Pressman, 1995; Whyte,1988).

Boddy (1992) also considers the indoor system as an analogue or a surrogate, and the interiorization process as the "suburbanization of downtown." He holds that by eliminating the most fundamental urban activity --- people walking along streets --- the new system is changing the very nature of streets that are the last remaining vestige of urban public life, thus also changing the characteristics of North America cities and having deep influence on political life.

As a supplement to outdoor public space, and as a choice for people living in harsh climatic conditions, indoor public space does have its reasons for existence. However, the large scale downtown interiorization process is far from a correct solution to solve problems of climate and downtown revitalization.

f. The privatization of public spaces

The privatization process of urban public spaces is undergoing noticeable changes from two perspectives. First, private developments located on land formerly city owned is emerging using large scale public subsidies, ranging from single items, such as indoor atria, galleries and "festive market places", to large, more comprehensive developments --- new pedestrian systems which cover whole downtown areas, such as skyways, underground concourses and indoor shopping centres. Although these commercially managed spaces provide a relatively high level of comfort and security, opportunities for passive engagement and discovery, at the same time, they limit users' access to freedom of action, and the right of claim and change (Carr et al. 1992). Second, financially strapped city agencies are turning over the maintenance, renovation, and management of some urban spaces to private agencies, reserving only the ownership and the right of overall supervision. Bryant Park of New York City is an example of this kind of hybrid space. The renovated Bryant Park has attracted a great number of users. However, people still worry that, in the long run, the idea of maximum access to public parks may not be well-served by the city government turning over considerable control to private agencies (Carr et al. 1992). Although some aspects of maintenance and security may be efficiently improved by private control, privatization is not a panacea for the problems of public space management. In order to provide users with the full spectrum of needs and rights, management must be under public control, no matter whether the property is public or private. Those new downtown developments which are under public subsidy are more vulnerable to public influences. The public voice should be heard in their management.

g. Design guidelines

Design guidelines are the transmission of environmental design research information to the language of design process (Chapin & Cooper Marcus, 1993). Schmidts' (1985) study shows that design guidelines are the practising designer's preferred way of using research to inform design.

The open- space-related patterns developed by Alexander et al. (1977) are the most notable pioneering work of design guidelines. Whyte (1980) provides performance criteria and design principles which specify how plazas can be designed or improved so as to facilitate social life and enhance a sense of well-being in public. Lennard and Lennard (1987) put forward physical and social principles of urban space design based on an examination of Europe's most successful urban spaces. In their book, Cooper Marcus and Francis (1990) address the needs of landscape architects for ready access to relevant user-needs research in the design of urban plazas, neighbourhood parks, campus outdoor spaces and outdoor spaces for the elderly, children and hospital patients, etc. Pihlak (1983, 1994) and Hough and Sijpesteijn (1990) give detailed design outlines for outdoor urban spaces in winter cities in terms of orientation, solar access, wind protection materials, and passive solar heating, etc. All these guidelines have documented design principles for urban spaces including the location of plazas and other urban spaces, the size and scale, natural elements, micro-climate control, public art, seating, paving, visual enclosure, territory and sub-space, ledges and walls, rails and steps, etc. They provide practitioners with a foundation for creating more livable outdoor public spaces. However what we should keep in mind is that people-environment relationships are interactive and complex. Apart from their physical qualities, the needs, rights and meanings of urban spaces are also very important aspects influencing the popularity of these places (Carr et al. 1992). Chapin and Cooper Marcus (1993) point out that transmitting EDR information is an extremely subjective process depending a great deal on the person who is doing it and his or her values. They suggest that it is essential for the authors of design guidelines to preface their work with an honest statement of who they are, what they stand for, and what they believe in. Readers can then adjust their use and acceptance of these guidelines accordingly.

C. Major Theoretical Frameworks of Winter Cities and Urban Spaces

The research and practice of northern development and environmental studies have been promoted greatly since the emergence of the Livable Winter Cities Movement in the mid 1980s. Theoretical frameworks and strategic perspectives have been developed in some very important areas, such as winter climate and environment, urban form and structure, land use patterns, and downtown development and urban spaces, etc. However, we still have a long way to go to establish an integrated theoretical system of a uniquely "northern" urbanism.

1. Climate and the built environment

Colgate and Erskine and Pressman all agree that the more extreme the climate, the more necessary it becomes to respond to it. However, Colgate and Erskine (1983) take climate as only one of the many factors which influence built forms and hold that climate should be regarded as a modifier rather than a determinant. Pressman (1985, 1988a, 1993) argues that climate is "a significant modifier" of urban spatial forms, and under certain critical conditions it may even act as a determining force depending on the harshness of the climate. It is apparent that Pressman places greater emphasis on the role climate plays in shaping the form of the built environment.

2. Protection and exposure

A balance between protection from the worst part of the climate and exposure to the active aspects of it is the basic strategy of winter cities that Culjat and Erskine (1983), Pressman and Epic (1986), and Gehl (1990) all look for. They all agree that this can be identified more often at the level of details but it is difficult to find examples to illustrate how this could be done at a city scale.

In terms of the active aspects of climate, what Gehl (1990) refers to are "the seasonal changes" of the northern cities, especially "the good days in good seasons", whereas what Pressman refers to are the active aspects of winter itself: skating, tobogganing, courting, singing, dancing, and strolling and juxtaposed against evergreen trees, white snow and charming, colorful and brightly lit cluster of houses. The rural scene is usually depicted by a sleigh ride through the forest, the gathering of neighbours in front of the church or with a highly artistic image of a farm fence (Pressman & Zepic, 1986).

It seems that Pressman holds a more active and romantic attitude toward winter since he proposes to enjoy and challenge winter, whereas Gehl simply regards winter as a time for enduring the climate and waiting for the "really enjoyable summer" (1990, p. 28).

3. City structure

Gutheim (1979) supports a dense and compact city structure from the social planning point of view for the purpose of encouraging face-to-face contact and round-the-clock urban life especially in public environments. Pressman (1985, 1987) prefers a compact city fabric mainly for the purpose of high energy efficiency and cost saving with respect to urban infrastructure systems. Pressman (1985) also encourages greater mixed land use and even mixed building use for bringing people closer to entertainment, shopping, places of work and recreation. This has also been echoed by Broberg's (1985, p. 10) "local urban mini-cities" concept which integrates the functions of living, working, shopping, studying together to satisfy the need of "belonging to a large comprehensible and safe, but socially and functionally mixed, milieu."

4. About downtown indoor systems

Downtown indoor shopping and recreation centres, skyways, and underground concourses are changing the nature of downtown and urban public life tremendously. Broberg (1985) has even suggested that a "climate-zone-system" be established by enclosing large urban rooms with glazing, including streets and squares, space between houses, around houses and in direct connections to houses, etc. He argues that this semi-indoor, semi-outdoor and frost-free space is usable and comfortable for most of the activities which urban dwellers engage in during the warm time of the year, and this will also open the door to a richer urban culture and to an urban citizen with a broader register of life opportunities.

Gehl (1990) thus strongly opposes comprehensive downtown indoor systems. He criticizes them for being poor social arenas, taking away seasonal changes, especially all the joys of good days. Gehl suggests that one ought not to think about summer or winter in isolation but seek a combination of solutions which will respect the culture of the northern communities. He mentions "the Parisian Sidewalk Cafe" as an example illustrating how a flexible system which respects the city fabric and the seasonal change works: one system, one location but "two overcoats": one for summer, one for winter.

Nash also strongly criticizes indoor systems by pointing to the consequent problem of depression: "Depression is less a consequence of winter and more consequence of doming, malling and staying inside." (Nash, 1987, p. 21) He holds that winter climate conditions can affect social order in significant ways and abstract normal appearance, and they also give rise to opportunities for greater freedom in the use of public spaces (Nash, 1981, 1983). He also advocates increased individual freedom in terms of territoriality in public space design, planning, and policy directed at wintertime utilization (Nash, 1981, 1983).

Colgate and Erskine (1983) argue that to replace all outdoor social spaces with indoor ones is economically and physically impossible as well as socially undesirable. Indoor social spaces can only be a supplement to outdoor spaces with the knowledge that it is impossible to duplicate the forms of social interaction generated by outdoor environments.

Pressman's attitude to indoor systems is somewhat different from all those expressed above. He recognizes that though there is a unique beauty intrinsic to winter, not all urban dwellers will be able to enjoy it, such as the elderly, the handicapped, those with medical problems, and those who are extra-sensitive to the cold (Pressman, 1985, 1987). Therefore, the provision of interconnected outdoor and indoor urban spaces, which offer a greater degree of choice to users, is critical. In this way, people can choose to move about the city as a whole, stay outdoors or withdraw into warm protected recesses either inside buildings themselves or in urban pockets that trap the sunlight (Pressman, 1985, 1987). With regard to public outdoor space and park design, planning and policy, Pressman (1987) wishes to see a shift from focusing on the brief summer to a year-round perspective, but with an emphasis on winter use.

5. Outdoor Urban Space

Outdoor urban space is an important winter cities issue. Based on his and his students' intensive participant observation, Nash (1981, 1983) points out that customary social norms tend to be suspended and outdoor public spaces seem to become democratized in winter. Therefore, it would be inappropriate to plan for the winter use of urban public space in detail. Winter utilization should allow for increased individual freedom in definition of territoriality. Planners and designers would better serve the year-round needs of the public by creating adaptive urban spaces responding to seasonal change in terms of social activity and behavioral responses.

Culjat and Erskine hold that outdoor social spaces "have to be located, designed and equipped to extend the outdoor season and support social activities during the cold part of the year, even if not necessarily with the same intensity and in the same way" (Culjat & Erskine, 1983, p. 22). They argue that the nature of the outdoor environment, behavior patterns, and social activities generated by the outdoor urban spaces cannot be duplicated by the indoor ones. Therefore, outdoor social spaces would never be replaced, but only complemented by indoor ones. They pay special attention to marginal seasons holding that by careful micro-climatic design, the outdoor season could be extended for up to six weeks during marginal seasons.

Pressman (1989b) advocates a holistic perspective in terms of year-round utilization of outdoor urban spaces with an emphasis on winter. He also calls for a comprehensive pedestrian network which integrates streets, sidewalks, plazas, parks, laneways, lawns, and leftover spaces between buildings, and which is carefully designed to deflect the wind, brighten the streets, and encourage pedestrian use (Pressman & Zepic, 1986).

Gehl strongly emphasizes the positive aspects of the northern climate---the seasonal changes, especially the good days in good seasons. He admires particularly the summer function of these spaces in northern cities. In terms of urban space planning, he holds that the main point is "to think not in summer or in winter only but to think about a combination of solutions which will respect the culture of northern community" (Gehl, 1990, p. 30).

6. Summary

Nash's theory is based on data analysis from more than 800 hundred hours of intensive observation --- one of the few convincing results of winter environmental research Nash, (1981, 1983). However he does not illustrate how increased individual freedom in using outdoor urban spaces in winter can be achieved in terms of planning and design. Pihlak (1983, 1994) and Hough and Sijpesteijn (1990) pay a close attention to the bio-climatic comfort of urban spaces and give detailed design guidelines for site planning. These are very important for micro-climatic design of urban spaces. However, there is something missing in their studies: people's behavioral response to winter climate and the psychological and social comfort issues of winter urban spaces. Gehl is one of the pioneers of winter cities studies, especially in the urban space domain. What we should notice is that the positive aspect of the climate he refers to is the seasonal changes of northern cities, not the positive aspects of the winter itself. Gehl (1990) particularly emphasizes the summer function of urban spaces. It seems to him that if the space works well in summer, then everything would be satisfactory. In fact, what we need now is to focus on the improvement of the winter use of outdoor urban spaces. We need a more positive attitude in this respect. Culjat and Erskine (1983) insist that the planning and design should not only extend the outdoor season during marginal periods, but also support social activity during the cold months of the year. This is where and how they differ from Gehl. Pressman's theories involve almost every aspect of winter developments. He has put forward a series of very important principles for winter environmental studies by analysing the available literature and existing research. Although he has not given concrete research methods and examples to illustrate these principles, his numerous articles still have strategic significance with respect to guiding winter environmental studies. Generally, I agree with Pressman on his major points, such as the relationship between climate and the built environment, between protection and exposure, the structure of winter cities, downtown indoor systems, and urban public spaces.

D. A Perspective on Winter Urban Space

Based on my review and analysis of the available literature, the existing empirical studies related to winter urban spaces, and my own pilot work, I have developed a basic conceptual framework for my research.

1. The use of an urban space, especially the winter use, is the result of the comprehensive effect of a whole range of physical, social-cultural, and climatic factors. Any

single factor such as the location, visual quality, seating spaces, micro climate conditions, activities or control, etc. may influence the use to some degree. However, the overall use of the urban space cannot be explained by any single factor only. Therefore, over-emphasizing the effect of any single factor is one-sided. And at the same time we must also understand that "use" is not the only dimension for measuring the quality of an urban space. Rights, meaning, and connection to the urban space are also important dimensions.

2. Spaces require people. It is people and their activities that attract people, and it is people and their activities within the space that are the most important influences on the vitality of the space. People may not intentionally come to an urban space to stay. Some of them may just pass by randomly and get involved gradually and randomly, especially in winter. In order to increase the vitality of the space, we should introduce "necessary activities" which take place under almost any circumstances, such as shopping, goal-oriented movement (passing through) into the winter urban space.

3. Very few people stay in outdoor urban spaces in winter simply because it is either uncomfortable to stay or not worth staying in the cold. People must have multiple reasons to come to a winter urban space and remain there. In order to attract people to come, enter, and stay in an urban space, including those who pass by the space just because of necessary activities, physiological, psychological and social comfort should be provided.

4. The issues of winter urban spaces are not related to winter only. We simply cannot imagine that an urban space which does not work in other seasons could work well in winter. If an urban space meets the general prerequisites of a successful one (the congruence between physical characteristics and user's behavior is only one aspect) plus the special requirements

of winter, then it may work well in winter. Winter must not be considered as an isolated part of the year, but as a part of the total cycle. We emphasize the winter issues of outdoor urban spaces because they have long been neglected, but it does not mean that we should disregard other seasons. The need for a holistic perspective in planning and designing of winter outdoor urban spaces must therefore be emphasized.

CHAPTER II

METHODOLOGY

It is believed that people's relationships with the world cannot be understood by isolating and investigating any of the single elements that make up the relationship but rather can only be understood by seeing all the elements in the context of one another (Altman & Logoff, 1987; Ittelson, 1973; Saegert & Winkel, 1990). The use of outdoor urban space in winter offers a good example to illustrate this viewpoint. Many factors, physical, social-cultural, and climatic influence the winter use to varying degrees. However, the overall winter use of an outdoor urban space will be the result of a comprehensive integration of all these related elements. An outdoor urban space may meet winter requirements quite well, for example, it may have ideal micro-climatic conditions: fully exposed to the sun and free from the cold wind, however, it may still fall into low use category. Also, an urban space located in a very prosperous commercial district may still function like a desert forgotten by people. These examples are not meant to imply that those positive elements do not work at all, but that they may not be able to balance all the other negative elements working at the same time. To study such a complicated topic, any single method seems to be limited. For studying users' behavior in winter, field observation is needed. For generalizing the findings obtained from several urban spaces, survey research might be a suitable method. And for analysing the single or integrated role of various elements in influencing the use of urban spaces, quantitative analysis (multiple regression) should be adopted. Therefore, a multi-method approach is inevitable for this study.

Fieldwork, survey research, experimentation, and non-reactive studies are the four principal methods employed by social researchers today.

> Field workers observe people and events first hand in natural social settings. Survey researchers either interview or administer questionnaires to samples of respondents drawn statistically from the populations in which the phenomena of interests occur. And experimentalists study phenomena under controlled conditions deliberately established by the experimenter to test particular causal hypotheses. ... Non-reactive researchers either employ various unobtrusive observational techniques or study artifacts, archives, official statistics, and other natural byproducts of the past social life. (Brewer & Hunter, 1989, 13-14)

Because any single method has its weakness and limitation, to overcome this, the multi-method approach is a strategy developed by deliberately combining different types of method in the same investigation. Therefore, the convergent findings of multi-method approach may be acceptable with far greater confidence than the findings from any single method. And the divergent findings are also important because they signal the need for further analysis of a research problem and the cautions to be taken in interpreting the significance of any set of data or any single variable (Brewer & Hunter, 1989).

A. Research Questions

My research started with a general purpose to study how people use outdoor urban spaces in winter and how climatic conditions and other elements influence the winter use of these spaces. Along with the progress of the field observations, through the data collecting, coding and initial analysis, new ideas and concepts were constantly emerging. And my research questions became clearer and more specific during these processes. In this research, I have tried to answer the following questions:

1. In which outdoor urban spaces in New York City do people usually stay in winter?

How do people use outdoor urban spaces in winter? Do their behavior patterns change with the variation of climatic conditions and how?

2. Do the climatic conditions and the physical elements of an urban space influence its winter use individually and collectively? Which elements are significant in predicting the "use density" of an urban space in the winter and other related seasonal periods?

3. Do necessary activities have a positive influence on optional activities in outdoor urban spaces in winter? If the answer is yes, how? and to what degree? And what implications does it have for the planning, design and management of urban spaces?

4. Does the temperature around 40° F represent an independent seasonal period with respect to the influence on users' behavior and the public life of urban spaces? How does it influence users' behavior and the public life of urban spaces? What are the implications?

5. Why do some urban spaces lose their users very rapidly whereas others do not when the climate turns cold? What are the elements that contribute to the ability of retaining users (holding power) of an urban space during this process? What is the significance of the holding power?

B. Hypotheses

My hypotheses were developed and refined during the field observation. And they were tested further in this study by using quantitative analysis.

The periods between late winter and early spring or late fall and early winter, when the daytime high temperature is around 50°F, are defined as marginal seasons. It has been found that during marginal seasons, on a sunny day with mild wind when the local temperature reaches 48° F (spring) and 52° F (fall), the number of people staying in outdoor urban spaces increases significantly. I defined the periods between winter and marginal seasons when the daytime high temperature is about 40° F as the "sub-marginal" periods.

My first hypothesis is: Sub-marginal periods are independent seasonal periods different from both winter and marginal seasons with respect to the influence on users' behavior patterns and the public life of outdoor urban spaces.

Gehl (1987) holds that outdoor activities in public spaces can be divided into three categories: necessary activities, optional activities, and social activities. He defines necessary activities as those that are more or less compulsory. Examples could include going to school or to work, shopping, waiting for a bus or a person, running errands, etc. These activities are influenced only slightly by the physical framework and will take place throughout the year under almost all conditions. Optional activities in places are those that take place only if external conditions are favorable such as when the weather and the place are inviting. Examples could include taking a walk for getting a breath of fresh air, standing around enjoying life, sitting and sun bathing, etc. Gehl (1987) holds that social activities are those that depend on the presence of others in public spaces. Examples might include greetings and conversations, children at play, and various kinds of communal activities. He regards passive contacts (simply seeing and hearing other people) as the most widespread social activities.

Some activities are difficult to categorize just by their own characteristics. One example is Christmas shopping. To some people, it may be optional because they regard it as a kind of recreational activity. Others may see it as necessary because they have to buy

Christmas gifts for their family members. However, in the urban spaces I am studying, passing through to go somewhere for Christmas shopping is categorized as a necessary activity because the passers do not come to this space to stay.

My second hypothesis is: Passing, as a kind of necessary activity, has a positive and significant influence on the "use density" of an urban space, especially in winter.

After the fall marginal season, with the temperature dropping, some outdoor urban spaces began to lose their users very rapidly whereas others did not. The ability to retain users after the fall marginal season differs from one urban space to another. To study this ability of urban spaces, a new concept--"holding power" has been introduced. I define "Holding Power" as: "The percentage of use (or "use density") an urban space can retain with each degree (F) temperature decrease within a specific temperature range after the fall marginal season".

My third hypothesis is: The "holding power" of an outdoor urban space is positively and highly correlated to the necessary activities provided within the ground floor of the buildings directly adjacent to the space.

C. METHOD

The current study has employed a strategy of combining qualitative field observation with quantitative analysis of users' survey data and of the counts of users data collected for a large sample of urban spaces. The fieldwork used a "grounded theory" approach in the data collection, research problem and hypotheses formulation process. Glaser and Straus (1967) insist that the researcher should have extensive familiarity with the settings and the daily experience of people. The valid interpretation and explanation of human phenomena should be based on concepts that have meaning to the experience of the people studied. Thus in the process of my field observation, the data were not forced to fit a theory, rather the relevant concepts and hypotheses were developed and refined from the data collecting process. This approach involves a continuous process of rigorous analysis of organizing the data already gathered and informing the collection of new data needed. At the same time, it helps the researcher to come into a hermeneutic circle (Gadamer, 1975) of ever increasing understanding of the phenomenon being studied, and in this process, the researcher's preconceptions and pre-judgement are also examined entirely. The process of verifying the existence of the "sub-marginal periods" (the seasonal periods when the daytime high temperature is around 40 F) is a good example of my "grounded theory" and "multi-method" approach.

During my continuous and repeated field observations at the Seagram Plaza, I first noticed that the users' behavior patterns became more diversified at the 40° F level than at the 30° F level. Some behavior patterns which were seldom observed at 30° F or lower began to appear at about 40° F, such as lying, dozing and intimate behaviors. This might indicate that 40° F could be a very special temperature level with respect to influencing users' behavior and the public life of urban spaces. Based on this finding I compared the "average length of stay" of users, the "sitting rate" and the "hour use" (number of users recorded within an hour) of the Seagram Plaza trying to find more evidence. And the comparison revealed that there were significant increases in all these three aspects at the 40° F level than at the 30° F level. All these supported the idea that 40° F level represents an independent seasonal period different from both winter and the marginal seasons. However, whether this idea was applicable to other urban spaces had not been considered. Therefore, I expanded my observations to some other urban spaces, such as Herald Square Park, 1155 Sixth Avenue Plaza, etc. Similar findings were obtained. Up to that point, the qualitative analysis had already verified the existence of the sub-marginal periods. To make the conclusion more convincing, I took this as the formal hypothesis and tested it by using quantitative analysis. This was done from two aspects: one was to analyze the significance of the difference in the grand means of "use density" of 32 NYC urban spaces in winter, the sub-marginal and the marginal; the other was to develop users survey framework based on the results of the field observations and to analyze the significance of the difference in the grand means of users' perception and attitude toward three different temperature levels. The results of the quantitative analysis from these two aspects all indicate that the sub-marginal periods are independent seasonal periods different from both winter and the marginal. In addition, the results of the multiple regression analysis also shows that climatic variables played very different roles in influencing "use density" in different seasonal periods. This also indicates that the sub-marginal periods are independent seasonal periods. Since convergent findings have obtained from all these different methods, I can confidently announce the existence of the sub-marginal periods.

D. Research Setting and Field Observation

The following outdoor urban spaces in midtown and downtown Manhattan Central Business District were chosen as my research settings:

Group A (low to moderate use): Seagram Plaza, Herald Square Park, 1155 6th Ave. Plaza, Collect Pond Park;

Group B (moderate to high use): Time & Life Plaza, General Motor Plaza;

Group C: A total of 32 midtown and downtown Manhattan outdoor urban spaces were selected (including the above spaces) for counting users (people staying) and passers-by (people simply passing through). Figure III-1 shows the distribution of these spaces.

For Group A settings, because of their relatively low use, it is possible to conduct continuous and repeated observations. This was done for eight to twelve days for each space, two and a half hours each day during lunch hours (11:30 am to 2:00 pm) on weekdays. Some observations were done on weekends in some plazas just for comparisons. The date, weather conditions, users' genders, age groups, length of stay, major behavior patterns, and major events happening during observations were recorded. For each group of users, detailed notes were taken as to what they do in the space from their arrival until their departure. Behavior mapping, field notes, and photography were used as major data collecting methods. The data obtained from Group A settings were mainly used for qualitative analysis.

For group B settings, because of their higher use compared with Group A, continuous observation is very difficult to conduct by one observer. Instead, instant mapping and recording were used for these spaces. This was done every 30 minutes during lunch hours for each space five times each day for fifteen weekdays. The data obtained from Group B settings were used for qualitative and quantitative analysis.

For Group C settings, 32 Midtown and Downtown urban spaces were chosen for counting the number of users and passers-by of these spaces. The counts were conducted on weekdays in winter (December and January, at 32° F and lower), sub-marginal periods (late February to early March around 40° F), and Marginal seasons (mid March to early April, late October to early November, around 50° F). The counts were conducted during lunch hours (11:30 a.m. to 2:30 p.m.), and about 15 to 17 urban spaces were counted each day by the observer riding a bike in a loop connecting them. The number of users and passers-by were counted at each arrival on a regular schedule. Temperature, wind force and "sun exposure" of the space were also recorded at each arrival. Each urban space was counted once per hour and three times a day. People sitting, standing or wandering in the space were considered users, while those who just passed through as passers-by. The count for each urban space was conducted for five days for each seasonal period (15 days in total). The data thus obtained were used for multiple regression analysis.

E. Definition of Concepts and Variables:

The following concepts have been used in this research:

marginal seasons (the marginal): the seasonal periods between winter and spring (spring marginal)

or between winter and fall (fall marginal) when the daytime high temperature is around 50°F.

sub-marginal periods (the sub-marginal): the seasonal periods between winter and the spring marginal or between winter and the fall marginal when the daytime high temperature is around 40°F.

holding power: The percentage of use (or "use density") an urban space can retain with each degree temperature (F) decrease within a specific temperature range after the fall marginal season.

user: people sitting, standing or wandering within an urban space are considered as users of the space.

use: the number of users within an urban space at one instant.

hour use: the number of users within an urban space recorded in one hour.

passers-by: people who pass through an urban space without a stop.

passing: the movement of passers-by within an urban space.

passing volume: the number of people passing through an urban space at one moment.

The following variables were used for multiple regression analysis in this research:

Dependent Variable:

use density: the number of users within one thousand square feet area of an urban space an one instant.

passing density: the number of passers-by within one thousand square feet area of an urban space an one instant. ("Passing density" was used as an explanatory variable when "use density"

as the dependent variable in the multiple regression analysis)

Explanatory Variable:

activity: any commercial, recreational, or cultural activity provided within an urban space (each such activity gets 3 points, such as the skating activity in Rockefeller Center Plaza); or within the ground floor of the buildings directly adjacent to the urban space (each such activity gets one point, such as FAO Schwarz --- the toy store, and the

New Auto Exhibit in the GM Building). The score for activity is the sum of all these points.

visual diversity: the visual delight elements of an urban space, which consists of five aspects: planting, sculpture, water space, paving and Christmas decoration. A scale system was developed in which the score for each aspect ranges from zero to three points:

a. Planting --- the area of an urban space covered by evergreen trees or shrubs. Each one thousand square feet gets one point and the maximum is three points.

b. Sculpture is measured as:

0 --- no sculpture or monument

1 --- unattractive sculpture or monument

2 --- attractive sculpture monument

3 --- very attractive sculpture or monument

c. Water space was measured as:

0 --- no water

1 --- still water

2 --- moving water

3 --- water space with fountain or cascade

d. Paving was categorized as:

1 --- plain paving

2 --- patterned paving

3 --- patterned paving with bright color

e. Christmas decoration was scaled as:

0 --- no decoration

1 --- Christmas trees with white bulbs

2 --- Christmas trees with color bulbs

3 --- Christmas trees with color bulbs combined with water space.

The sum of all these points is the score for the visual diversity of an urban space.

Seating density : the linear footage of the seating space within one thousand square feet of an urban space area.

Potential footage: the maximum square footage permitted by the Zoning Resolution of New York City for the six 200 by 200 feet lots within the six blocks surrounding an urban space. It refers to the same lot as the variable "land use diversity".

Land use diversity: the ground floor land use of six 200 by 200 feet lots within the six block surrounding an urban space (see Fig. II-1).

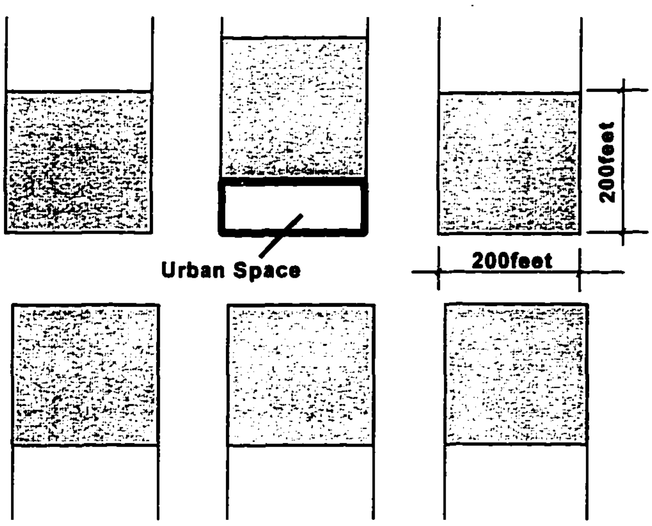


Figure II-1 Six 200 by 200 feet lots around the Urban Space

Each such land use gets one point, e.g. a restaurant, a bank, or a retail store; a small scale department store gets five points, e.g. "Woolworth"; and a large department store gets 20 points, e.g. "Macy's" or "Lord & Taylor". The sum of all these points is the score representing the land use diversity of an urban space.

Temperature: measured by using the mean of the Fahrenheit temperature at the three times counting of the day. For example, if the temperatures were 20°F, 23°F and 25°F at the three arrivals of an urban space respectively during the day, then the temperature of that day was the mean of the three temperatures: (20+23+25)/3=22.67°F. The temperature at Cental Park of New York City was taken as the standard day time temperature for this study, and it was available every ten minutes from the radio broadcasting of WCBS Station (88.80 AM).

Wind: the mean wind grade at the three counts of the day. The grade was estimated based on the Beaufort Wind Comfort Chart.

Sun exposure: the percentage of the urban space area which was directly exposed to sunlight at the three counts of the day. This was estimated at each arrival of the urban space.

F. User Interviews

User interviews were conducted at Rockefeller Center Plaza, General Motor's Plaza, Time & Life Plaza,, Seagram Plaza, Herald Square Park, Collect Pond Park, and 1155 6th Avenue Plaza in order to understand people's perceptions and attitudes toward three different temperature levels. Since the difference between 50°F and 40°F, or 50°F and 30°F is very easily to be identified by people, 50°F was eliminated from the questionnaire. Thirty users were picked up randomly, and they participated voluntarily in each of the above urban spaces. The purposes of the users' interview lie in two aspects. The first purpose is to understand users' evaluation of the physical environment of the urban space, such as the scale of the space, the attractiveness of the pavement, the sculpture, the water space, and the Christmas decorations of within the space. The data thus collected were used for qualitative analysis of the visual environment of the urban space studied. The second purpose is to understand the differences among 20°F, 30°F and 40°F with respect to users' perception of and attitude toward these three different temperature levels. A specific emphasis was put on the difference between 30°F and 40°F. The data thus collected were used for the analysis of the significance of the difference in means in order to verify the hypothesis that the sub-marginal periods are different seasonal periods from winter from another angle.

G. Data Analysis

A combination of qualitative and quantitative analysis has been employed for the data analysis process. The qualitative analysis process did not begin at the finish of the data collection; rather it was a back-and-forth procedure between data collection, coding, memo writing, literature review, and interpretation based on the "grounded theory" approach. During this process, some conclusions were reached and taken as the hypotheses to be tested further by quantitative analysis. All the three major hypotheses were thus developed, refined and tested further.

During the quantitative analysis process, the SAS One Way ANOVA program was used for testing the significance of the difference in the means of "use density" of 32 urban spaces in the three seasonal periods, and of the users' perception and attitude toward three different temperature levels (20° F, 30° F, and 40° F). The findings were compared with those obtained from the field observations.

Multiple regression method was used to analyse the data collected from counting the users and passers-by in the 32 outdoor urban spaces. The purpose of the multiple regression analysis was to understand how various physical, climatic and managerial elements influence "use density" and "passing density"of an outdoor urban space individually and collectively and which elements were significant at the 0.05 level in predicting "use density" and "passing density." To make a comparison, another regression model of 31 urban spaces data set (without Rockefeller Center, because its "use densities" were extremely high) has also been provided in order to get an in-depth understanding of the roles all these elements play. And the findings were also compared with those obtained from field observations. Both convergent and divergent findings from different methods have been discussed.

Multiple regression was also used for analyzing which elements were significant in predicting the "holding power" of an urban space at the 0.05 level. And grouping correlation analysis was done to analyze the correlation between "holding power" and the explanatory variables for different urban space groups with different "use density" level. This was to see whether different variables influenced "holding power" significantly in different groups.

CHAPTER III

USERS' Behavior IN WINTER

People's behavior in urban spaces in winter is very different from that in summer and other warm seasonal periods. An in-depth understanding of how people use urban spaces in winter, how their behaviors change along with the variation of climatic conditions, and how physical characteristics of an urban space can be congruent with the behavior are the prerequisites of winter urban spaces planning and design.

A. Where do People Stay in Winter?

Photo III-1 Standing (GM Plaza)

Photo III-2 Sitting & Talking (1155 6^{th} Ave. Plaza)

Some researchers have pointed out that the number of people who use urban spaces has been increasing in recent years (Bach and Pressman, 1992; Gehl, 1987; Cooper Marcus and Francis, 1990; Whyte, 1980, 1988). On a wind free sunny day in late spring or early summer, if you walk along Sixth Avenue in Midtown Manhattan during lunch hours, you can see that most of the plazas located on this avenue are filled with people. Even the Grace Plaza, which is usually under-used,

Photo III-3 Eating (Time & Life Plaza)

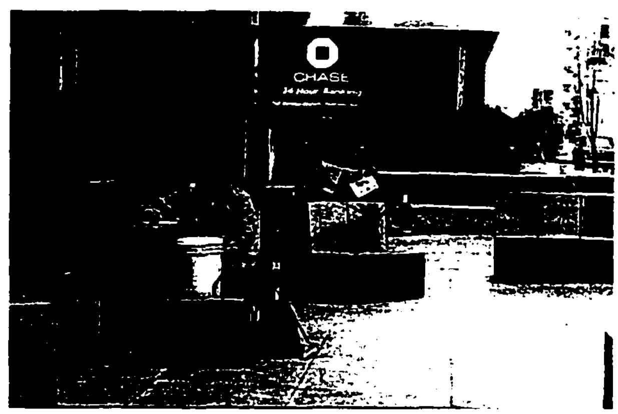


Photo III-4 Reading (Webber's S. Plaza)

Photo III-5 Passing (Police Plaza)

has users sitting on the steps or ledges adjacent to the Sixth Avenue sidewalk and watching people coming and going. However, most of these plazas become empty in winter. At the first glance, you will find that even standing is very rare in most of the Midtown and Downtown Manhattan urban spaces in winter, not to mention sitting. But if you are patient enough and walk around these spaces one after another, you can see that there are still some people staying there when the temperature is at the freezing point or even lower. You will find people standing (Photo III-1), sitting (photo III-2), eating or drinking (Photo III-3), reading (photo III-4), passing (Photo III-5), or taking pictures (Photo III-6), etc. It seems that there are still some people who need urban spaces and the public life within them in winter. Field observations showed that the winter life of small urban spaces was not as dead as it looked like superficially. For example, the winterlife of the Rockefeller Center Plaza was even more abundant than its

Photo III-6 Picture Taking (Exxon)

summer life, especially during the holiday seasons. The lighting ceremony of its "world's biggest Christmas tree" attracts tens of thousands people every year. The skating activity in the sunken plaza draws hundreds of fans to participate and thousands of people to watch every day. Its plentiful Christmas decorations provided colorful backgrounds for people who wanted their pictures taken at this cheerful moment of the year (Photo III-7, III-8). Observations also showed that during the holiday seasons (from Thanksgiving to The New Year's Day), the "use density"of Rockefeller Center Plaza is higher than its summer "use density". This is really an exception. As the symbol of contemporary American capitalism, Rockefeller Center is also the symbol of the United States to a lot of Americans. Just a few years ago, when Mishubishi of Japan bought more than half of the Rockefeller Center's stock shares, many Americans felt hurt, shamed, and angry. Rockefeller Center Plaza is not just an urban space, it has special meaning and attachment to many American people. To people from other countries, it is also a special place to visit. During my users' interviews there, I once met a young Argentinean couple who

Photo III-7 Christmas Decoration (Rockefeller Center) came to Rockefeller Center for a visit directly from the JFK Airport before they settled down in a hotel. From this plaza we can understand why Frances (1989) says that meaning and attachment are also dimensions for measuring the success of an urban space.

Photo III-8 Picture Taking (Rockefeller Center)

It is surely impossible to make every urban space as attractive or as heavily used in winter as the Rockefeller Center Plaza. However, there is really another urban space in New York City which is almost as popular as the Rockefeller Center Plaza during the holiday seasons. That space is the General Motor's Plaza. In this plaza, especially on its south platform, people waited in a long line to enter the FAO Schwartz toy store (Photo III-9, III-10). Sometimes, the line was so long that it had to go off the platform and turned back east along 58th Street for more than 100 feet. There were also many people who came to see the new model GM cars of the coming year.

Photo III-9 General Motor's Plaza (1)

Photo III-10 General Motor's Plaza

After the holiday seasons, the number of people staying in the General Motor's Plaza decreased greatly. However, its "use density" was still higher than those of most other urban spaces studied, except Rockefeller Center Plaza. What needs to be mentioned here is that the micro-climatic conditions of the General Motor's Plaza are not good. It is located on the east side of Fifth Avenue between 58th and 59th Street. There is no sunlight at all during the whole winter because of the high-rise building to its south. And the wind in this plaza is usually strong because it faces Central Park in the northwest direction where there is a wind tunnel in winter. Nevertheless, all these factors seem have little negative influence on its winter use. It is believed that apart from various facilities, such as the toy store, the new car exhibit, the restaurant and other services, which generated a huge amount of passing and other necessary activities within the plaza, its location and the urban context also play an important role. The famous Grand Army Plaza and the Plaza Hotel are just across the Fifth Avenue, Bergdorf Goodman, the high priced clothing store is next door across 58th Street, the Warner Brothers Disney Cartoon Store, the Trump Tower Building and a group of other brand name stores are all nearby. This section of Fifth Avenue is one of the most high scale areas within the whole city.


Photo III-11 Urban Plaza

The Urban Plaza located on 53rd Street between Fifth Avenue and Madison Avenue is a typical urban pocket (or vest pocket) park. It has a southern exposure and is protected from the north wind. A Japanese restaurant at its back generates passers-by and provides potential users for the space. There were always some people staying in this urban space, especially on a sunny day (Photo III-11). The famous Paley Park is also located on the same street just a few steps away. It is heavily used in warm seasonal periods. However, its winter "use density" is much lower than that of Urban Plaza (0.34 vs 1.13). The ecological environment and the visual attractions in Paley Park are much better than those in Urban Plaza but its southern exposure is blocked by a high-rise building. Obviously, the micro-climatic conditions here are the key factors which make the difference (Photo III-12). The Time & Life Plaza is located on the west side of Sixth Avenue between 50th and 51st Streets. It was used moderately in winter ("use density" was 0.75). To its east across Sixth Avenue are the Radio City Music Hall and the Rockefeller Center Main Building which are major attractive places during the holiday seasons. There are also many theaters, restaurants, banks, and retail stores around this area. It is one of the most high scale commercial districts in the city. The main Time & Life Building sets back from the property line for about 150 feet, and the north wing building stretches forward blocking the northwest wind in winter. The plaza is exposed to the sunlight during lunch hours on a sunny day. Therefore the micro-climatic conditions of this plaza are very good. The Chemical Bank branch within the ground floor of the north wing building, the subway entrance within the plaza boundary, and the food vendors along the 50th Street sidewalk all made the space a very lively one in winter. During the holiday seasons, the colorful

Photo III-12 Paley Park

Photo III-13 Time & Life Plaza (1)

Photo III-14 Time & Life Plaza (2)

Christmas decorations coupled with the water fountain space made this plaza very attractive. People kept stopping to watch and take pictures. In the Time & life Plaza, many factors contributed to its vital winter life: a suitable location, a rich urban context, diversified land use which brings plentiful commercial and cultural activities around, its own visual diversities and ideal micro-climatic conditions, etc. (Photo III-13, III-14) The other plazas of the Rockefeller Center System: Exxon Plaza, McGraw Hill Plaza, and Celanese Plaza were less used than Time & Life Plaza in winter. However, because of the similar urban context, land use diversity, and visual attractions, they were all among the moderately used ones.

Herald Square Park is located at the intersection of Broadway and 34th Street, which is another high scale commercial district clustered with various stores, restaurants, banks, and other service facilities. The so-called world's largest department store, Macy's, is just across Broadway. This small triangular park is at the extension of Broadway and Sixth Avenue sidewalks. The south-bound pedestrian streams from these two streets are naturally led into this park. Therefore, the all day non-stop pedestrian streams brought a vital life to this small park. The monument to the Herald often attracted people to stop to read the inscription or take pictures. The pay phones and the information windows standing at the south end of the park also attracted users frequently. This park and the Greeley Square Park next to it on the south side are both moderately used small urban spaces (Photo III-15, III-16). Seagram Plaza is located on Park Avenue between 52nd and 53rd street. It is famous because the Seagram Building and the plaza were designed by Mies van der Rohe. The nearby area is mainly for office use with little retail and recreational activities. Although Seagram Plaza is usually heavily used during warm seasons, its winter "use density"was among the lowest ones (only 0.04). In winter, because of the shadowing of the surrounding high-rise buildings, sunlight cannot penetrate into this plaza and is only available from the beginning of March. It was really like a desert forgotten by people in winter.

Photo III-15 Herald Square Park (Monument)

Photo III-16 Herald Square Park (Payphone & Info. Window)

From the initial field observations, a summary has been made as follows:

1. Programmed activities are the most significant elements to attracting other people to come to urban spaces and stay, such as the skating activity and other programmed activities in Rockefeller Center Plaza.

2. The commercial and recreational activities provided within the ground floor of the buildings directly adjacent to the urban space can generate passing and other necessary activities and also provide potential users. Observations showed that most of the urban spaces with high passing volume usually had high "use density".

3. Micro-climatic conditions are not the most significant influential factors with respect to the "use density" in winter. The two most heavily used plazas, Rockefeller Center Plaza and the General Motor's Plaza, both do not have ideal micro-climatic conditions. However, there seems to be no detectable negative influence on their winter use. Nevertheless, the cases of the Time & Life Plaza, Urban Plaza, and Seagram Plaza showed that micro-climatic conditions still had some influence.

4. The location and the surrounding urban context play a very important role on the use of an urban space. All the heavily and moderately used urban spaces are located in high scale commercial districts with diversified land use.

5. The visual attraction of the urban space itself may also play an important role in influencing use, such as the Christmas decorations in the Rockefeller Center System plazas.

In all, people tended to stay in urban spaces which are located in high scale commercial districts with diversified land use. These spaces all have facilities which can either provide attractive programmed activities or diversified visual attractions and generate a huge amount of passing volume as well. In addition, people also preferred those spaces to have ideal micro-climatic conditions, if possible. Figure III-1 shows the distribution of the 32 urban spaces studied and Table III-1 is the comparison of the "use density" of these spaces in winter, sub-marginal periods, and marginal seasons.

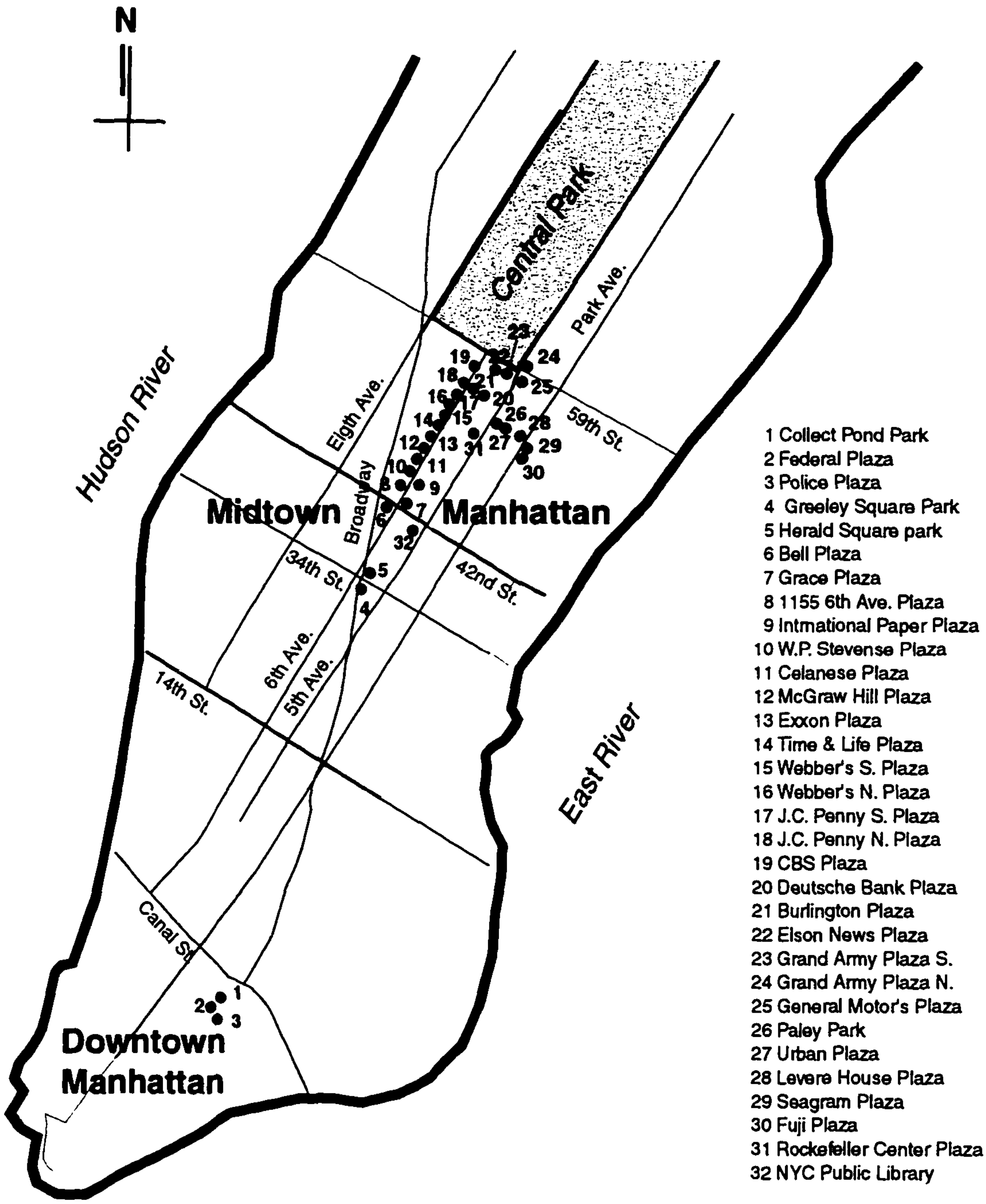


Figure III-1 Distribution of Urban Spaces Studied

Table III-1
Seating Density and Use Density for 32 NYC Urban Spaces

Urban Spaces	Seating Density	Mean of Use Density		
		winter	Sub-marginal	Marginal
Public Library	22.4	0.16	0.80	2.04
Greeley Square Park	12.5	0.25	0.93	2.42
Herald Square Park	14.6	0.55	1.84	4.31
Bell Plaza	6.4	0.01	0.08	0.15
Grace Plaza	16.7	0.04	0.17	0.56
1155 6th Avenue Plaza	18.1	0.27	0.87	1.67
International Paper	61.9	0.27	0.80	2.61
W. P. Stevens Plaza	0	0.24	0.55	0.65
Celanese Plaza	25.9	0.22	0.54	2.09
McGraw Hill Plaza	13.1	0.24	0.46	1.60
Exxon Plaza	17.9	0.36	0.67	2.37
Time & Life Plaza	27.1	0.75	1.20	4.50
Webber's Plaza S.	29.6	0.47	0.80	3.70
Webber's Plaza N.	29.3	0.23	0.65	1.24
J. C. Penny Plaza S.	46.8	0.11	0.23	0.85
J. C. Penny Plaza N.	37.3	0.49	0.79	1.99
CBS Plaza	10.9	0.10	0.21	0.39
Deutsche Bank Plaza	39.6	0.31	1.02	3.16
Burlington Plaza	51.8	0.40	1.30	3.00
Elson's News Plaza	8.6	0.08	0.29	0.55
Grand Army Square S.	25.8	0.12	0.37	2.47
Grand Army Square N.	20.2	0.15	0.49	1.74
General Motor's Plaza	19.6	1.69	1.86	2.18
Paley Park	37.2	0.34	1.35	4.25
Urban Plaza	46.0	1.13	2.16	5.41
Lever House Plaza	8.5	0.07	0.14	0.33
Seagram Plaza	19.5	0.04	0.14	0.77
345 Park Avenue Plaza	17.8	0.07	0.37	1.32
Police Plaza	11.2	0.14	0.25	1.00
Federal Plaza	15.4	0.03	0.12	0.67
Collect Pond Park	35.1	0.21	0.39	2.41
Rockefeller Center Plaza	10.3	9.69	6.43	7.58

B. Sitting and Standing

Sitting and standing are the two most popular behavior patterns of urban space users. Other behavior patterns such as eating, reading, smoking, and talking, etc. are usually combined with either sitting or standing. The only exception is lying down.

Whyte (1980) considers sitting space as the most prerequisite variable in influencing the use of a small urban space, though he is not sure whether there is a "cause and effect" relationship between the two. He recommended a standard of seating space to make a plaza work: one linear foot of seating space for every 30 square feet of plaza. Converting this into "seating density", we get 33.3 linear feet of seating space within each thousand square feet of urban space.

1. Seating Density and Use Density

Let us use this standard to compare the "seating density" of the 32 urban spaces studied and their corresponding "use density" in winter, sub-marginal periods and marginal seasons (see Table III-1).

> Among all these urban spaces, seven had a higher "seating density" than the standard, five had a density close to the standard (more then 25 linear feet within each thousand square feet of urban space).

Some of these urban spaces with high "seating density" have relatively high "use density" in winter, the sub-marginal periods and the marginal seasons as well, such as Burlington Plaza, Time & Life Plaza, Deutsche Bank Plaza, Urban Plaza etc. However, the two most heavily used plazas, Rockefeller Center Plaza and General Motor's Plaza, have relatively low "seating density", especially Rockefeller Center Plaza. Its "seating density" (10.3 ft/kft^2) is among the lowest of the urban spaces studied. There are also some other urban spaces which have high "seating density" but very low use density, such as the J. C. Penny South Plaza. Based on the data from the observations of 32 urban spaces, the

Pearson's Correlations between "seating density" and "use density" are: -0.109 in winter, 0.052 in sub-marginal periods, and 0.223 in marginal seasons (see Table VII-2). This means that in winter and the sub-marginal periods, "seating density" has very little influence on "use density".

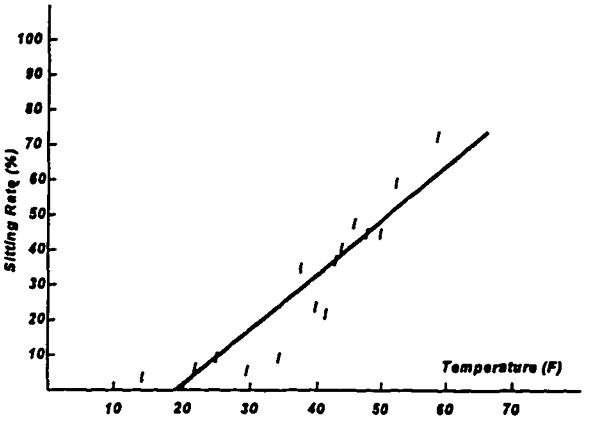


Figure III-2 Grand Mean of Sitting Rate of 32 Urban Spac-

The observations show that very few users sat in urban spaces in winter. Most of the activities were carried out in the standing or walking mode. The grand means of sitting rate (the percentage of sitters among all users) of 32 urban spaces are as follows: Winter --- lower than 10%, Sub-marginal periods --- about 20% to 40%, Marginal seasons --- about 50 to 60% (see Figure III-2). These sitting rates might differ a great deal from one urban space to another.

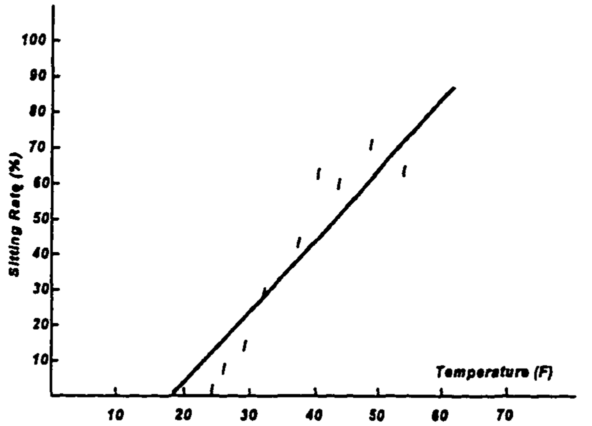


Figure III-3 Sitting Rate of Seagram Plaza

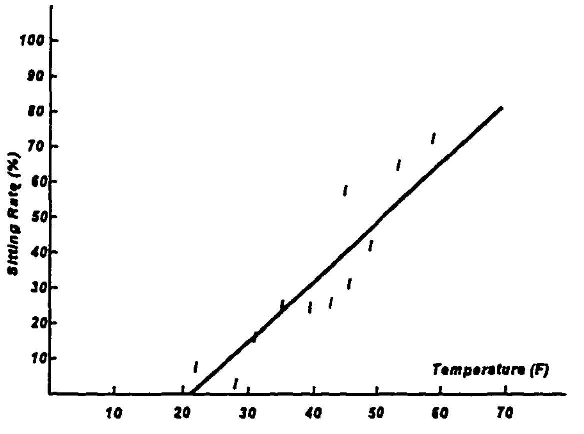


Figure III-4 Sitting Rate of 1155 6th Avenue Plaza

Figure III-2 shows clearly a linear rate: the lower the temperature, the lower the sitting rate. In New York City, when the temperature dropped to about 10°F, the sitting rate was almost zero. In some urban spaces,

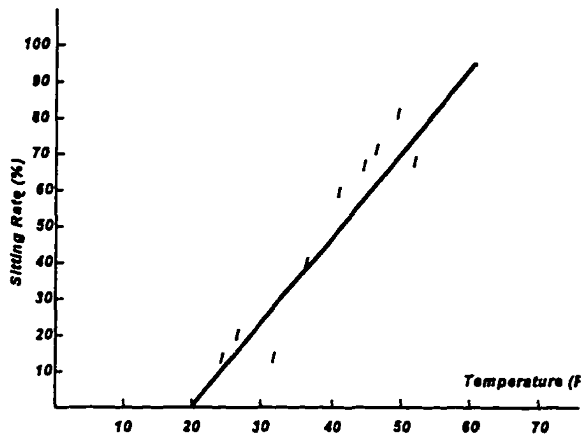


Figure III-5 Sitting Rate of Herald Square Park

when the temperature was about 20°F, there were almost no people sitting at all, such as Seagram Plaza and 1155 6th Avenue Plaza (see Figure III-3, III-4). In some other urban spaces, for example, Herald Square Park, the temperature at which sitting behavior began to disappear is a little bit lower than 20°F (see Figure III-5). All these show that Whyte's (1980) conclusion that seating space is the most prerequisite variable for urban spaces is not applicable to urban spaces in winter.

2. Sitting, Standing and Personal Control

In winter, there were some interesting changes in users' behavior in urban spaces. These changes showed that people used personal control mechanisms intuitively to mediate the discomfort caused by the environmental stressor of cold climate.

Most of the construction materials for seating spaces in midtown and downtown Manhattan are either stone or concrete. It is very uncomfortable to sit on them in winter. Some users could only sit for a few seconds before they had to stand up.

> * 11:44 a.m., a young lady wearing a red overcoat bought her lunch from the nearby food vendor. She walked to the northwest corner bench and sat there to eat. But only a few seconds later, she stood up, and continued eating while standing. She stayed for about 3 minutes (Field notes, 1155 6th Ave. Plaza, Jan 21, 1994, sunny, 23°F).

> * 12:07 noon, a young man wearing a bomber jacket with his hat and gloves on came to sit on the ledge of the front flowerbed. He seemed reluctant to experience the icy

cold of the stone ledge, so he sat half on the ledge and the remainder of him was hanging in mid air. He stayed there for five minutes (Field notes, same as above). * 1:16 p.m., two middle aged ladies came out from the main building of the plaza. One was wearing a dark overcoat smoking, the other was wearing a grey down coat. They sat on the ledge of the front flowerbed talking. About one minute later, they both stood up, walked up to the porch, and stopped at the window of Hallmark Store . They stood there talking for seven more minutes and then went back into the building (Field notes, same as above).

Photo III-17 Sitting on Paper

Photo III-18 Sitting on Cardboard

* 1:16 p.m., two middle aged ladies came out from the main building of the plaza. One was wearing a dark overcoat smoking, the other was wearing a grey dawn coat. They sat on the ledge of the front flowerbed talking. About one minute later, they both stood up, walked up to the portico, and stopped at the window of Hallmark Store. They stood there talking for seven more minutes and then went back into the building (Field notes, same as above).

Feels too cold to sit there? Just stand up. This is the choice you can make --- a decisional control response. Or put something underneath to isolate the cold --- a behavioral control response. Some people do this by using newspapers, books, handbags, card boards, or even plastic bags (Photo III-17, III-18). A very interesting phenomenon observed is that somebody brought a cushion with him for sitting outdoors in winter:

* 2:00 p.m., a well dressed middle aged man wearing a black overcoat came to the park. He stopped at the third southeast Chair and put his business case on it. Then

Photo III-19 Staying in Sunlight (Exxon)

he opened the case and took out a colorful patterned cushion. He put the cushion on the Chair and sat down. He lit a cigarette and watched pigeons looking for food on the ground. He stayed for six minutes (Field notes, Herald Square Park, Feb. 9, 1989, sunny, 25°F).

It looks as though this gentleman often comes to sit in urban spaces in the cold and is well prepared for doing this. These personal control responses suggest that stone or concrete are not suitable materials for seating spaces in winter. Wood is much better.

Personal control responses are also reflected in people's tracing sunlight during their sitting or standing in urban spaces. Although similar behavior patterns can also be found in the spring and autumn, this kind of behavior especially expresses people's eagerness for winter sunlight because of its rareness. Photo III-15 shows that when the benches on the west side of Herald Square Park were in the shadow, all the users chose to sit on the east side benches where sunlight was available. Photo III-19 shows that on the north terrace of Exxon Plaza, all the users whether sitting or standing, stayed in the sunlight. Photo III-20 shows a young girl standing in the only narrow sunlight strip available in the Webber's South Plaza. She leaned on the column with her eyes closed and face upward trying to grasp the last few minutes to enjoy the available sunlight.

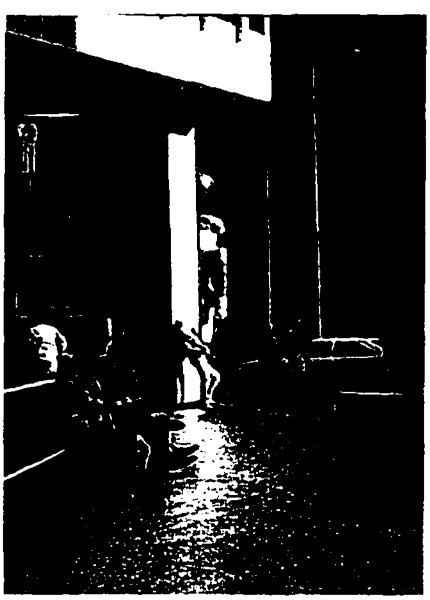


Photo III-20 Staying in Sunlight (Webber's S.)

* 2:50 p.m., five people are sitting on the ledge of the northeast corner of the plaza — the only area exposed to sunlight, and they are the only users in the plaza now. 2:56 p.m., when the shadow is approaching two of the users, they stood up and left the plaza. A middle aged man wearing a trench coat sitting next to them also stood up. However, instead of leaving, he moved further to the corner in order to stay in the sunlight a little longer. 2:59 p.m., another man is in the shadow now, he stood up and left. 3:00 p.m., the shadow is reaching the lady who is reading newspapers. She stood up and walked toward the Seagram Building. Now, the only one left in the plaza is the middle aged man wearing a trench coat. He moved to the far side of the northeast corner again to stay in the sunlight for a few more minutes. 3:03 p.m., the whole plaza is in the shadow now. The man got up and left. Now, the plaza is empty (Field notes, Seagram Plaza, Mar. 9, 1989, 40°F, sunny).

Tracing sunlight to sit or stand is a choice, and also a reflection of the decisional control mechanism. Observations showed that sunlight alone was not enough to attract people to come to an urban space and stay there in winter. However, if it was available, people still preferred to stay in it.


Photo III-21 Eating (St. Andrew Plaza)

C. Eating and Drinking

Most of the urban spaces in midtown and downtown Manhattan function as open air lunchrooms in warm seasons. After a whole morning's hard work in sealed spaces, people brought their brown bags and gathered in these spaces for a break. They ate, drank, talked, enjoyed the sunlight and fresh air, and they also engaged in social contacts. In winter, when the temperature dropped, fewer and fewer people stayed in urban spaces for lunch. However, even on very cold days of around ten or twenty degrees (Fahrenheit), eating and drinking behavior could still be found in urban spaces. It seems that slippery ice or heavy snow cannot totally expel such behavior from urban spaces (see Photo III-21).

1. Eating and Drinking Rate

Eating and drinking rate is defined here as the percentage of users who involved either drinking or eating behavior (or both) among all the users during their stay in the urban space. This rate differs to some extent from one urban space to another. For example, the eating and drinking rate at Time & Life Plaza was:

Around 30°F, 5% to 10%

Around 40°F, 20% ±

Around 50°F, 30% +

At General Motors Plaza, the rate was lower than that of Time and Life Plaza when the temperature was at the 40°F and 50°F level::

Around 30°F, 5% to 10%

Around 40°F, 10% ±

Around 50°F, 10% to 20%

In spite of the differences between these two plazas, their eating and drinking rate both had a linear regression relationship with temperature (see Figure III-6, III-7). This kind of linear regression relationship

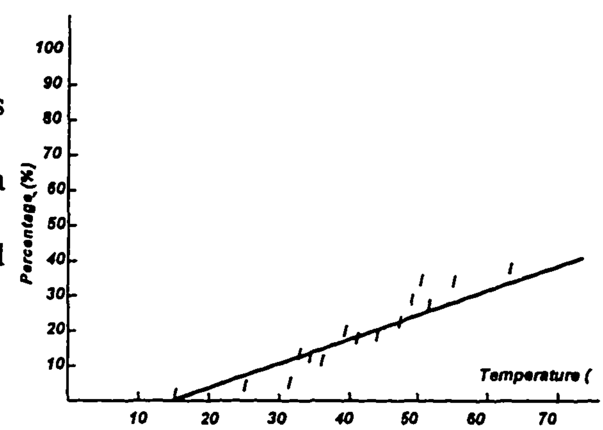


Figure III-6 Eating/Drinking Rate at Time & Life Plaza

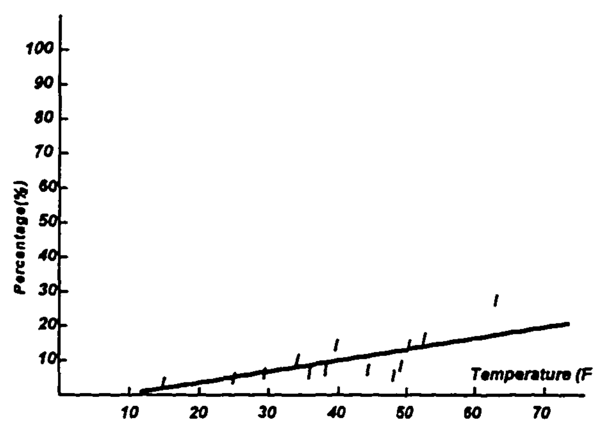


Figure III-7 Eating/Drinking Rate at General Motor's Plaza also applied to Seagram Plaza, 1155 6th Ave. Plaza and Herald Square Park, etc. Therefore, It is safe to say that this is a popular phenomenon of urban spaces in midtown and down town Manhattan.

2. Sitting to Eat, Standing to Eat, and Temperature Change

Most of the eating and drinking behavior in urban spaces was combined with sitting in warm seasons. However, with the decrease in temperature, a greater proportion of people chose to stand while eating or drinking. Let us take General Motor's Plaza as an example, when the temperature was above 50°F, standing while eating and drinking only occupied less than 10% of the total eating/drinking behavior. When it was about 40°F, this rate went up to more than 50%. When the temperature dropped below 30°F, this rate was almost 100% (Figure III-8). A similar linear relationship was also found at 1155 Sixth Avenue Plaza and Seagram Plaza. All these show that there is a negative correlation between the rate of standing while eating or drinking and temperature, and also a linear regression relationship between the two.

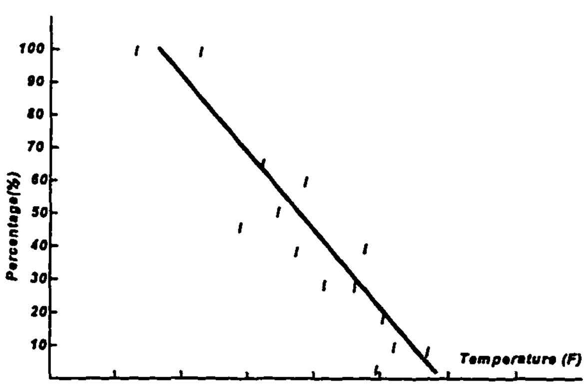


Figure III-8 Standing while Eating/Drinking Rate at General Motor's Plaza

3. Eating and Use Density

Eating and drinking together in outdoors is often associated with a kind of festive atmosphere of celebration (Leonard & Leonard, 1995). This is true not only in warm seasons but also in winter. Along 50th Street near the corner of 6th Avenue between the Time & Life Plaza and the Exxon Plaza, there used to be the densest cluster of food vendors in New York City. There were always about ten vendors on each side of the street. The smell of various ethnic food filled the air. People waited in line at each vendor stand. Some of them ate in the plazas right after buying. During this process, waiting for friends, exchanging hellos, introducing friends, talking, smoking, reading etc. were all the accompanying behavior patterns that could be easily seen. It was "steaming hot" here even on the coldest days. However, since the Rockefeller Center Authority decided to prohibit food vendors from the area in 1993, these once a bustling places with people and activities suddenly looked cold and cheerless. The vendors have gone and so has the life of the space brought about by them.

J. C. Penny North Plaza is located at the southwest corner of the intersection of the 6th Avenue and the 53rd Street. It is a strip plaza facing the north without sunlight during the whole winter. Obviously, its micro-climatic conditions are not good. However, since there is a busy restaurant (Lou's Cafe) in this plaza, which also has a patio in warm seasons, a continuous stream of customers makes this plaza a live one. Vendors soon nosed this out , and nearly a dozen of them gathered on the sidewalk including two selling small tourism gift items. After food vendors were "kicked out" of Time & Life Plaza and Exxon Plaza, J. C. Penny North Plaza has become the densest gathering place of food vendors in New York City. "Food attracts people and people attract more people" (Whyte, 1980, p.52). For this reason, J. C. Penny North Plaza on the contrary had a significantly higher "use density" than that of the J. C. Penny South Plaza (0.49 vs 0.11 in winter, 0.79 vs 0.21 in the sub-marginal periods, and 1.99 vs 0.39 in the marginal seasons).

Observations showed that almost all the plazas with a restaurant open directly to the main part of the plaza had relatively higher "use density" than those without it, e.g. Exxon Plaza, General Motor's Plaza, Urban Plaza, and McGraw Hill Plaza etc. (see Table III-1).

C. Smoking

Since the early 1960's when smoking regulations were first imposed, many states, cities, even big companies across the United States have tightened their own anti-smoking regulations.

In 1964, Los Angles banned smoking on its public buses.

In 1987, Aspen, Colorado, banned smoking in all restaurants.

Since February 1993, it has been illegal to light a cigarette in an outdoor cafe, bar, or any restaurant in Davis, California.

Washington has become the first state in America since March, 1994 with a general smoking ban in both public and private offices.

New York City joined the national movement toward snuffing out cigarettes in public. In 1987, it banned smoking in most of the work places and some indoor public places. In January 1995, the most strict anti-smoking bill in the whole country was officially signed in New York City. It is this "Smoke Free Air Act" that bans smoking in virtually all indoor public

Photo III-22 Smoking at the Entrance (1)

Photo III-23 Smoking at the Entrance (2)

places except the designated, separately ventilated smoking rooms. For the first time in New York City, smoking is prohibited in outdoor seating areas of sports and recreational arenas. Nowadays, smokers feel it is more and more difficult to find a place to smoke, and smoking is increasingly becoming a private act. All these have a profound influence on the public life of outdoor urban spaces especially in winter. In recent years, standing at the entrance or under the porch of office buildings to smoke has become an increasingly popular phenomenon (Photo III-22, III-23). Since most of the office buildings do not provide separately ventilated smoking areas, smokers have to go outside to smoke. Some buildings even prohibit smoking near the entrance and smokers have to walk more than twenty steps away from the building entrance before they can light up a cigarette. All these have caused a dramatic increase in smoking rate among users of urban spaces, especially in corporate plazas. In winter, when general users gradually disappeared in plazas because of climate reasons, smokers still stayed there summoning clouds and puffing fogs. Smoking, as a kind of addictive (necessary) activity, happens under almost any climatic conditions.

1. Smoking Rate

When the weather got colder, smoking rate (the percentage of smokers among all users) in the plazas got higher steadily. Observations in General Motor's Plaza and Time & Life Plaza showed that when the temperature was at 50 °F and higher, the smoking rate was about 20%;

when the temperature decreased to the freezing point (32 °F and lower), this rate increased to about 30%; when the temperature went down further to about 20 °F, the rate was more than 50%. These are the results from instant recording. The continuous observations and recording in 1155 Sixth Avenue Plaza showed that the actual smoking rate was even higher. Around 50 °F, it was about 20%; around 40° F increased sharply to about 50%; around 30°F, it was about 60%; and when temperature dropped to 20 °F and lower, the smoking rate was more than 70%, which means that when the temperature was at the freezing point or lower, most of the plaza users were smokers (see Figure III-9).

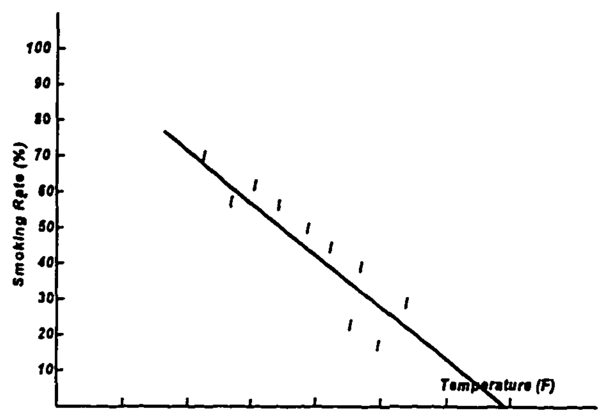


Figure III-9 Smoking Rate of 1155 6th Avenue Plaza

Let us take the 1155 6th Ave. Plaza as an example to analyse smoking behaviors in detail. 1155 6th Ave. Plaza is located at the northwest corner of the intersection of the 6th Ave. and the 44th Street in New York City. It is a street corner plaza facing the south. On a sunny winter day, most of the time it is exposed to solar radiation directly during lunch hours and protected from northwest wind by the surrounding buildings. Let us analyse the data from three days observation of this plaza in January and February, 1994 to see how smokers were distributed in the plaza, how long they stayed, and what they did there, etc. It is likely that the facts revealed here are very typical of corporate plazas in New York City. (See Table III-2).

Table III-2
Climatic Conditions, Number of Users, Smokers and Smoking Rate in Three Observations

Observation	Date	T (°F)	Sunny	Wind	Total User	Total Smoker	Smoking Rate
1	01/21/94	22°F n	Sunn y	2-3	82	56	0.683
2	01/31/94	32°F	P. Sunny	2-3	108	67	0.690
3	02/17/94	42°F	Sunny	3-4	128	62	0.484

These observations were basically conducted under sunny, mild wind weather conditions during lunch hours (11:30 am - 2:00 pm). When the temperature went up, the smoking rate in this plaza went down steadily. This is consistent with the findings in General Motor's Plaza and Time & Life Plaza. The only difference is that the smoking rate in this plaza was much higher at corresponding temperatures. Another finding is that when temperature went up, the total number of users also went up steadily, however, the total number of smokers was changed only slightly. The same phenomenon was also found at GM Plaza and Time & Life Plaza (see Figure III-10, III-11). This means that each of these plazas holds a relatively stable smoking population. These people showed up under almost all weather conditions.

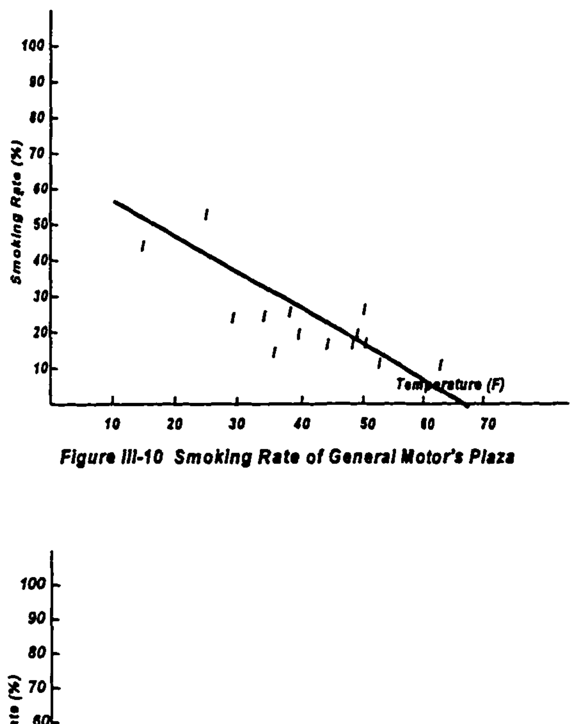


Figure III-10 Smoking Rate of General Motor's Plaza

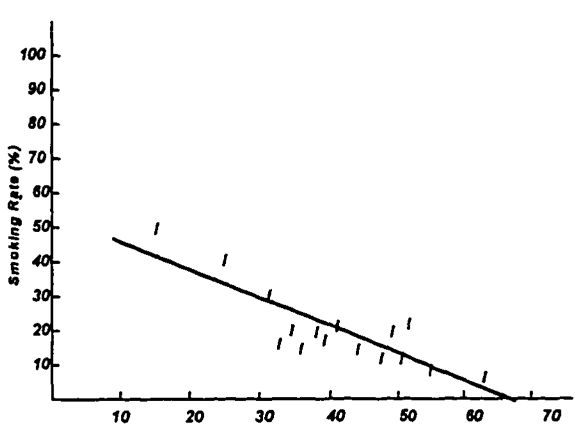


Figure III-11 Smoking Rate of Time & Life Plaza

The above analysis is based on the

observations of several corporate plazas. However, the findings obtained from observations conducted in Herald Square Park did not support these findings. There was no such phenomenon in this small park that when temperature went down the smoking rate went up. The smoking rate

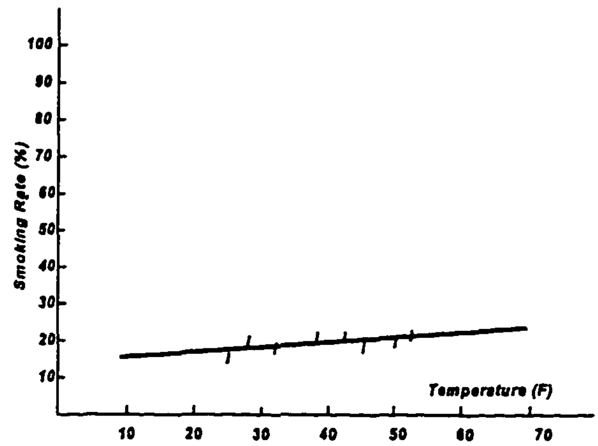


Figure III-12 Smoking Rate of Herald Square Park

in this small park was relatively stable at about 20%. The only change was the slight decrease in smoking rate when the temperature went down (see Figure III-12). Herald Square Park is a small triangular island located at the intersection of Broadway, 6th Ave and 34th to 35th Street. The surrounding area is a very busy commercial district. The so-called largest department store in the world, Macy's, is just across Broadway facing the park. Unlike corporate plazas whose users are predominantly office workers, the users group here is highly diversified: office workers from nearby buildings, shoppers, travellers, students, passers-by, vendors, and homeless people, etc. People came here for a break. Some of them might be smokers. However, people did not come to this park specifically for smoking. Smoking here was just an accompanying behavior of taking a break. So, the 20% smoking rate may be a reflection of the general smoking rate in the population around this area.

The findings of Herald Square Park suggest that the phenomenon that smoking rate is linearly and negatively correlated with temperature might apply to corporate plazas only or to other urban spaces which are closely adjacent to work places.

2. Spatial Distribution of Smokers

With respect to the distribution of smokers and other users, 1155 6th Ave. Plaza can be roughly divided into four areas:

A. Front flower bed

B. Rear flower bed

C. Main entrance and portico

D. Entrance of Hallmark gift store (see Figure III-13, III-14, & III-15)

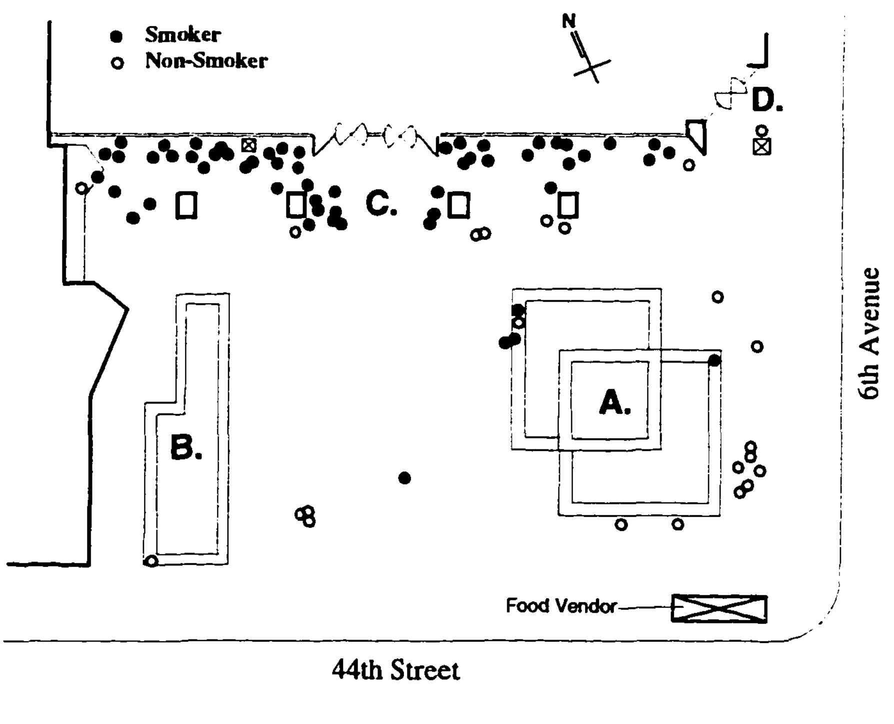


Figure III-13 Spatial Distribution I of Smokers at 1155 6th Ave. Plaza (18-22 degree F)

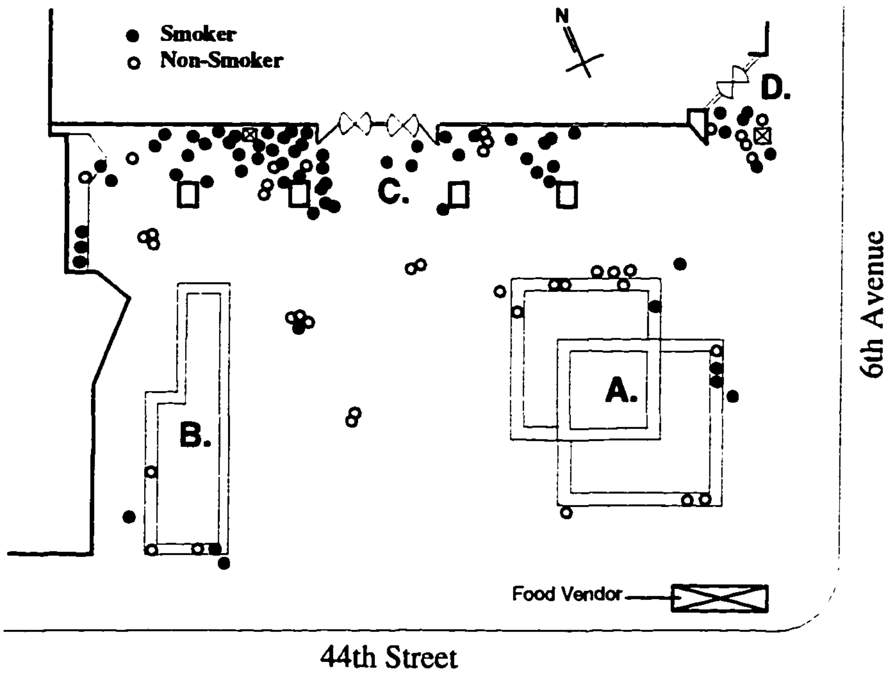


Figure III-14 Spatial Distribution II of Smokers at 1155 6th Ave. Plaza (30-32 degree F)

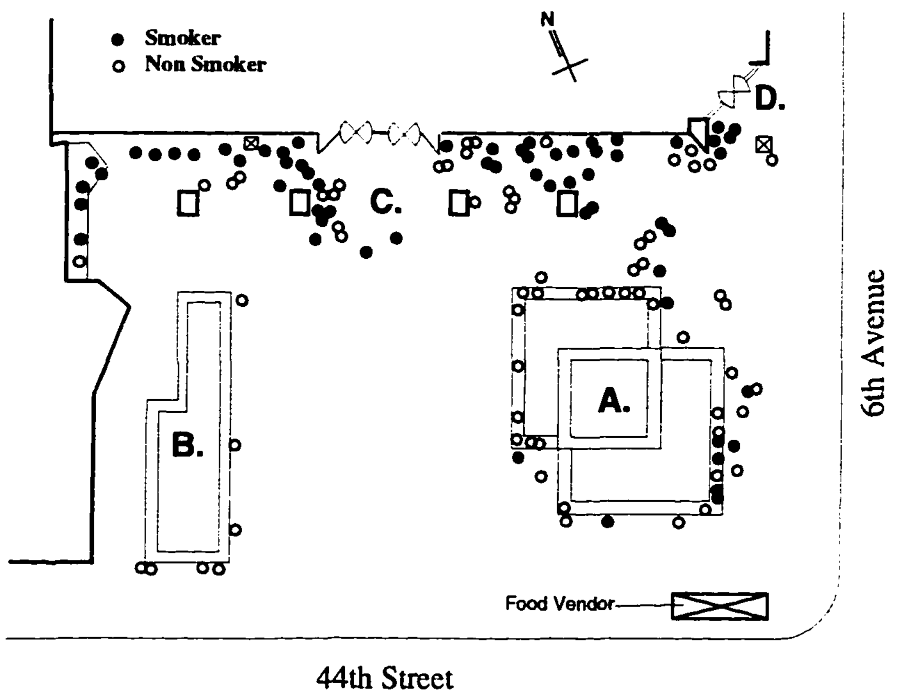


Figure III-15 Spatial Distribution III of Smokers at 1155 6th Ave. Plaza (36-42 degree F)

From Figure III-13. To Figure III-15, we can see that most of the smokers stood near the main entrance and under the portico (Area C --- more than 50%). They stood against the wall or near the column, or facing the window. Very few smokers stayed in other three areas (A , B, and D). However, when the temperature increased, the percentage of smokers staying in area A, B, and D increased slightly, especially in the front flowerbed area (Area A) and the percentage of smokers staying in area C decreased (see Table III-3).

Table III-3
Spatial Distribution of Smokers

Observation	Area A	Area B	Area C	Area D	Other Areas	Total
1 (22°F)	3 (5.4%)	0	52 (92.9%)	0	1(1.8%)	56 (100%)
2 (32°F)	5 (7.5%)	3 (4.5%)	52 (77.6%)	6(8.9%)	1(1.5%)	67 (100%)
2 (42°F)	10 (16.1%)	0	47 (75.8%)	5(8.1%)	0	62 (100%)

The distribution of smokers in this plaza was consistent with the "edge effect" concept which argues that edge areas of an outdoor urban space are the preferred zones for people to stay. This will de discussed further in the next chapter.

Most of the smokers in this plaza were office workers from the dominant building. The portico area provided them with an ideal place to smoke, convenient to get in and withdraw. Here, they were protected from snow, rain and cold wind, exposed to sunlight, and able to observe comfortably things going on in the plaza and on the streets from a small space.

3. Smoking Behavior

Observations show that most of the smokers in the 1155 6th Avenues Plaza came from the main office building of the plaza, and more than half of them stood under the portico with only indoor clothes. They usually finished smoking one cigarette and went back to the building immediately. Some of the smokers just lit a cigarette and smoked deeply two or three times before they ceased, and then went back to the office. It seemed that they had an urge to smoke and just came out in a hurry to satisfy the craving.

Some of the smokers from the main building were wearing outdoor clothes. They usually stayed longer. I noticed that a middle aged man with dark grey overcoat came out almost once very hour and smoked three cigarettes each time. He usually stayed more than ten minutes. Most of the smokers with outdoor clothes stayed longer than those with only indoor clothes.

Some people paced to and fro under the porch during smoking; some held a cup of coffee drinking while smoking. In each of the three days' observations, there were people standing under the porch reading a newspaper while smoking.

On the west side of the main entrance was the window of a news-stand within the building, and the merchandise in this window provided smokers with something to look at when they stood there smoking. The windows of the Hallmark Store on the east side of the main entrance functioned the same way.

Table III-4
Numbers of Standing, Sitting, with Indoor and Outdoor Clothes Smokers

Observation	Standing		Sitting		Indoor Clothes		Outdoor Clothes		Total	
	#	%	#	%	#	%	#	%	#	%
1 (22°F)	52	92.9	4	7.1	26	46.4	30	53.6	56	100
2 (32°F)	59	88.1	8	11.9	31	46.3	36	53.7	67	100
3 (42°F)	51	82.3	11	17.7	39	62.9	23	37.1	62	100

Table III-4 gives us a brief summary of the percentage of smokers sitting and standing, and of indoor clothes and outdoor clothes of smokers at the three different temperatures. We can see that when the temperature went up, the percentage of smokers sitting and smokers with indoor clothes increased slightly. Even when the temperature was around 20°F, nearly half of the smokers came out to smoke with indoor clothes only.

4. Length of Stay

When it became warmer and warmer, smokers tended to stay longer and longer in the plaza. The length of staying for smokers standing, smokers with indoor clothes and smokers with outdoor clothes all increased significantly when the temperature went up from 20°F to 30°F and to 40°F. The only exception was smokers sitting, as their length of stay did not seem to change much (see Table III-5).

Table III-5
Length of Stay of Smokers

Observation	Average Length of Stay (Min)	Standing Smoker (Min)	Sitting Smoker (Min)	Indoor Clothes Smoker (Min.)	Outdoor Clothes Smoker (Min)
1 (22°F)	3.41	3.14	5.80	2.13	5.04
2 (32°F)	4.36	4.16	5.86	2.44	6.19
3 (42°F)	5.41	5.09	5.50	3.48	7.26

The smokers from the 1155 6th Avenue main building usually stayed for a few minutes. It was very rare to find examples of smokers who stayed longer than ten minutes. However, some smokers who came from outside the building stayed up to one hour at about 40°F, a half hour at about 30oF, and 15 minutes at about 20°F.

Smoking issues make more complicated the study of the winter use of small urban spaces, especially corporate plazas. As a kind of addictive (necessary) activity, smoking behavior happens almost under any climatic conditions. The "use density" of plazas in winter seems to be influenced not only by the variables mentioned in this study, but also by the smoking population and the availability of the designated smoking rooms within the building directly adjacent to the urban space.

This gives rise to the higher "use density" at some plazas than others although the winter environmental conditions of these plazas are even worse than those of the latter, such as the West Point Stevens Plaza. It is a through block plaza sandwiched in by two high rise office buildings. The overhead skyway bridge connecting the two buildings presses down the vertical space of this plaza making it very gloomy. There are no seating spaces, no visual delights, and no sunlight during the whole winter. Obviously, it is not a friendly nor a pleasant space. However, almost every time when I arrived at this plaza during my fifteen-day counts, there were always some smokers standing there. Its " use density" in winter (0.24) and sub-marginal periods (0.55) were among the medium rank of all the urban spaces studied.

Under current smoking regulations, some smokers feel that they are being treated as pariahs. They are angry, resentful, cannot help but face a morass of law backed up by weak enforcement but strong peer pressure (Manegold, 1994). Whether smoking in corporate plazas in winter is only a transitional problem during the execution of the smoking ban or whether it will stay and become an important part of winter public life of these plazas will become a critical question. If the specifically designated smoking rooms increase in the near future, the percentage of smokers who are plaza users in winter may decrease gradually.

Then the smoking issue of corporate plazas in winter will not be a serious problem. Otherwise, since many smokers have to stay outside to smoke in the cold winter, especially the nearly half of them who are with only indoor clothes at the temperature below the freezing point, a serious health threat will become a serious issue. People already complained that there had been an increase of common cold or flu rate in work places in the past few winters. This could be related to outdoor smoking, which needs an immediate investigation. Some serious questions will also be raised for the planning, design and management of urban spaces, such as:

1. Who are the priority users of small urban spaces? Smokers or non-smokers? Will the smoking ban be extended to outdoor urban spaces?

2. Is it necessary to designate smoking area in outdoor urban spaces? If it is, where should it be located in the space? How can it be separated from other areas?

3. Is it necessary to create a smoker-friendly environment in these designated outdoor smoking areas? (such as providing passive solar facilities, visual delights, or pacing space, etc.)

These questions all need to be addressed and further explored.

D. Social Contact between Strangers

One of the important functions of urban spaces is to provide people with opportunities for participating in social activities in the public. This includes both active and passive contacts. The physical characteristics of an urban space can either promote or discourage social contacts which need to be carefully considered during the planning and design process.

1. "Triangulation"

In urban spaces, some elements can function as external stimuli to provide a linkage between people and promote strangers talking to one another. Whyte (1980) defines this process as "triangulation". My field observations revealed that picture taking frequently functioned as this kind of stimulus:

> * 1:45 p.m., an old gentleman (over sixty) wearing a grey down coat came to the park. He looks like a professional photographer with his camera hanging on his neck and a big camera bag on his shoulder. He took a few pictures of the monument in the plaza from different angles and then moved to the first bench at the southwest corner to take a few more pictures of the Macy's Department Store across the street. 1:50 p.m., a middle aged man with a camera entered the park from the north end. he walked toward the old photographer and asked him to take a picture of him with the monument as the background. The old man seemed very happy to help (Field notes, Herald Square Park, February 28, 1993, sunny, 32° F).

> * 1:54 p.m., a young girl in a bright color (red, white and green) down coat with her sunglasses on came to the park. She sat on the second bench at the northwest corner and took out a camera from her bag. She began to load film into her camera. But it seemed that something was wrong with the camera and she did not know what to do with it. The old photographer sitting on the adjacent bench noticed this. He got up and walked to the girl and offered his help. The girl stood up, and showed him the camera. He took it, and they both sat back on the bench. The old man examined the camera for a while and then explained something to the girl. She listened and nodded. She stood up again and watched him fixing her camera. 2:00 p.m., the camera was fixed. The girl hung the camera on her neck and thanked the old man again and again. They stood by the monument talking for a few more minutes (Field notes, same as above).

> * 2:40 p.m., a young man in his mid 30's came to the park. He squatted in the middle of the park in order to take a picture of the monument. he raised the camera and looked through the viewer. But he stopped, got up and walked toward a person sitting on the second bench of the northeast corner near the monument. They exchanged a few words. The young man came back to his former position squatted again and finished his picture. When he left the park, he spoke to that person on that bench again. Probably the young man asked that person whether he could include him into the picture, and it seemed that the person did not mind (Field notes, same as above).

Picture taking is a very popular activity at the Herald Square Park. The monument in the park is a most attractive object for this purpose. During the three-hour observations on February 28, 1993, 26 people were involved in picture taking activity among the 79 users recorded. This is a very high percentage (32.9%) and definitely means that there are some visual delights in this park which attract people's attention.

It is very interesting that ice and snow can also promote the "triangulation" process. The following examples happened during the same day's observation in Herald Square Park on March 15, 1993. The so-called "Century Winter Blizzard" had drawn New York City back to winter again during the past weekend. This was the sixteenth storm in the 1992/1993 winter.

> * The snow in the park is about a half foot deep. 12:35 noon, three people entered the park successively from the south end. They are apart from each other by two or three steps. A middle- aged woman wearing a black overcoat was walking in the front. When they approached the middle part of the park, the lady slipped and staggered. She struggled to balance herself but failed. She fell down on the ground. The middle-aged man behind her hurried up one step offering her a hand to help her on her feet and asked whether she was hurt. They talked and laughed all the way through the park and walked along Broadway toward the north. (Field notes, Herald Square Park, March 15, 1993)
>
> * 12:44 noon, people keep coming to the park in a stream from the south end. A middle-aged man in a navy trench coat quickly noticed the icy spot on the ground. He turned back to the lady behind him and alerted her of this. He held out his hand toward her to help her walk over the spot cautiously. (Field notes, Same as above)
>
> * 1:06 p.m., a young man wearing a black bomber jacket in his early 20s entered the park. Just as he passed that icy spot, a group of pigeons looking for food on the ground suddenly flew up flapping around him. He struggled to use his both hands to protect his face, but slipped and fell down. He sat on the snow ground laughing loudly toward me and other people sitting in the park, and we all laughed back. (Field notes, same as above)
>
> * The snow piled at the south end of the park is about two feet high blocking people's traditional crossing route. 1:35 p.m., an old lady in her 70's walked with difficulty

> along the sidewalk outside the park (the snow there has been cleared out). She stopped in front of the snow heap and hesitated. It seemed that she was not sure whether she could walk over. The two middle-aged ladies behind her noticed this, they almost stretched their hands at the same time. They held her arms from both sides to help her walk over the snow heap very cautiously and then cross the street to the Macy's. (Field notes, same as above)

From these examples we can see that snow and ice make people more sociable and more helpful toward each other.

A lot of other elements or behavior patterns can also stimulate the "triangulation" process, such as smoking. Since the smoking rate is high in the 1155 6th Avenue Plaza, the related social contacts between strangers took place frequently, e.g. borrowing a light with a brief exchange of conversation. Sometimes, some novel phenomenon can especially rouse people's curiosity and thus promote the "triangulation" process.

> * 1:03 p.m., two middle-aged men stood at the front flower bed talking. One of them seemed to find something and pointed at the central part of he flower bed to the other man. Then he stepped up bending over to look carefully at something there. The other man followed him. They talked about it looking quite excited. Their action attracted the attention of people nearby . A few of them joined to see what happened. It turned out to be that a bunch of orchid buds just emerged from the soil. Everyone looked very excited ---spring finally comes. People talked, argued and laughed. This "triangulation" show caused by the orchid buds lasted for about five minutes (Field notes, Mar. 30, 1994, 1155 6th Ave. Plaza, 46°F, cloudy).

> 1:25 p.m., a group of five old ladies came from the north along 6th Avenue talking all the way. When they turned at 44th Street to the west by passing through the 1155 6th Avenue Plaza, one lady saw the orchid buds and pointed at to her companions. They gathered round the flowerbed observing and laughing. People attract people. Soon, a few groups of other users crowded over --- another orchid buds "triangulation" show (Field notes, same as above).

The more the "triangulation" promoting elements there are in an urban space, the more lively the public life is in that space. In Herald Square Park, a lot of such elements could be found. For example, the window of the information board standing in the middle of the park contained displays of midtown Manhattan maps and some other exhibits providing information for travellers. Observations showed that this information window was frequently used by people. It provided not only information but also a place and opportunity for people to exchange information and offer help. Sometimes people have questions after reading the board. They turned to the passers-by for more information. And the latter usually were more than happy to offer help.

Asking the way, a brief exchange of conversation on the monument, and a talk with the homeless people in the park were a few more examples of social contact between strangers taking place in Herald Square Park. The rate of this kind of contacts taking place in this park was much higher than any other urban spaces studied. No doubt, "triangulation" has contributed greatly to this high rate.

2. Spatial Scale

Apart from "triangulation", spatial scale is another factor that contributed to the high rate of social contact among strangers in Herald Square Park. A compact urban space can provide people with more chances to engage in face-to-face interactions. Even the passive contacts by sensing other people's existence within a compact space can promote a more intimate sensory involvement. This is particularly important in winter. This will be discussed further in the next chapter.

CHAPTER IV

PHYSICAL CHARACTERISTICS AND THE WINTER LIFE OF URBAN SPACE

The physical characteristics of an urban space include many elements, such as its spatial characteristics, visual diversities, and edge facilities. They all influence the winter life of urban spaces in different ways and to different degrees. Their overall influence determines the degree of user-friendliness of the space. The congruence between the physical characteristics of the space and users' behavior is a preliminary requirement of a successful urban space.

A. Spatial Scale

Participant observations showed that there was a relatively high level of social contact occurrence at Herald Square Park. Apart from the surrounding urban context and its own visual delights, the spatial scale of this park is also a contributing factor. Herald Square Park is a very compact urban space with the Herald Monument at the north as its visual focus. The main sitting area is just about 35 by 80 feet and the two rows of wooden benches are arranged face-to-face (Figure IV-1). Based on Hall's (1969) theory of "distance in man", Ashihara (1970) translated the application of architectural height-distance relationships into human interactions. He demonstrated that in the design of exterior space, a modular unit of 70 to 80 feet is useful and appropriate, and he called it "70-foot

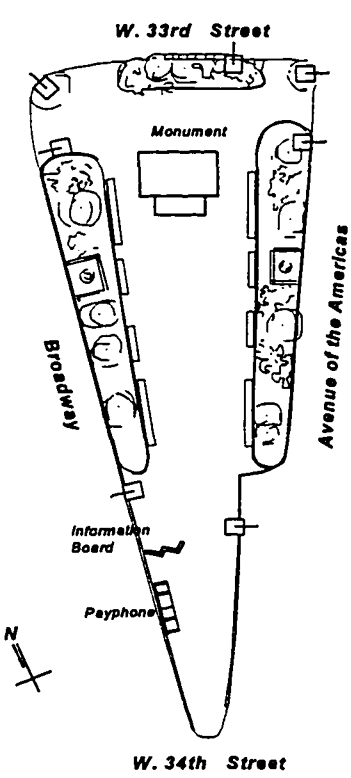


Figure IV-1 Herald Square Park

modular unit method." Actually, this is also the distance between the last row of seats and the stage in some theatre. Within this distance (70~80 feet or about 25 metres), people can identify each other's facial expressions, learn about other people's talking and laughing under the typical urban background noise level (60~70 dBA), namely, people can keep close sensory involvement among themselves. Measured by this standard, it is obvious that the main sitting area of Herald Square Park has an intimate exterior spatial scale. Social activities are all activities that depend on the presence of others in public space. This includes both active and passive contacts. A compact urban space can provide people with more chances to engage in face-to-face interactions. Even passive contacts by sensing other people's existence within a compact space can promote a more intimate sensory involvement. This is particularly important in winter. Being close to other people, one can have a feeling of warmth that will make the cold climate more tolerable. Such a compact urban space can also function as a street performance arena which could seldom be found in other urban spaces studied (Photo IV-1).

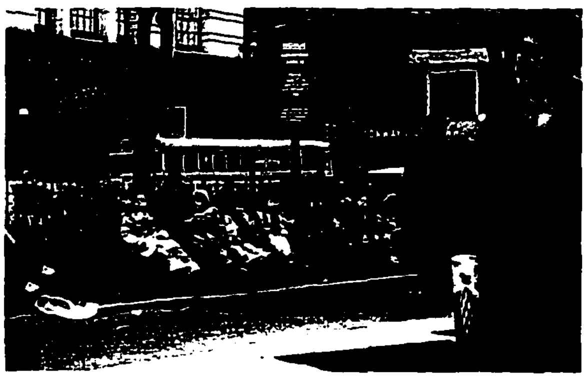


Photo IV-1 Herald Square Park

Among all the 32 NYC urban spaces studied, smaller urban spaces usually had higher use densities, and higher use density means smaller distances among people within the space and thus people have the possibility for more intimate sensory involvement among themselves. A too spacious urban space is not welcomed especially in winter. Grace Plaza is a typical example. It is about 100 feet in the south-north direction and about 220 feet in the east-west direction. Its area is about twenty two thousand square feet. There is almost no amenity except a long stone bench near the bare south wall (Figure IV-2). There used to be a 50 by 50 feet sub-space at the northwest corner. It was said that there were always some drug dealers using this sub-space and therefore it was eliminated. And now everything in this plaza can be taken in at a glance. Grace Plaza is at the lowest used urban space rank. Another interesting case is Seagram Plaza. It is heavily used in summer and warm seasons, whereas in winter, it is one of the least used plazas. Its spacious scale is one of the reasons that contributes to this. An urban space needs to have an human exterior spatial scale. This lies in three aspects. Firstly, the scale of the urban space itself, namely at least one dimension of the space, should be within or around the "70-foot modular unit". If the space is too big, it needs to be sub-divided according to either functional or formal requirements. In this way, each of the composing parts will be within the "70-foot modular unit" scale. In most of the urban spaces which have relatively high "use densities", there always exists this kind of division. Take Rockefeller Center Plaza for example. The whole plaza is composed of five obvious parts, the promenade between the British Building and the Francis Mansion, the sunken plaza, the north and south platforms, and the conjunction area between the promenade and the sunken plaza (Figure IV-3). At each of the five parts, there is at least one dimension which is within the "70-foot modular unit". The General

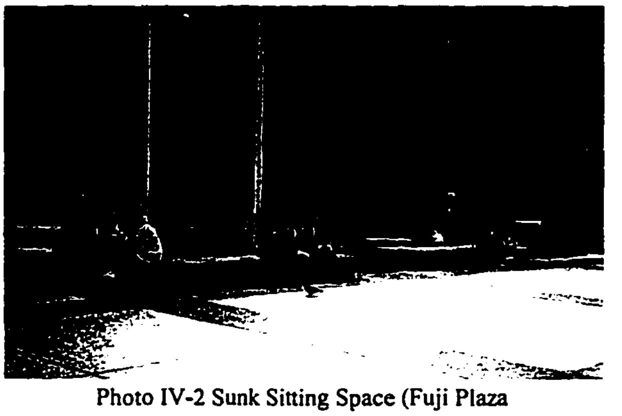


Photo IV-2 Sunk Sitting Space (Fuji Plaza

Motor's Plaza can be easily divided into four major parts: the sunken plaza, the porch and the front area, the south and north platforms (Figure IV-4). The sunken plaza is the largest one among the four, which is divided further by stairs and flowerbeds. And each component of the plaza is within the "70-foot modular unit" scale. The Time & Life Plaza (Figure IV-5), the Exxon Plaza (Figure IV-6) and the McGraw Hill Plaza (Figure IV-7) all have such a division. Second, within the entire urban space there should be sub-spaces with an "intimate interior spatial scale" (Ashihara, 1970) of about one hundred square feet (10 m^2). As an interior space, such a scale is suitable for a couple in a very romantic situation. And as an exterior space, it is suitable for a small group (3-5 people) to sit together talking and laughing. The sunken area at the front part of 345 Park Avenue Plaza is divided into several such small spaces (Photo IV-2). This sunken space is the most popular area of the whole plaza and is fully filled with people in warm seasons. Such a small space provides people with an opportunity to observe what is happening in the big space with their back protected, which is a kind of psychological comfort. Third, the ground level facade treatments of the buildings surrounding the urban space, and the various amenities and signs within the space should also have a human scale. All these elements should be related to pedestrians' scale and pace (Tibbalds, 1992). Whether an urban space has a human scale in these aspects influences if it is a "people friendly" space which invites people to stay. This has a particular significance in winter.

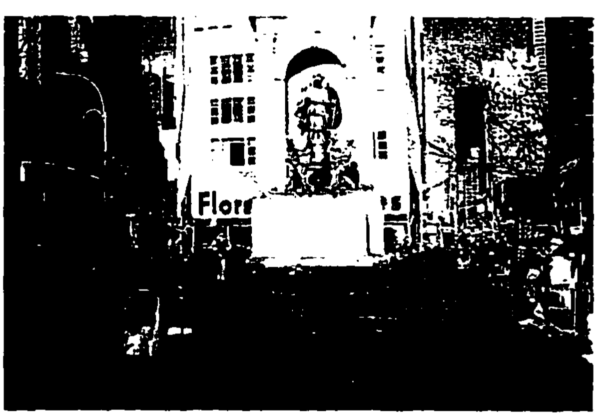


Photo IV-3 Herald Square Park

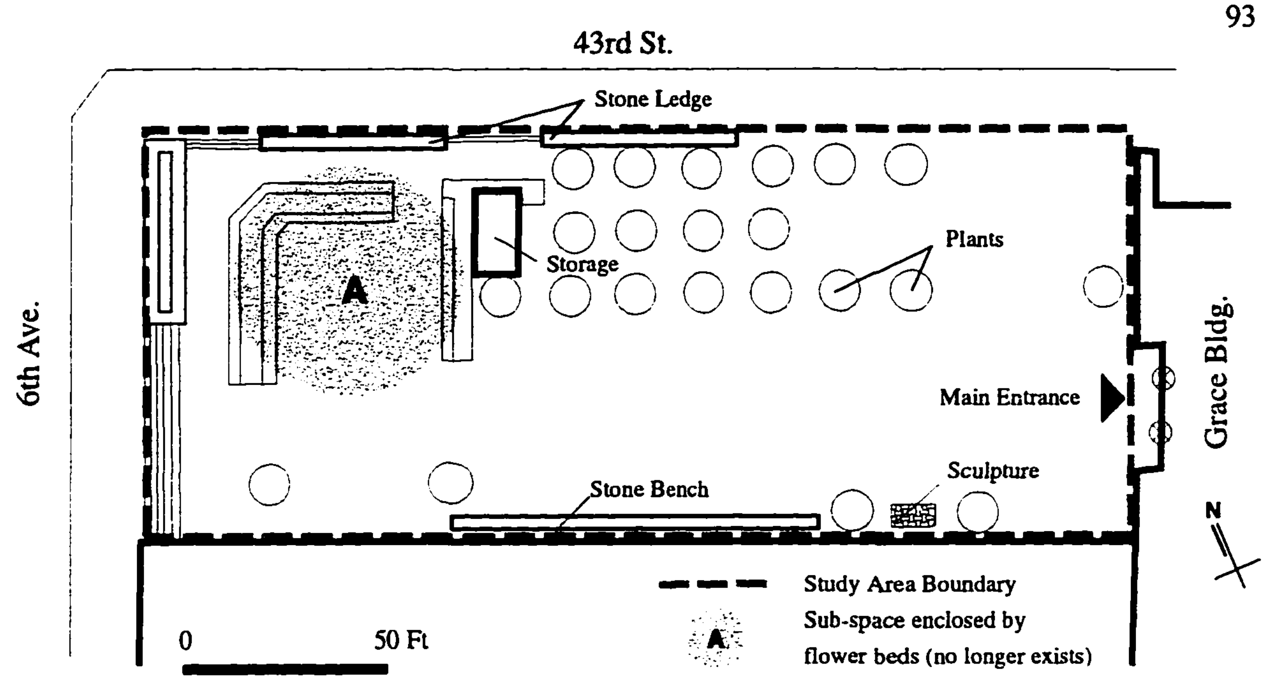


Figure IV-2 Grace Plaza

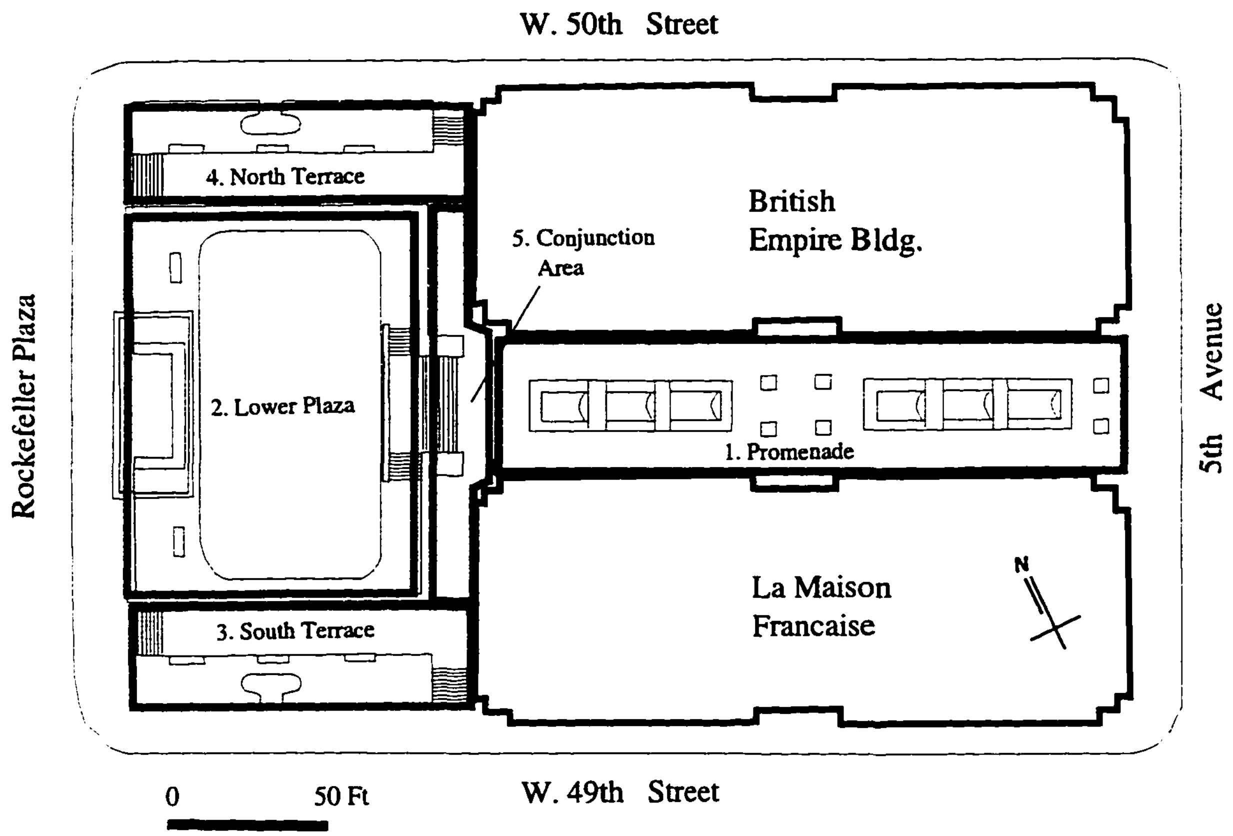


Figure IV-3 Rockefeller Center Plaza

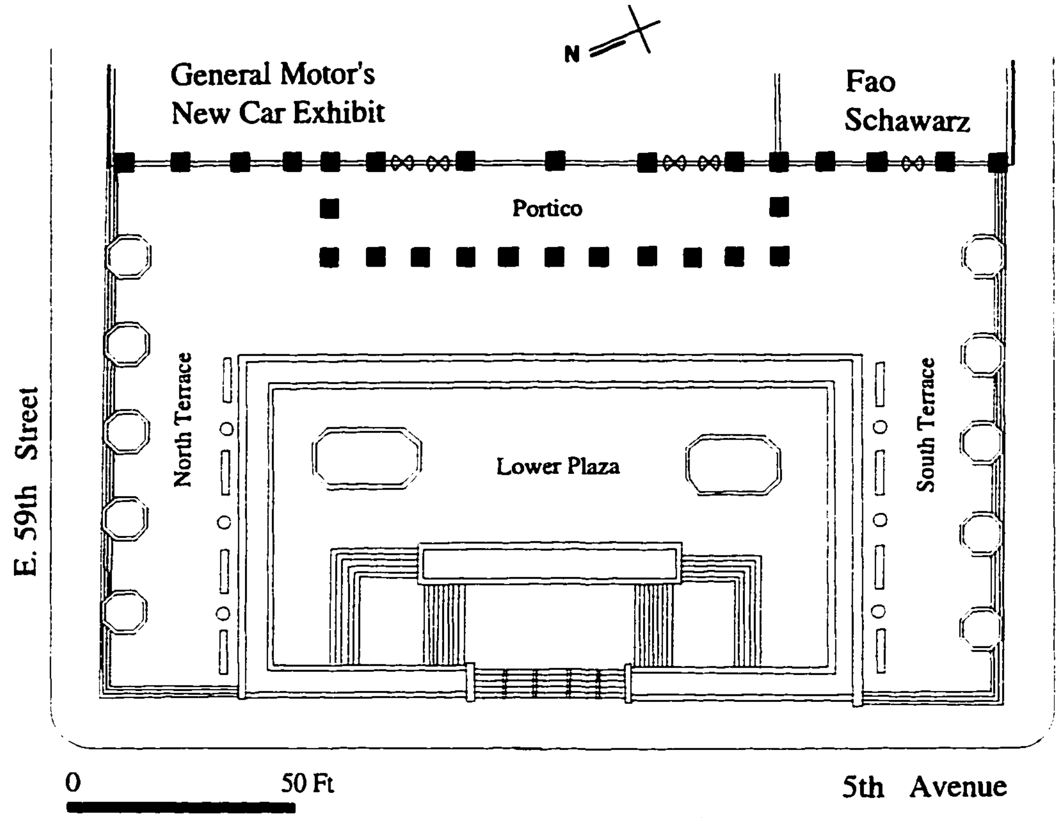


Figure IV-4 General Motor's Plaza

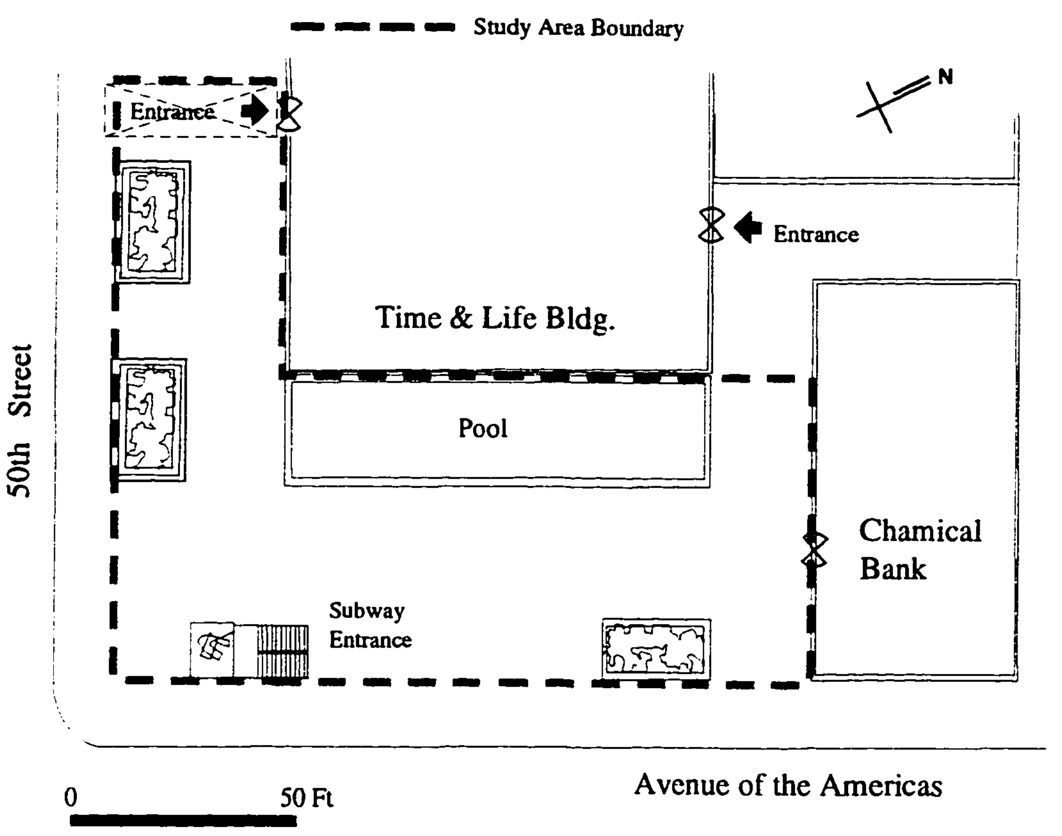


Figure IV-5 Time & Life Plaza

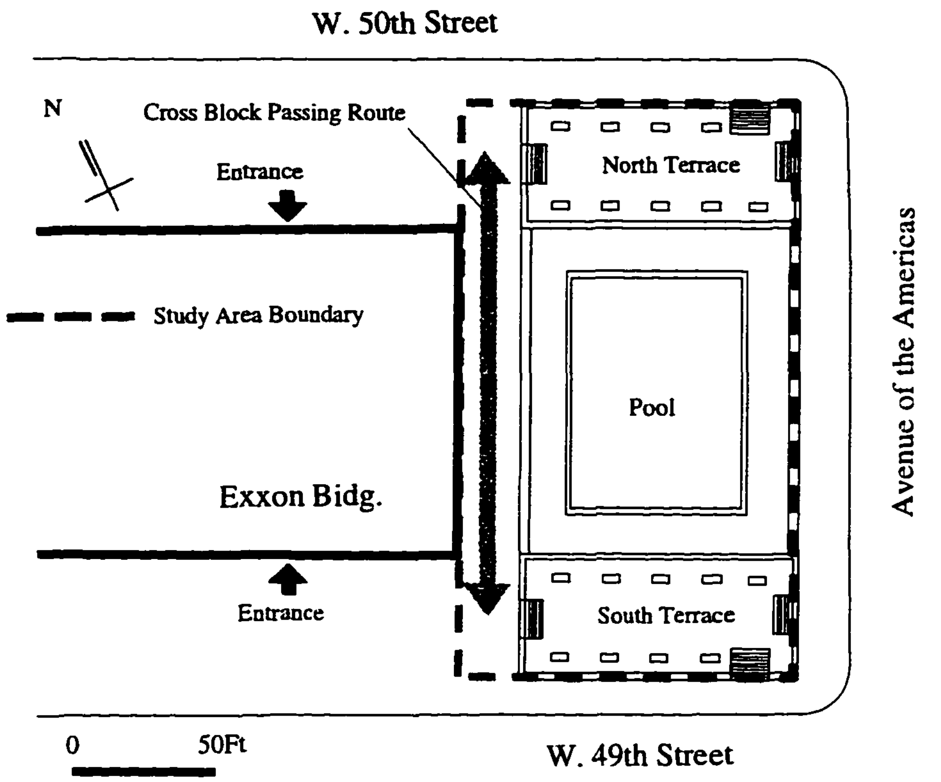


Figure IV-6 Exxon Plaza

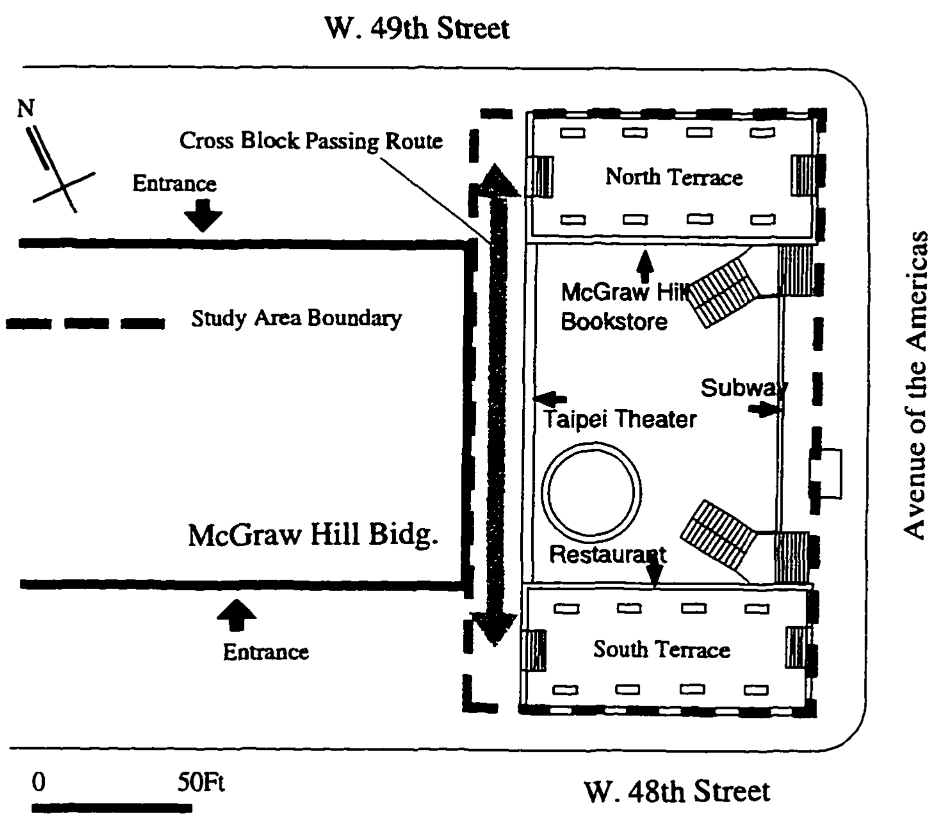
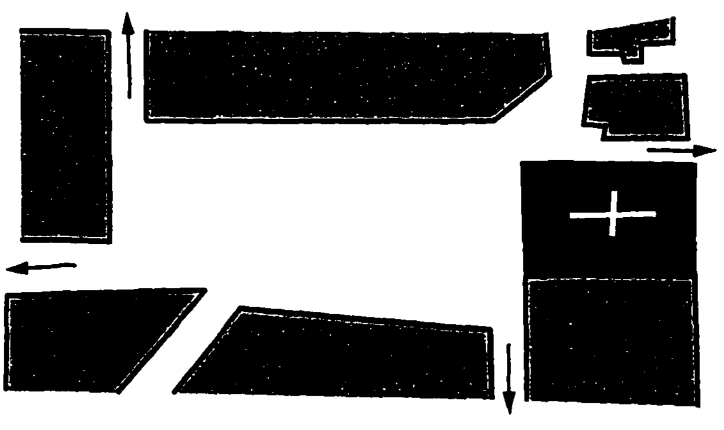


Figure IV-7 Mcgraw Hill Plaza

B. Enclosure and Openness

Camillo Sitte analysed a large number of European plazas and city squares and found that the urban spaces which are frequently used by people and filled with vitality are those with two properties: first, they are partly enclosed, and second, they are partly open to another urban landscape (Collins & Collins 1988). People usually want an urban space to have some degree of enclosure, a distinct and definite shape converging inward from the enclosing edges, namely, with a centripetal tendency. Within such a "positive space" (Alexander et al, 1977), people can feel comfortable and organize various activities in a planned, intended way. Whereas those shapeless, centrifugal and "negative spaces" are always leftovers, seldom used for public activities.

However, the need for enclosure is not easy to explain. It may go back to the human's most primitive instincts of obtaining security and intimacy when they look for a place to sit outdoors (Alexander et al, 1977; Ashihara, 1983; Whyte, 1980). Cullen (1961) holds that enclosure is the most powerful device to instill a sense of position, of identity with the surroundings embodying the idea of hereness, whereas the openness, or looking out of enclosure will create a sense of thereness. It is these two qualities that the spatial drama of relationship is set up. Figure IV-8 shows the plan of Piazza del



(Source: Collins & Collins, 1986)

Figure IV-8 Piazza del Duomo (Ravenna)

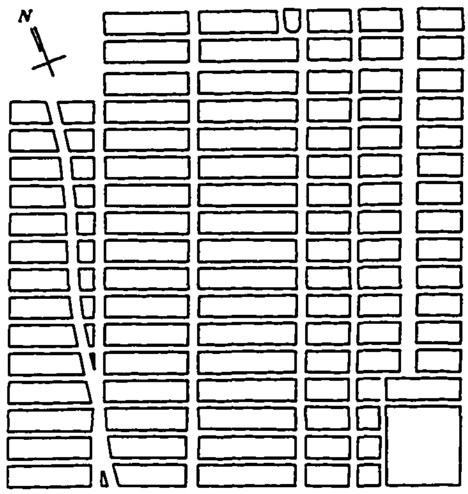


Figure IV-9 Grid Plan City Structure of Midtown Manhattan

Duomo in Ravenna. We can see that there is only one street entering the Piazza at each corner forming a shape of turbine blades. In this way, from any point within the Piazza no more than one single view out of it is possible at a time. Therefore, there is also only one single interruption in the enclosure of the whole. If we take a look at the urban spaces studied in New York City, no such similar example can be found. This is because of the disrupted sense of enclosure by the streets at the four corners of the urban spaces within a regular grid plan (Figure IV-9). Among all the urban spaces studied, Rockefeller Center Plaza is the only one which has a four-side enclosure. However, it still cannot escape the interruption of enclosure at its northwest and southwest corners (Figure IV-10). But its lower plaza creates four solid “inside corners” (Ashihara, 1983) that produce, in exterior space, the sensation of being “inside”. It is believed that this sensation of enclosure is one of the reasons which contribute to the popularity of Rockefeller Center Plaza. The new Rockefeller Center System buildings along the west side of Sixth Avenue built in 1960s have a plaza in front of each high-rise building (Celanese, McGraw Hill, Exxon and Time

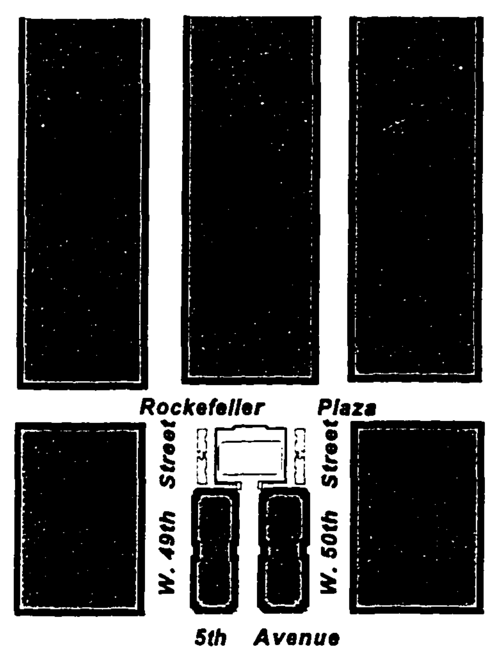


Figure IV-10 Rockefeller Center Plaza within a Grid Plan

& Life). None of these plazas have the sense of enclosure of the original although there is a similar sunken plaza in the McGraw Hill Plaza. The popularity of these plazas is far lower that the original Rockefeller Center Plaza. It seems impossible to build Italian style plazas within North American city structures. Even the kind of enclosure the original Rockefeller Center Plaza has is difficult to realize. Whereas the plaza with two sides enclosed like the Time & Life Plaza and the 1155 Sixth Avenue Plaza is possible. This kind of plaza with its west and north sides enclosed gives people the preliminary feeling of enclosure. Both plazas face to the south and are free from the dominant winter wind. Therefore, they have relatively good micro-climatic conditions in winter. Observations showed that the Time & Life Plaza was among the top five urban spaces studied in terms of winter "use density" (0.75), and 1155 6th Avenue Plaza had a moderate winter "use density" (0.27). However, the orientation of this kind of two-side enclosed plaza is very important. Grace Plaza has a similar layout but open to the north and west. It is windy and has no sunlight in winter and its winter "use density" is among the lowest. The "urban pocket" or "vest pocket", frequently mentioned in winter city literature (Pressman, 1985; Pressman & Epic, 1986), is a kind of urban space with both enclosure and openness. It is enclosed on three sides facing to the south, such as the Urban Plaza in New York City (Figure IV-11). It is usually located at the north side of a street and since it is open to the south, it is sunny and wind free in winter. It is highly possible for an "urban pocket" to be a well used

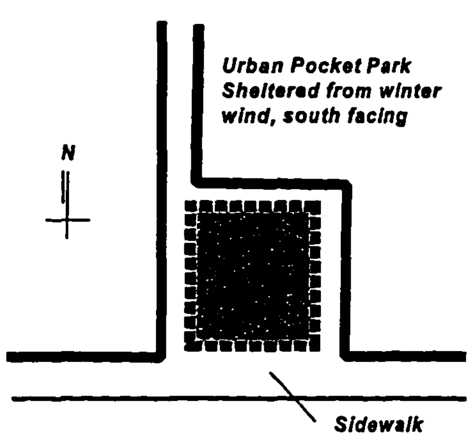


Figure IV-11 Urban Pocket Park

urban space in winter if it is well designed with respect to scale, enclosure and openness, and of spatial hierarchy, edge effect and visual diversity which will be discussed in the following sections.

C. Spatial Hierarchy

The spatial hierarchy here includes two aspects: the hierarchy of the space itself --- small spaces within the big space and the hierarchy between privacy and publicness.

1. The hierarchy of the Space Itself

In the section on spatial scale, we have already talked about the issues of smaller spaces within big spaces and their scales. When people stay in outdoor spaces, they always look for some small spaces where their backs can be protected and from which they can observe the landscape of and activities within the big space. The way people occupy spaces is a kind of instinct related to the requirements of security which can be traced back to cave dwelling periods (Alexander et al, 1977; Gehl, 1987; Hall, 1969; Whyte, 1980). We may call this kind of instinct the "dependency" of people in their environments. That is, people like to observe a big space from a small space with something to depend on. Therefore, a space where people feel comfortable staying usually has two characteristics: first, it is a small, partially enclosed, space or it has something that people can depend on as a back; and second, it has a view into a larger

Photo IV-4 The Northwest Corner of 1155 6th Ave. Plaza

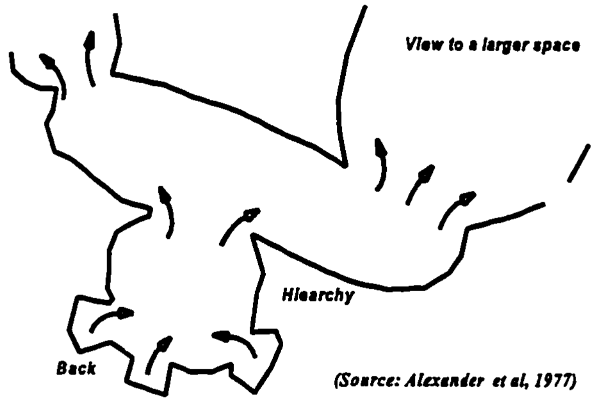


Figure IV-12 Spatial heracky

space (Alexander, et al, 1977). Taking the 1155 Sixth Avenue Plaza as an example, the bench area at the northwest corner of the plaza is just such a space (Figure III-13). Observations show that this is one of the favorite areas within the plaza. Even when it was too cold to sit down, there were still some people either standing or wandering around in this area (Photo IV-4). Figure IV-12 is an illustration provided by Alexander, et al (1977) showing how this kind of spatial hierarchy can be formed.

2. The Hierarchy between Privacy and Publicness

Because of behavioral requirements, people often form behavior settings with different private-public degrees in outdoor spaces. In 1155 Sixth Avenue Plaza, the side of its front flowerbed facing Sixth Avenue (A) has the highest degree of publicness (Figure III-13). The passers-by who wanted to take a short break always stayed there. The other three sides of the front flowerbed (B, C, and D) and the porch area (E), the east side of the back flowerbed facing the plaza (F) have less publicness. Talking, reading, smoking, taking a longer break, eating and drinking often happened in these areas. The bench area at the north west corner (G) and the west side of the back flowerbed facing the wall (H) have the highest degree of privacy. Intimate behaviors were often seen in these areas. A similar publicness-privacy hierarchy could also be found at other urban spaces, such as the Seagram Plaza and the Exxon Plaza. At the Seagram Plaza, the front ledges have the highest publicness, where the plaza is connected to the Park Avenue sidewalk with people coming and going frequently. The north and south ledges next to the pools have less publicness. Long period stays involving reading, eating and drinking, etc. often happened in these areas. The east corner of the north and south ledges had the highest privacy. Dating could frequently be observed in these areas (Fig. IV-13). At Exxon, the ledge of the pool facing Sixth Avenue (A) had the highest publicness, and the ledge of the pool facing the Exxon. Building (B) had less publicness. The elevated north and south terraces of Exxon Plaza had the highest degree of privacy within this Plaza where long staying periods usually took place (Figure IV-6).

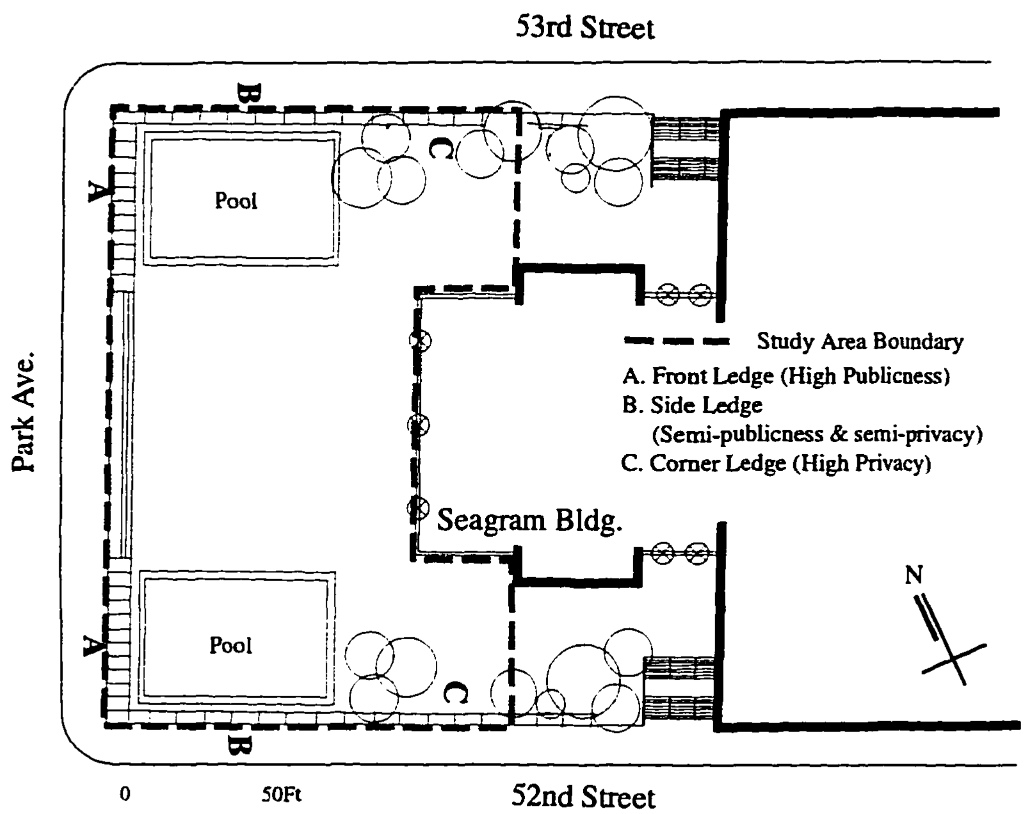


Figure IV-13 Seagram Plaza

The hierarchy of the space itself from the small to the big or from the inside to the outside is usually consistent with the hierarchy of privacy-publicness. The design of the space needs to support behaviors which frequently happen at different hierarchies of spaces, a series of spaces with different degrees of privacy-publicness could be formed, and clear privacy-publicness hierarchies with hints to indicate the kind of behavior suitable to the corresponding hierarchy could be provided. For example, the seating space arrangement in urban spaces could provide seats with greater privacy for reading and dating, seats with some degree of privacy and near pedestrian traffic circulation for passers-by to stay for a break, sociopetal seats for small groups of people to get together and sociofugal seats for individuals to ponder, etc. The spatial hierarchy design is closely related to people's needs for different degree of privacy-publicness and their physical and psychological comfort in urban spaces. Stereotyped arrangements cannot meet the needs of all of the users.

D. Edge Effects

Some researchers have shown that when people stay in an outdoor space, they tend to stay at the edge zones of the space or near the facade of the buildings adjacent to the outdoor space (Alexander, et al, 1977, Gehl, 1987, Hall, 1969, Jonge, 1967/68). This phenomenon exists in urban spaces regardless of seasonal change. This phenomenon is called the "edge effect" (Jonge, 1967/68). The spatial distribution of smokers at the 1155 Sixth Avenue Plaza in winter totally matches this effect. (Figure III-13 to Figure III-15). Observations of New York City urban spaces showed that edge effects existed universally in various types of urban spaces. At the Seagram Plaza, most of the users stayed at the front edges, the north or south ledges near the pools, or under the porch near the entrance of the Seagram building (Figure IV-13). The central space of the plaza was usually empty. People passed this area quickly and seldom stayed. At the Time & Life Plaza, people stayed at the pool ledge, the ledges of the front or the side flowerbeds, or near the sculpture,

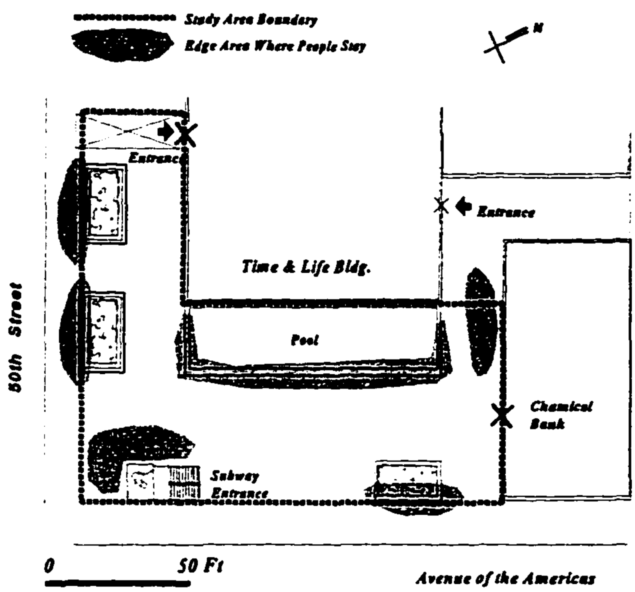


Figure IV-14 Edge Effect (Time & Life Plaza)

subway entrance, or against the wall of the north wing building (Figure IV-14). The analysis of these edge effects existing in different urban spaces studied has revealed some commonalities:

* There are physical objects in the edge areas for people to sit on, to stand against, or hang on so that they could feel being protected, such as the front ledges at the Seagram Plaza, the pool ledges at the Exxon Plaza and the Time & Life Plaza, the flowerbed ledges at the Time & Life Plaza and the 1155 Sixth Avenue Plaza, the porch and columns at the General Motor's Plaza and the 1155 Sixth Avenue Plaza, etc. These objects provide people with conveniences that may encourage them to stay.

* There are some amenities at these edge areas which can generate some activities such as the pay phones and the information windows at Herald Square Park. These amenities were frequently used by people who passed by and generated staying in the park (Photo III-16).

* The edge zones adjacent to sidewalks are the active parts of urban spaces which are often vitalized by sidewalk activities. The food vendors at the Time & Life Plaza, the Exxon Plaza, and the J. C. Penny North Plaza always attracted people to line up. Sometimes the lines even extended into the plaza territories becoming a part of the plaza life (Photo IV-5).

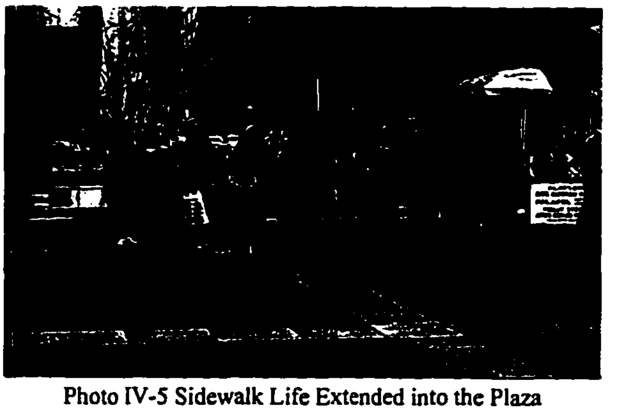


Photo IV-5 Sidewalk Life Extended into the Plaza

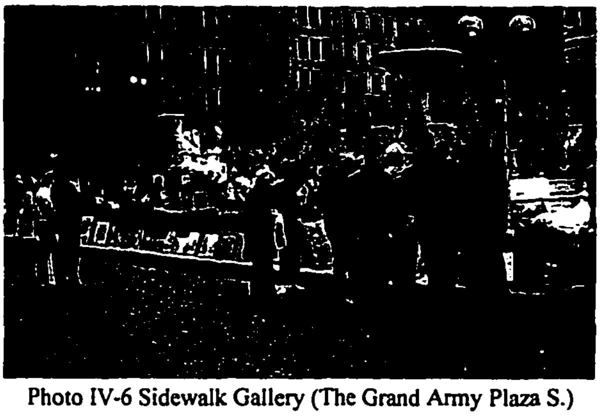


Photo IV-6 Sidewalk Gallery (The Grand Army Plaza S.)

* There are other activities the food vendors can generate: eating and drinking, talking, greeting, etc in the plazas. At both the north part and south part of the Grand Army Plaza, sidewalk activities also frequently extended into the plaza's territory. For example, the sidewalk gallery used the plaza boundary ledge to back up the exhibits (Photo IV-6).

Photo IV-7 Store in General Motor's Plaza

* The stores, restaurants, banks, etc. located in the ground floor of the buildings directly adjacent to the urban spaces also cause a kind of edge effect. Because they are

Photo IV-8 Store in the Burlington Plaza

Photo IV-9 Store in Rockefeller Center Plaza

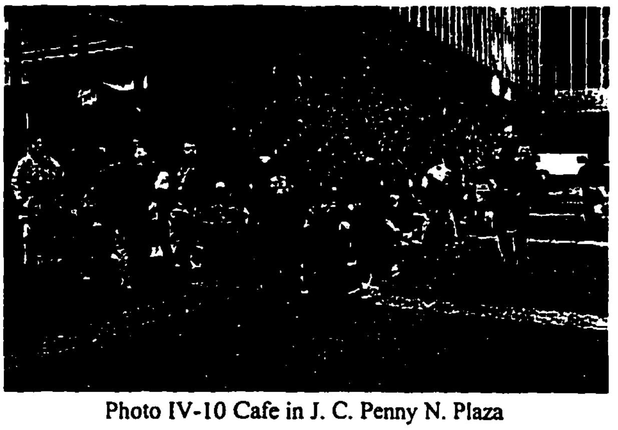


Photo IV-10 Cafe in J. C. Penny N. Plaza

always located along the edge zones of these spaces and they generate necessary and optional activities in these zones and even in the urban spaces themselves, such as the store in the General Motor's Plaza (Photo IV-7), the Burlington Plaza (Photo IV-8) and the Rockefeller Center Plaza (Photo IV-9), the restaurants in the J. C. Penny North Plaza (Photo IV-10) and the banks in the Times & Life Plaza (Photo IV-11) and the Webber North Plaza (Photo III-4), etc.

The behavior of people staying in urban spaces is influenced by the essence of territoriality. Hall (1966) points out that the placement at the edge zones or close to a facade helps the individual or group to keep distance from others. Gehl (1987) thinks that under such a situation, one is less exposed and one's back is protected and others can only approach from the front, which makes it easy for the person to keep watching and to react. Events happening in an urban space always grow inward, from the edge toward the middle of the urban space. If edge zones do not provide people with places wherepeople can linger naturally, the space will become a place only for passing through rather than a place to stay. Alexander et al (1977) therefore, suggest that a public square should be surrounded

Photo IV-11 Bank in Time & Life Plaza

by pockets of activity shops, stands, benches, displays, rails, courts, gardens, news racks. He argues that: "The life of a public square forms naturally around its edge. If the edge fails, then the space never becomes lively" (Alexander et al, 1977, p. 600). Under some circumstances,


Photo IV-12 What are They Looking at? (Exxon)

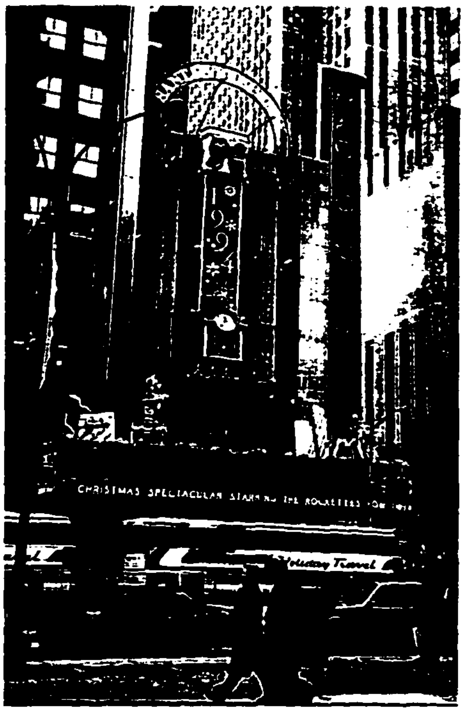


Photo IV-13 Christmas Decorations of the Radio City Music Hall

edge effects can be extended even further. Photo IV-12 shows some people in Exxon Plaza and some on the sidewalk next to the plaza looking up at something on the other side of Sixth Avenue. What were they looking at? Photo IV-13 revealed that they were looking at the Christmas decorations on the top of the Radio City Music Hall entrance across the street. It is very interesting that something or some activities far beyond the boundary of an urban space can also stir the life within the space. At the sunken plaza of Rockefeller Center, the life of the indoor restaurant and the activity in the skating rink were actually intermingled visually. Each side could experience the existence of the other and take the other as an organic part of their environment. In traditional Chinese gardening, this kind of situation is called "landscape borrowing". It is a frequently used principle or method which introduces the remote mountains or water space sceneries into the garden with the help of a "landscape window" or a "landscape frame". In this way, a "moving space" between the garden and the outside will be established making the landscape more plentiful and vital. This kind of "landscape borrowing" can also be applied during the planning stage of urban spaces. If a group of urban spaces will be next to each other, like the Time & Life, the Exxon, the McGraw Hill and the Celanese of the Rockefeller Center system, how they can have a positive influence on each other visually should be taken into consideration. How the existing visual attractions within the direct urban context can be "borrowed" into the to be planned urban space should also be considered.

E. Visual Diversity

When leaves drop, flowers disappear and water freezes, the winter landscape usually gives people a feeling of grey monotony. Diversity is stimulating and monotony is boring in both the social and biological senses. Persinger (1988) points out that the reduced variety in colors, sounds and smells in nature makes people suffer from perceptual monotony in winter causing a downward psychological stimulus ratio. Some urban spaces in New York City are more interesting and enjoyable than others in winter, such as the Rockefeller Center Plaza. Visual diversity here plays a significant role.

> Analysing the nature of diversity and classifying its range to take advantage of it are matters of some complexity, however. Here is where the skill, training and experience of the designer comes into play. For a designed space to be valuable and attractive, it must recognize the diversity of its settings and include diversity as a component of design. (Lewis Jr. 1996, p. 28)

1. Hard Landscape

Hard landscape refers to architectural scenery composed of hard materials (bricks, stones, metal, concrete, wood, etc.) such as pavements, sculptures, rockery and various outdoor amenities. This is in comparison with soft landscape (trees, water spaces). Hard landscape is suitable for any seasons and is rarely influenced by climatic conditions. This is especially important in winter when leaves have dropped and water is frozen or drained off whereas the hard landscape still remains attractive visually if it is well designed.

a. Pavements

Pavement is an important component of hard landscape which can either easily draw people's attention by its bright color and attractive patterns or be ignored totally because of its monotony. Therefore, the color, pattern and texture of the pavements are very important. 90% of the interviewees responded that the bright, warm colored and patterned pavement were attractive in Time & Life Plaza (37%--very attractive and 53%--somewhat attractive) and Police Plaza (40%--very attractive and 50%--somewhat attractive). 60% of the responses said that the pavement of the Time & Life Plaza gave them a warm feeling in winter and the percentage for the pavement of the Police Plaza is 70%. However, the grey colored pavement with a very simple pattern of the J. C. Penny North Plaza got only 30% positive responses (3%--very attractive and 27%--somewhat attractive), and only 10% of the responses said that it gave them a warm feeling. A bright warm color seems to be able to improve people's psychological comfort in winter and patterned pavements with trim materials to please both the eyes and the minds of people.

Pavements also have important functions in outdoor spatial organization, such as spatial divisions, spatial orientation and territory restriction, etc.

b. Public Art

Public artworks are becoming more and more an indispensable compositional part of the visual environment in urban spaces. Some cities have already established an art-in-architecture program allocating up to 1% of the construction cost toward the purchase of public works. My observations showed that the existence of public art works made an urban space more attractive. They were often the main reason for some people to stay watching or taking pictures, such as the monument and the sculpture in the Herald Square Park and the "Prometheus" sculpture in the Rockefeller Center Plaza. Twenty one out of the 30 users (70%) interviewed at the Herald Square Park evaluated the monument as "somewhat attractive" or "very attractive" and all the 30 users interviewed at the Rockefeller Center Plaza evaluated the "Prometheus" sculpture as "somewhat attractive" or " very attractive". Many public art works also could promote the "triangulation" process, encouraging social contact in urban spaces no matter whether the art work is abstract or concrete. Although, sometimes people might not understand the meaning of some abstract art works, they still might think that these works beautify the environment. For example, twenty seven out of the 30 interviewees (90%) said they do not know the meaning of the "Five in One" sculpture at the Police Plaza, however, twenty (67%) thought that it beautifies the visual environment of the plaza.

The color of a sculpture plays an important role in influencing the winter environmental atmosphere of urban spaces. In the Police Plaza (Photo IV-14), nineteen out of the 30 interviewees (63%) said that the scarlet "Five in One" gives them a warm feeling in winter. The "Prometheus" in Rockefeller Center and "Sherman Monument" in Grand Army Plaza North are both have a golden color (Photo III-7 and Photo IV-15). Gold is the color of the sun and fire which might excite people and give people the association of

Photo IV-14 Sculpture "Five in One" in the Police Plaza

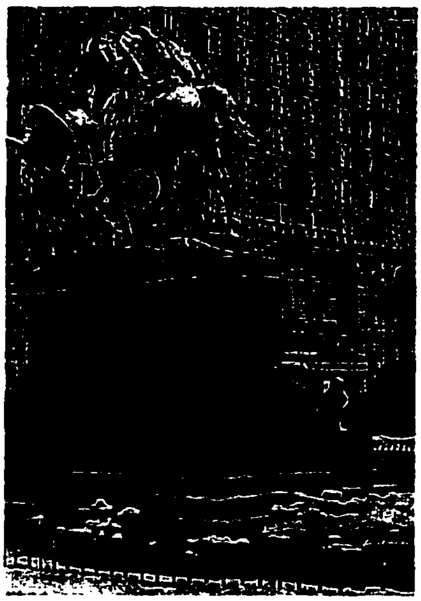


Photo IV-15 Sherman Monument in Grand Army Plaza N.

warmth and life, and the color that belongs to northern winter environment (Gutheim, 1979). Twenty two out of the 30 (73%) interviewees said that the golden sculpture of the Sherman Monument in the Grand Army North Plaza gives them a warm feeling, but only 8 out of the 30 (27%) said that the blue colored sculpture "Curve" in the Time & Life Plaza gives them a warm feeling.

The results of the interviews show that totally 93% of the interviewees thought that the representational imaged Sherman Monument sculpture is very attractive (43%) or somewhat attractive (50%) , and the percentage for the abstract image sculpture "Five in One" of the Police Plaza is 70% (17%--very attractive and 53%-- somewhat attractive) and "Curve" of the Time & Life Plaza is 68% (13%--very attractive and 55%-- somewhat attractive). It seems that more people prefer sculptures with a clear representational image than those with an abstract image.

The existence of public artworks increases the cultural atmosphere of urban spaces changing them from pure physical spaces into cultural and emotional spaces with artistic conceptions. And these are obviously independent of climatic conditions.

2. Light and Shadow Art

Being exposed to sunlight is an important requirement for a vital urban space. An urban space exposed to the sunlight and free from wind provides people with not only a better, thermally comfortable environment, but also a better visual environment. In winter, with

Photo IV-16 Shadow Projected by a Sculpture on the Bare Wall of the UN Assembly Building

leaves fallen, water frozen or drained off, the sunlight becomes a very important element which makes an urban space vital. There are some plazas in New York City with northern exposure functioning like a desert in winter, such as the Grace Plaza, the Elson's News Plaza , and others. There are other northern exposed plazas which work relatively well in winter, such as the J. C. Penny North Plaza. This means that sunlight is not the only influential element. However, if other conditions are basically the same, being with or without sunlight would make a big difference, such as the Webber's South Plaza and the Webber's North Plaza. Their physical conditions and urban context are almost the same, however, the mean of "sun exposure" in winter was 12% for the former and zero for the latter, and the corresponding mean of "use density" in winter was 0.47 for the former was and only 0.23 for the latter.

Sunlight may play an important role in influencing the vitality and attractiveness of an urban space, if the light/shadow art could be well applied. Photo IV-16 show a golden aluminium sculpture on the east wall of the United Nations General Assembly Building facing the East River. This is an example to show how the shadow variation of a public art work on a bare wall can enrich the visual environment. This effect can be obtained in any season.

3. Christmas Decorations

The holiday seasons from Thanksgiving Day to the New Year's Day are the most important shopping periods of the year. The store facades and windows of the major commercial streets and some plazas in midtown and downtown Manhattan are decorated with colorful Christmas decorations. They sweep away the visually monotonous feeling of winter and fill the central business areas with a kind of festive atmosphere. People wander on streets, in plazas, standing in front of store windows looking at and admiring the decorations and exhibits, taking pictures, etc. Photo IV-17 to Photo IV-19 are a few snapshots taken during the 1995 holiday seasons on the streets and in the plazas of New York City. They vividly reflect people's surprise and admiration when they saw some novel decorations.

Photo IV-17 People on Street during Holiday Seasons

Observations showed that the shopping and recreational activities during the holiday seasons generated passing and staying in urban spaces where shops, restaurants and other commercial and

Photo IV-18 Window Shopping during Holiday Seasons

Photo IV-19 Children in Holiday Seasons

recreational facilities were available, such as General Motor's Plaza and Rockefeller Center Plaza.. Stores with special features closely related to the holiday seasons such as the Warner Brothers's store at the intersection of Fifth Avenue and East 57th Street, and the FAO Schwarz toy store in General Motor's Plaza attracted a huge amount of people who lined up everyday to enter during the holiday seasons. Even in other seasons, FAO Schwarz also attracts a lot of people and generates passing and staying in the plaza. Obviously, this toy store has contributed a great deal to the popularity of General Motor's Plaza.

The Christmas decorations are often the reason for people to stay watching and taking pictures. Thus, urban spaces with Christmas decorations usually have higher winter use density than those without. Among the plazas studied, eleven urban spaces with Christmas decorations (without Rockefeller Center) had a grand mean of winter "use density" of 0.4545, whereas the twenty urban spaces without Christmas decorations had a grand mean of only 0.2325. At the Rockefeller Center Plaza, all the 30 users interviewed during the holiday seasons responded that the Christmas tree and other holiday decorations in this plaza were very attractive and 26 (86.7%) of them said these were the reasons for them to come to the plaza. Observations also showed that Christmas decorations consisting of colorful lighting, moving water (fountains) and Christmas trees (such as those in The Exxon Plaza and the Time & Life Plaza) could attract more people than those with only monochromatic lighting or with quiet water (such as those in the Seagram Plaza), or without water at all (such as those in the Elson's News Plaza on 58th Street). Apparently, Christmas decorations are very useful ways to increase the visual attraction of urban spaces during the holiday seasons.

Visual diversity contributes a great deal to the popularity of urban spaces, especially in winter. There is no doubt that there should be an optional balance between the perceptual visual diversity and the harmony or the clarity of the environmental design of these spaces. People prefer a medium degree of complexity (Rapoport, 1967). It is generally accepted that large scale environments should be well organized and composed of sub-environments with different degrees of complexity, whereas some specific or small scale environments should have a high degree of complexity. It is very important to maintain the difference in complexity for different areas or elements of an environment, because if all the areas or elements are highly complicated, then the whole may be monotonous (Rapoport, 1967).

However, the problem urban spaces face in winter is far from being too visually complicated or chaotic to repel use or evoke displeasure. On the contrary, an assessment of the sites studied reveals that perceptual monotony is the real problem for most of the urban spaces in New York City in winter. Therefore, there is enough room for visual diversity or complexity in our urban spaces design without being apprehensive of visually chaotic situations.

CHAPTER V

SUB-MARGINAL PERIODS

Sub-marginal periods refer to the seasonal periods between winter and marginal seasons when the daytime high temperature is around 40°F (Li, 1994). Marginal seasons (about 50°F daytime high) are the beginning (early spring) or ending (late fall) of the outdoor season. One of the noticeable features of marginal seasons is that people feel comfortable outdoors without heavy clothes (Culjat & Erskine, 1983). But people have to wear heavy outdoor clothes in order to stay outdoors for long periods of time in sub-marginal periods. This is the significant difference between sub-marginal periods and marginal seasons. In sub-marginal periods, there is no ice and snow and this makes it different from winter. From these two aspects, we can preliminarily differentiate sub-marginal periods from marginal seasons and winter.

As far as the use of urban spaces is concerned, the difference between sub-marginal periods and winter is not as obvious as that between sub-marginal periods and marginal seasons because there is a large increase in the number of users in outdoor urban spaces in marginal seasons especially in early spring. However, continuous and repeated observations at seven urban spaces in New York City revealed some very important facts that had long been neglected in the research literature. During sub-marginal periods, users' behavior patterns become more diversified; the average length of stay, the rate of sitting, and the number of users recorded in one hour all increased significantly compared with those in winter. Users' perceptions and attitudes toward sub-marginal periods and winter, and the grand means of "use density" in these two seasonal periods are also significantly different.

All these show that sub-marginal periods are different from either marginal seasons or winter. It is a seasonal period that has an important influence on the public life of urban spaces.

A. Diversified Users' Behavior Patterns

Compared to the winter, users' behavior patterns become more diversified in sub-marginal periods. More people stay in urban spaces, sitting and standing, eating and drinking, talking, smoking, reading, listening to the "walkman" etc. Some behavior patterns which are very rare in winter begin to appear, such as lying, dozing and intimate behaviors, etc. Actually, almost all the behavior patterns that appear in urban spaces in summer can be observed in sub-marginal periods.

1. Lying Down

At Seagram Plaza, two cases of people lying down were observed on March 2, 1989 (38°F), and four cases were observed on March 9, 1989 (41°F). However, there was not a single case of lying down during three days' observation when the temperature level was at 28°F, 30°F and 32°F respectively in this plaza. Similar things happened at Herald Square Park. Nobody laid down during two days' observation when the temperature level was at 28°F and 32°F; whereas on January 28, 1989 (42°F) , three cases were observed. These show that lying down examples (Which do not include homelesspeople) is a behavior pattern that appears only when the temperature reaches 40°F level. However, lying down for a long period on a stone or concrete ledge, even at about 40°F, is not a comfortable thing to do.

* 1:00 p.m., a young man in his mid 30s in leisure clothes came to the plaza. He sat

on the south ledge, opened his brown bag and began to eat and drink while listening to his walkman. After eating, he laid on the stone ledge. But just a few seconds later, he got up. It seemed that the stone ledge is still too cold to lie on. He took off his jacket and put it on the ledge. Then he began to dance while listening to his walkman. 1:15 p.m., he put his jacket on, and left the plaza with dancing steps (Field notes, Seagram Plaza, March 9, 1989, sunny, 41°F).

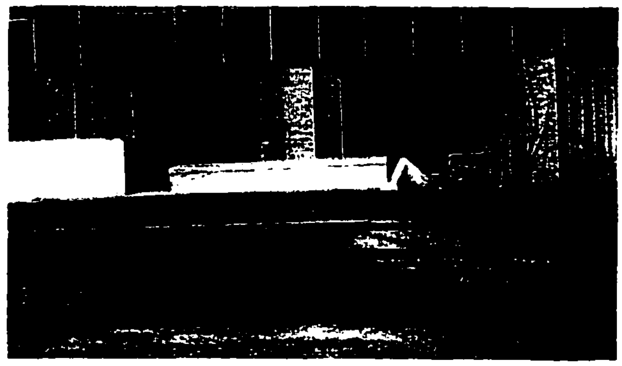


Photo V-1 Lying Down (Seagram Plaza)

* 1:44 p.m., a young man in his early 30s with a short jean jacket came to sit on the west end of the north side ledge near Park Ave. At 2:35 p.m., the shadow reached him. He got up and moved to the north side ledge near the northeast corner of the pool, where the sunlight would last a little bit longer. He laid on the ledge for ten minutes (Field notes, same as above. See Photo V-1).

These two examples show that people differ in their tolerance for the cold and also that when the temperature is at 40°F level, users still use personal control mechanisms to mediate the unpleasant feelings caused by the cold. In the two cases above, the first stood up and discontinued lying on the stone ledge, and the second followed the sunlight so that he could lie down.

2. Intimate Behaviors


Photo V-2 Intimate Behavior in Public (Seagram Plaza)

Intimate Behaviors here refers to the loving behaviors in public between a couples in an urban space, such as embracing, kissing, touching and fondling, etc. This kind of behavior was observed at different urban spaces when the temperature reached the 40°F level (Photo V-2).

* 1:50 p.m., a young man and a young woman in their mid 20s sat on the middle of the north side ledge near the northeast corner of the north pool. They kept talking, laughing. Sometimes, they kissed each other warmly; sometimes they laughed madly. They stayed for 45 minutes (Field notes, Seagram Plaza, Mar. 9, 1989, sunny, 41°F).

* 2:05 p.m., a middle aged couple came to the park and sat on the middle bench on the west side (the east side benches are all in the shadow). They took out food boxes from their brown bags and began to eat. 2:12 p.m., they finished eating and drinking. The man stood up looking around for a while before he laid down on the bench with his head on the woman's lap. She fondled his hair while talking with him. 2:15 p.m., the man sat up, he took out cigarettes. The man lit up cigarettes for both of them, and they began to smoke. 2:33 p.m. they left the park (Field notes, Herald Square park, Jan. 28, 1989, 42°F, sunny).

Similar behavior was also found at the NYC Public Library Plaza, the Collect Pond Park, and the General Motors Plaza at 40°F level.

3. Dozing

Many homeless people in New York City live in parks or on the streets in winter. In order to survive, they have to tolerate the cold weather. In Herald Square Park, one homeless person laid on a bench in the shadow sleeping for a little more than one hour at a freezing temperature. For other people, dozing outdoors even at 40°F is not comfortable and might be considered to be inappropriate (Photo V-3).

Photo V-3 Dozing (Webber's Plaza S.).

* 1:12 p.m., a young man in his early 30s with a navy overcoat came to sit on the southeast bench where there is sunlight. He took a magazine from his overcoat pocket and began to read. Five minutes later, he closed his eyes and laid his head on the back of the bench facing up to the sun to enjoy the sunlight. A few minutes later,

his head rolled to the right side, and his magazine dropped onto the ground. He seemed to fall asleep (Field notes, Herald Square Park, Jan. 28, 189, 42°F, sunny).

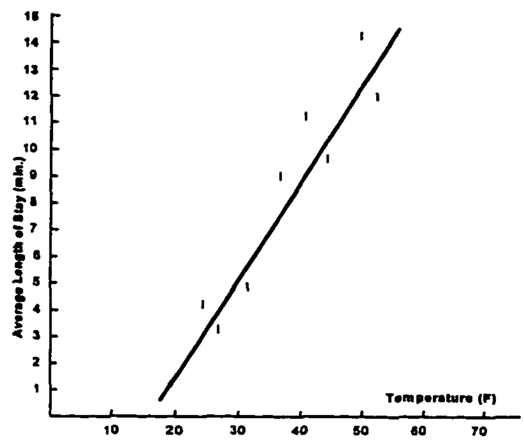


Fig. V-1 Average Length of Stay at Herald Square Park

Lying down, intimate behaviors, and dozing are the behavior patterns that appear when the temperature reaches 40°F level. Their appearance adds diversity to the behavior patterns in urban spaces in sub-marginal periods. Some other behavior patterns such as eating, drinking, and reading etc. can be found at 30°F, even at 20°F. But, at 40°F, the presence of these behavior patterns become significantly more frequent. However, instant observations will not reveal this increase. Only continuous and repeated observations can show these changes. In fact, almost all the behavior patterns that exist in urban spaces in summer can be found in the sub-marginal periods. The spring sub-marginal period is clearly a transitional period which prepares for the blooming of the public life in urban spaces in the spring marginal season.

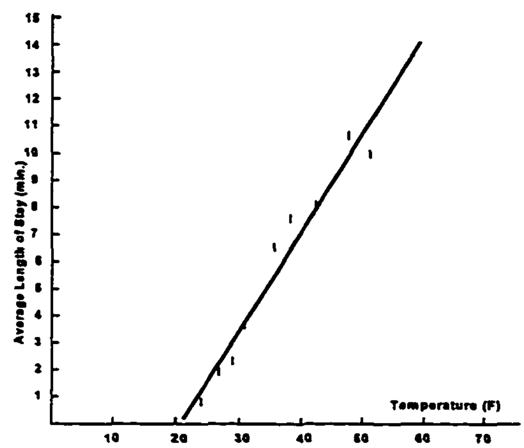


Fig. V-2 Average Length of Stay at Seagram Plaza

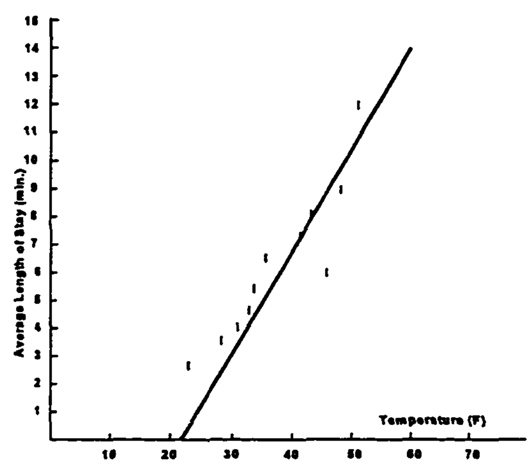


Fig. V-3 Average Length of Stay at 1155 6th Ave. Plaza

B. Prolonged Stay of Users

When the temperature reaches the 40°F level, users tend to stay in urban spaces significantly longer than they would at the temperatures around 30°F. This can be shown in two ways: one is the average length of stay of all users and the other is longest length of stay of a single group. At the Herald Square Park, the average length of stay increased from about four minutes to about ten minutes; the longest stay increased from 33 minutes to 62 minutes. At the Seagram Plaza, the average length of stay increased from about three minutes to about seven minutes, and the longest stay from 20 minutes to about 65 minutes. At the 1155 6th Ave. Plaza, the average length of stay increased from about 4 minutes to about 6 minutes, and the longest stay increased for 36 minutes to 60 minutes (see Fig. V-1, Fig. V-2, and Fig. V-3).

C. Significant Increase in Sitting Rate

Compared with winter, more users sit in urban spaces in sub-marginal periods. This is also reflected in two ways: one is from the grand mean of the sitting rate of 32 urban spaces in different seasonal periods based on instant observation records (Fig III-2). From Fig. III-2 we can see that the average sitting rate at the 40°F level (32%) is significantly higher than that in winter (8%). And in each group, the five observations at different temperatures are clustered. So, the two means of sitting rate in winter and sub-marginal periods are significantly different. i.e. sub-marginal periods have a significantly higher sitting rate than winter.

The other is from the continuous and repeated field observations at several urban spaces. The observations show that the sitting rates in sub-marginal periods are significantly higher than those in winter. At the 1155 6th Ave. Plaza, the average sitting rate increased from 10.4% in winter to 24.6% in sub-marginal periods. At the Seagram Plaza, it increased from 13.3% to 54.9%. And at the Herald Square Park, it increased from 15.6% to 55.2%. (See Fig. III-3, III-4, and III-5)

D. Significant Increase in "Hour Use"

"Hour use" is defined as the average number of users recorded within one hour. This concept is used for measuring the use of an urban space during continuous observations.

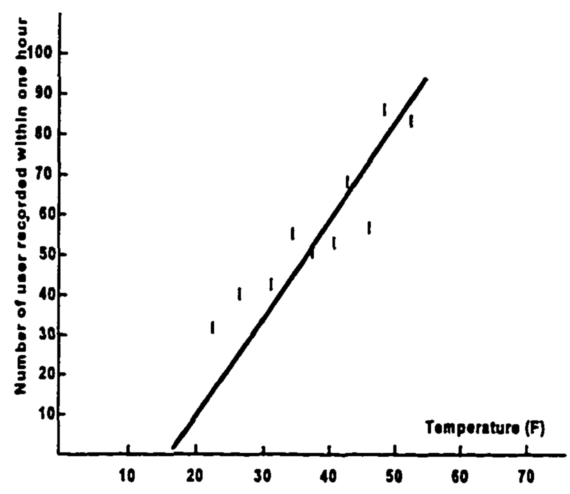


Figure V-4 Hour Use at 1155 6th Avenue Plaz

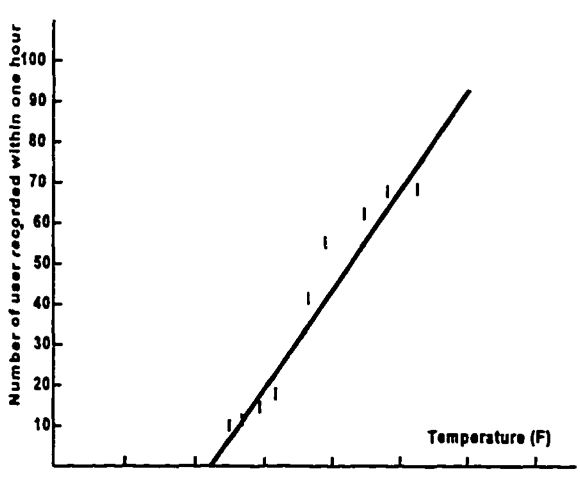


Figure V-5 Hour Use at Seagram Plaza

At the 1155 6th Ave. Plaza, the average "hour use" increased from 39.2 in winter to 57.8 in sub-marginal periods. At the Seagram plaza, it increased from 15.2 in winter to 49.0 in sub-marginal periods. At the Herald Square Park, it increased from 15.6 in winter to 55.2 in sub-marginal periods (see Fig. V-4, Fig. V-5, and Fig. V-6). From these figures, we can see that compared with that in winter, the "hour use" at all these three urban spaces increased significantly in sub-marginal periods. My field observations have shown that compared to those in winter, users' behavior patterns, average length of stay, the sitting rate, and the number of users recorded within one hour all changed significantly at this temperature level. The

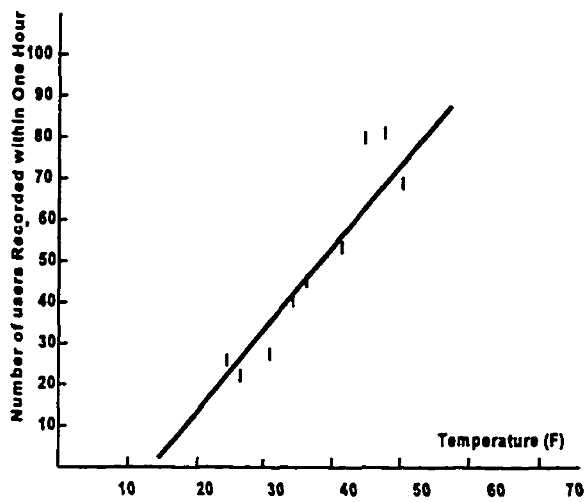


Fig.V-6 Hour Use of Herald Square Park

purpose of this one way ANOVA analysis, which was based on the data obtained from 32 New York City urban spaces, is to testify the following two points: (1). the means of use density of urban spaces in sub-marginal periods (about 40°F), marginal seasons (about 50°F) and winter (32°F or lower) are significantly different; (2). the users' perception (based on interview data) of "coldness", "pleasantness" and "willingness to go out" is significantly different at 20°F, 30°F and 40°F. In this way, the conclusion could be reached that the sub-marginal periods are independent seasonal periods different from either winter or marginal seasons.

E. The Differences in Means of "Use Density" in Three Seasonal Periods

Each of the 32 New York City urban spaces was observed three times a day for five days in each of the three seasonal periods: marginal seasons, sub-marginal periods, and winter. The mean of "use density" of each urban space is listed below in Table V-1.

In this analysis, "use density" is taken as the dependent variable and "season" as the explanatory variable to see whether the means of use density in three seasonal periods are significantly different.

Table V-1
Means of Use Density in the Three Seasonal periods

Urban Spaces	Means of Use Density		
	winter	Sub-marginal	Marginal
Public Library	0.16	0.80	2.04
Greeley Square Park	0.25	0.93	2.42
Herald Square Park	0.55	1.84	4.31
Bell Plaza	0.004	0.08	0.15
Grace Plaza	0.04	0.17	0.56
1155 6th Avenue Plaza	0.27	0.87	1.67
International Paper	0.27	0.80	2.61
W.P. Stevens Plaza	0.24	0.55	0.65
Celanese Plaza	0.22	0.54	2.09
McGraw Hill Plaza	0.24	0.46	1.60
Exxon Plaza	0.36	0.67	2.37
Time & Life Plaza	0.75	1.20	4.50
Webber's Plaza S.	0.47	0.80	3.70
Webber's Plaza N.	0.23	0.65	1.24
J.C. Penny Plaza S.	0.11	0.23	0.85
J. C. Penny Plaza N.	0.49	0.79	1.99
CBS Plaza	0.10	0.21	0.39
Deutsche Bank Plaza	0.31	1.02	3.16
Burlington Plaza	0.40	1.30	3.00
Elson's News Plaza	0.08	0.29	0.55
Grand Army Square S.	0.12	0.37	2.47
Grand Army Square N.	0.15	0.49	1.74
General Motor's Plaza	1.69	1.86	2.18
Paley Park	0.34	1.35	4.25
Urban Plaza	1.13	2.16	5.41
Lever House Plaza	0.07	0.14	0.33
Seagram Plaza	0.04	0.14	0.77
345 Park Avenue Plaza	0.07	0.37	1.32
Police Plaza	0.14	0.25	1.00
Federal Plaza	0.03	0.12	0.67
Collect Pond Park	0.21	0.39	2.41
Sub-Total	9.65	21.84	62.40
Sub-Grand Mean	0.3038	0.7113	1.926
Rockefeller Center Plaza	9.69	6.43	7.58
Total	19.34	28.27	69.98

Grand mean	0.5974	0.8901	2.093
R.C. Percentage	50.1%	22.7%	10.8%

The coding for the three seasons is:

Winter - 1

Sub-marginal - 2

Marginal - 3

The null hypothesis is that the means of use density are the same in all the three seasons. The research hypothesis is that the means of use density are significantly different in at least two seasons. By using the SAS ANOVA program, the following results have been obtained (Table 2):

Table V-2
ANOVA Table for Dependent Variable Use Density (1)

Source	D.F.	Sum of Squares	Mean Squares	F Value
Model	2	201.022275	100.511138	31.42
Error	477	1526.102214	3.199376	PR>F 0.0001
Total	479	1727.124490		

From the table, we can see that the F test value is 31.42, and $p < 0.0001$, which means that the possibility that the means of use density are all the same in all three seasons is less than 0.01%. Therefore, the null hypothesis can be rejected, and the research hypothesis is confirmed. Table IV-3 shows in which two seasons the means of use density are significantly different:

Table V-3
Significance Test of the Difference in Means of Use Density (1)

Grouping	Mean	N	Season
A	2.0929	160	3 (marginal)
B	0.8901	160	2 (sub-marginal)
B	0.5974	160	1 (Winter)

* Means with the same letters are not significantly different

From the table, we can see that the mean of "use density" in marginal seasons (3) is significantly different from that in winter (1) and in sub-marginal periods (2). However, the means of "use density" in winter (1) and sub-marginal periods (2) are not significantly different from each other.

In Table V-1, we can see that for all the urban spaces, "use density" is always the highest in marginal seasons, lowest in winter, and somewhat in between in sub-marginal periods, with only Rockefeller Center Plaza as an exception, where the use density is the highest in winter, lowest in sub-marginal periods, and somewhat in between in marginal seasons.

We can also see that the "use density" for the Rockefeller Center Plaza is much higher than that of any other urban spaces in all the three seasonal periods. It shares 50.1%of the winter total "use density", 22.7% of the sub-marginal total, and 10.8% of the marginal total of all the 32 urban spaces studied. Therefore, with Rockefeller Center Plaza included in the sample, the observations of winter and sub-marginal periods are too spread out. Within each of the two data groups, the observations vary considerably (from 0 -- Bell Plaza, to 13.24 --- Rockefeller Center Plaza in winter, and 0.02 --- Bell Plaza, to 11.17 --- Rockefeller Center Plaza in sub-marginal periods). That is why the difference between the two means of "use density" in winter and sub-marginal periods is not significant. However, when the Rockefeller Center Plaza was removed from the model, the following result was obtained (Table V-4 and V-5):

Table V-4
ANOVA Table for Dependent Variable Use Density (2)

Source	D.F.	Sum of Squares	Mean Squares	F Value
Model	2	217.854388	108.927194	75.22
Error	462	669.045316	1.448150	PR > F 0.0001
Total	464	886.899705		

Table V-5
Significance Test of the Difference in Means of Use Density (2)

Grouping	Mean	N	Season
A	1.9160	155	3 (marginal)
B	0.7113	155	2 (sub-marginal)
C	0.3038	155	1 (winter)

*Means with the same letter are not significantly different.

From these two tables, we can see clearly that the means of use density for winter (1) and sub-marginal periods (2) are significantly different. This is not only because the difference between the means of these two seasonal periods is larger (0.41=0.71-0.30, the difference of the Sub-Grand Mean of use density between the winter and the sub-marginal periods, compared at 0.29=0.89-0.60, the difference of the Grand Mean of use density between the winter and the sub-marginal periods---see Table V-1), but also because the observations are now clustered around their respective means (from 0 --- Bell Plaza, to 2.10 --- General Motors Plaza in winter, and 0.02 --- Bell Plaza, to 3.46 --- Urban Plaza in sub-marginal periods). Therefore, the two seasons are truly different from each other. Thus, the conclusion has been reached that sub-marginal periods (about 40°F) are independent seasonal periods from either winter or marginal seasons with respect to use density.

F. The Difference in People's Perception of Winter and Sub-marginal Periods

From the above analysis, we can see clearly the difference of "use density" between marginal seasons and sub-marginal periods. In order to further separate sub-marginal periods from winter, the second part of the statistical analysis has been done for testing the significance of the difference of people's perception and attitude of these two seasonal periods.

Thirty users were interviewed in each of the following urban spaces: Rockefeller Center Plaza, General Motors's Plaza, Herald Square Park, Time & Life Plaza, 1155 6th Ave. Plaza, Seagram Plaza, and IBM Plaza (indoor) with the following questions:

If it was a wind free, sunny winter day,

A. What would be your reaction to the three different temperatures listed bellow:

20°F	(very cold)	(a little cold)	(O.K.)	(Not very cold)	(not cold at all)
30°F	(very cold)	(a little cold)	(O.K.)	(Not very cold)	(not cold at all)
40°F	(very cold)	(a little cold)	(O.K.)	(Not very cold)	(not cold at all)

B. Is it a pleasant day?

20°F	(Yes)	(No)
30°F	(Yes)	(No)
40°F	(Yes)	(No)

C. If it is a weekday, would you like to go out for a walk during lunch hours?

20°F (Yes) (No)

30°F (Yes) (No)

40°F (Yes) (No)

The coding of the answers to these questions is as follows:

Answers to Question A: Very cold ----------- 1

A little cold --------- 2

O.K. ----------------- 3

Not very cold ------ 4

Not cold at all ------ 5

Answer to Question B: No ------------------- 1

Yes ------------------ 2

Answer to Question C: No ------------------- 1

Yes ------------------ 2

The temperature coding is:

20°F ----------------- 1

30°F ---------------- 2

40°F ---------------- 3

In the one way ANOVA analysis, the dependent variables are “coldness", "pleasantness", and "willingness to go out" respectively for Question A, B, and C. Temperature is used as the explanatory variable in order to find out whether the means of people's perception and attitude about 20°F, 30°F, 40°F are significantly different with a particular interest in the difference between 30°F and 40°F.

For Question A regarding people's perception of coldness at 20°F, 30°F, 40°F, the results are as follows (Table V-6):

Table V-6
ANOVA Table for Dependent Variable Coldness

Source	DF	Sum of Squares	Mean Squares	F Value
Model	2	363.072811	181.53406	398.66
Error	627	285.512903	0.455363	PR>F 0.0001
Total	629	648.585114		

From Table V-6, we can see that the possibility that the means of people's perceived "coldness" at the three temperatures are all equal is near zero. So the null hypothesis can be rejected, and the research hypothesis that the means of people's perceived coldness are significantly different at least at two of the temperatures is correct. Now let us take a look at Table V-7 to see whether the difference between the means of any two of the temperatures is significant.

Table V-7
Significance Test of the Difference in Means of Coldness

Temperature Comparison	Difference Between means	Simultaneous Lower confidence limit	Simultaneous Upper confidence limit	Significant
3 --- 2	0.84237	0.68073	1.00389	***
3 --- 1	1.85887	1.69710	2.02065	***
2 --- 3	-1.00389	-1.00389	-0.68073	***
2 --- 2	1.01657	0.85518	1.17795	***
1 --- 3	-1.85887	-2.02065	-1.69710	***
1 --- 2	-1.01657	-1.17795	-0.85518	***

Comparisons are significant at the 0.05 level are indicated by "***".

It is apparent that the means of the perceived coldness between any of the two temperatures are significantly different.

For Question B regarding the perceived "pleasantness" at the three temperatures, the following results have been obtained(Table V-8 and Table V-9):

Table V-8
ANOVA Table for Dependent Variable Pleasantness

Source	DF	SS	MS	F Value
Model	2	43.734343	21.867172	147.79
Error	627	92.773593	0.147964	PR>F
				0.0001
Total	629	136.507937		

Table V-9
Significance Test of the Difference in Means of Pleasantness

Temperature Significant Comparison	Difference between Means	Simultaneous Lower Confidence limit	Simultaneous Upper Confidence limit	
3 — 2	0.26527	0.17316	0.35737	***
3 — 1	0.64279	0.55057	0.73501	***
2 — 3	-0.26527	-0.35737	-0.17316	***
2 — 1	0.37752	0.28553	0.46952	***
1 — 3	-0.64279	-0.73501	-0.55057	***
1 — 2	-0.37752	-0.46952	-0.28553	***

Comparisons significant at the 0.05 level are indicated by "***".

From these two tables we can see that the means of the perceived pleasantness between any of the two temperatures are significantly different.

For Questions C regarding people's "willingness to go out" for a walk at the three temperatures, the results are as follows (Table V-10 & V-11):

Table V-10
ANOVA Table for Dependent Variable Willingness to Go Out

Source	DF	SS	MS	F Value

Model	2	38.442615	19.221308	119.46
Error	627	100.884369	0.160900	PR>F 0.0001
Total	629	139.326984		

Table V-11
Significance Test of the Difference in Means of Willingness to Go Out

Temperature Comparison	Difference between Means	Simultaneous Lower Confidence limit	Simultaneous Upper Confidence limit	Significant
3 --- 2	0.27978	0.17373	0.36583	***
3 --- 1	0.60458	0.50842	0.70074	***
2 --- 3	-0.26978	-0.36583	-0.17373	***
2 --- 1	0.33480	0.23887	0.43073	***
1 --- 3	-0.60458	-0.70074	0.5084 2	***
1 --- 2	-0.33480	-0.43073	-0.23887	***

Comparisons are significant at the 0.05 level are indicated by "***".

From these two tables, we can see that the means of people's "willingness to go out" for a walk at any of the two temperatures are significantly different. Up to now, I have successfully verified that people's perceptions of and attitudes to "coldness" and "pleasantness", and "willingness to go out" for a walk at 30°F and 40°F are significantly different, which is another piece of strong evidence to support my hypothesis that the sub-marginal periods (about 40°F) are independent seasonal periods with respect to influencing users' behaviors and the public life of urban spaces.

CHAPTER VI

PASSING AND THE WINTER LIFE OF URBAN SPACES

Passing is a kind of necessary activity defined as the action of going through an urban space without a stop. It happens under almost any weather conditions. Passing is an important behavior and also an important part of the public life of urban spaces. However, not much attention has been paid to it in the urban space research literature. I am devoting a whole chapter to this topic and trying to conduct an in depth exploration of its roles in influencing the public life of urban spaces in winter with a hope of attracting more attention to thisunderstudied area.

A. Passing Is an Important Part of Life in an Urban Space

Passers-by have never been taken as users in urban space research literature including this study. However, when we look at an urban space, what we see not only are the people staying in the space but also those passing through the space. The influence of the latter on the atmosphere of the urban space is also significant, especially in winter when there is almost nobody staying in the urban space, the presence of an endless stream of passers-by is one of the major elements that keep the space vital to some extent.

Photo VI-1 A Snap Shot at Greeley Square Park

> Whatever their cause is, people's movements are one of the great spectacles of a plaza... Down at eye level the scene comes alive with movement and color--people walking quickly, walking slowly, skipping up steps, weaving in and out on crossing patterns,


Photo VI-2 A Snap Shot at General Motor's Plaza

accelerating and retarding to match the moves of others. Even if the paving and the walls are grey, there will be vivid splashes of color--in winter especially, thanks to women's fondness for red coats and colored umbrellas. (Whyte, 1988, p. 108)

When we talk about the number of people within an urban space at an instance, we should include those people who pass by. This is just like a snapshot (see Photo VI-1, Photo VI-2). Thus, a new concept has been originated: "use plus density", which is defined as the number of all people (including passers-by) within each thousand square feet area of an urban space at one instant. This concept will be used in this study as a standard to measure the briskness of an urban space.

B. "Distance in Man", "Use Plus Density" and the Briskness of an Urban Space

Hall's (1969) theory of "distances in man" defines four categories of distances:

Intimate distance:	0 to 1.5 feet;
Personal distance:	1.5 to 2.5 feet (close phase), 2.5 to 4 feet (far phase);
Social distance:	4 to 7 feet (close phase), 7 to 12 feet (far phase);
Public distance:	12 to 25 feet (close phase), 25 feet and more (far phase).

Let us take D as the distance between two people and H as the height of the two people. Here, we take 5.54' as the average height of North Americans -- including both male and female (Woodson, Tillman & Tillman, 1991). When D/H = 4, then D = 22.16 feet, this is close to the marginal value between the close phase and the far phase of public distance (25 feet). This is a critical value. Beyond this distance, the sense of the details of facial expression and movement of a person begins to be lost, i.e. at this distance, two people begin to have a sense of interaction, beyond this distance, this interaction begins to be lost. We can convert this distance into "use plus density". Suppose the distribution of people in an urban space is even, then the area allowed to each person is 22.16 ft X 22.16 ft = 491.07 ft^2, about 500 ft^2 . Then the "use plus density" is 1000/500 =2 (people/kft^2), i.e. when the "use plus density" of an urban space is about two people per thousand square feet, the space begins to get some kind of briskness.

When D/H = 2, then D = 11. 08 feet, which is close to the marginal value between the far phase of social distance and the close phase of public distance (12 feet). This is also a critical distance with respect to the sensory involvement between two people. This distance can be used to insulate or screen people from each other (Hall, 1969). At this distance, two people can either stay uninvolved or engage each other briefly or disengage at will. And social discourse conducted at this distance has a more formal character than it occurs inside the close phase of social distance (4~7 feet). Within this distance (12 feet), skin texture, hair, conditions of teeth and clothes are readily visible (Hall, 1969). People can strongly sense the existence of others. Converting this distance into "use plus density", we have 11.08 X 11.08 = 122.77 ft^2, this is the area occupied by each person, and the "use plus density" is 1000/122.77 = 8.14 (people/kft^2). When the "use plus density" of an urban space reaches eight people per thousand square feet, the atmosphere of this space becomes highly brisk.

When D/H = 1, then D = 5.54 feet, which is close to the marginal value (4 feet) between the far phase of personal distance (2.5 ~ 4 feet) and the close phase of social distance (4 ~ 7 feet). This is a very common distance for people who are attending a casual social gathering. Impersonal business occurs at this distance and there is more social involvement than in the social far phase. When the distance between two people is equal to their heights (6 feet), a kind of pressing feeling appears. "Details of skin texture and hair are clearly perceived" (Hall, 1969, p. 121). Converting this distance into "use plus density", we have the area occupied by each people 5.54 x 5.54 = 30.69 ft^2, and 1000/30.69 = 32.58 (people/kft^2) in each one thousand square feet area of an urban space. It means that when the "use plus density" of an urban space reaches about 32 to 33 people per thousand of square feet, the brisk atmosphere of the space might reach the peak, and probably the comfort level with respect to density also reaches the upper limit. Beyond this limit, some pressing feelings will be experienced. As to the lowest limit of "use plus density" at the level of which crowding can be caused, the influential elements are very complicated. Whether or not high density leads to psychological stress will depend on an "individual's social and spatial needs in a particular situation, and the special characteristics of the situation as well (Freedman, 1975; Loo, 1977). It is widely accepted that when the invasion of personal space occurs, people feel some degree of discomfort or tension (Altman, 1975; Freedman, 1975; Loo, 1977; Sommer, 1969). Therefore, when the distance between two persons is four feet or less, i.e. a person occupies less than 4ft X 4ft =16 ft^2 area in the urban space, then the 'use plus density"will be 1000/16 = 62.5 (people/kft^2). This means that when the "use plus density" of an urban space is more than 62 people per thousand square feet, it would probably be perceived as crowded. Let us use these standards to take a look at the "use plus density" of 32 urban spaces studied (Table VI-1).

Table VI-1

"Use Density" and "Use Plus Density"of 32 NYC Urban Spaces

Urban Spaces	Winter		Sub-marginal		Marginal	
	UD	UPD	UD	UPD	UD	UPD
Public Library	0.16	0.35	0.80	1.00	2.04	2.27
Greeley Square Park	0.25	0.69	0.93	1.56	2.42	3.28
Herald Square Park	0.55	1.69	1.84	3.43	4.31	6.10
Bell Plaza	0.01	0.22	0.08	0.36	0.15	0.45
Grace Plaza	0.04	0.29	0.17	0.43	0.56	0.82
1155 6th Ave. Plaza	0.27	0.60	0.87	1.44	1.67	1.86
International Paper	0.27	0.70	0.80	1.44	2.61	3.44
W.P. Stevens Plaza	0.24	0.72	0.55	1.11	0.65	1.27
Celanese Plaza	0.22	1.22	0.54	1.59	2.09	3.12
McGraw Hill Plaza	0.24	0.73	0.46	0.93	1.60	2.70
Exxon Plaza	0.36	0.61	0.67	1.03	2.37	3.48
Time & Life Plaza	0.75	1.84	1.20	2.22	4.50	6.25
Webber's Plaza S.	0.47	0.99	0.80	1.49	3.70	4.51
Webber's Plaza N.	0.23	0.73	0.65	1.18	1.24	1.75
J.C. Penny Plaza S.	0.11	0.47	0.23	0.61	0.85	1.32
J.C. Penny Plaza N.	0.49	1.06	0.79	1.56	1.99	2.98
CBS Plaza	0.10	0.26	0.21	0.38	0.39	0.58
Deutsche Bank Plaza	0.31	1.17	1.02	2.05	3.16	4.41
Burlington Plaza	0.40	1.31	1.30	3.32	3.00	4.34
Elsons News Plaza	0.08	0.55	0.29	0.57	0.55	0.96
Grand Army Square S.	0.12	0.14	0.37	0.38	2.47	2.66
Grand Army Square N.	0.15	0.17	0.49	0.60	1.74	1.92
General Motor's Plaza	1.69	2.99	1.86	2.86	2.18	3.16
Paley Park	0.34	0.34	1.35	1.36	4.25	4.31
Urban Plaza	1.13	2.62	2.16	4.18	5.41	7.34
Lever House Plaza	0.07	0.30	0.14	0.36	0.33	0.55
Seagram Plaza	0.04	0.26	0.14	0.40	0.77	1.04
345 Park Avenue Plaza	0.07	0.52	0.37	0.79	1.32	1.71
Police Plaza	0.14	0.99	0.25	1.04	1.00	1.92
Federal Plaza	0.03	0.26	0.12	0.45	0.67	0.97
Collect Pond Park	0.21	0.35	0.39	0.50	2.41	2.60
Rockefeller Center Plaza	9.69	12.32	6.43	8.85	7.58	9.62
TOTAL	19.34	37.15	28.27	48.31	69.98	92.78
GRAND MEAN	0.60	1.16	0.89	1.51	2.09	2.90

UD--Use Density
UPD--Use Plus Density

From the Table, we can see that in winter, only the "use plus density" of General Motor's Plaza (2.99), and Urban Plaza (2.62) has reached the standard of "begins to be brisk"

(2.0), Time & Life Plaza (1.84) and Herald Square Park (1.69) is close to this standard. Rockefeller Center Plaza (12.32) is far beyond the standard of "highly brisk" (≥8.14). In sub-marginal periods, Herald Square Park (3.43), Time & Life (2.22), Deutsche Bank Park (2.05), Burlington Plaza (3.32), General Motor's Plaza (2.86), and Urban Plaza (4.18) reached or exceeded the "begin to be brisk" standard (2.0). Greeley Square Park (1.56), Celanese Plaza (1.59), and J.C. Penny North Plaza (1.56) were close to this standard. Rockefeller Center Plaza (8.95) was beyond the standard of "highly brisk" (8.14).

In marginal seasons, the "use plus density" of most of the urban spaces studied reached or exceeded the "begin to be brisk" standard (2.0). Those of Time & Life Plaza (6.25) and Urban Plaza (7.34) were close to the "highly brisk" standard (8.14), and that of Rockefeller Center Plaza (9.62) exceeded this standard.

The real spatial distribution of people in an urban space is not even. Some areas are congested with people and others are not. Some areas of an urban space such as pools, flower beds, areas with shrubs, trees, etc. cannot be stepped in by users. If these areas are taken out from the whole, we can get a much higher actual "use plus density" of the areas accessible for people within the space. Take Rockefeller Center Plaza as an example. The sunken plaza is not accessible by people who don't skate there, and the flower beds in the promenade area and around the sunken plaza are not accessible for stepping into either. Taking these areas out of the total area, the area left that is accessible to people is much less than the total. The actual "use plus density" for Rockefeller Center Plaza is: 34.3 (winter), 23.5 (sub-marginal) and 25.6 (marginal). These are nearly three times higher than their "use plus density". Clearly, the "actual density" in winter has already exceeded the critical value (30) of making people begin to feel some kind of pressure with respect to density. And the actual density in marginal seasons and sub-marginal periods is close to this value. During my observations of Rockefeller Center Plaza, the highest one time countable actual "use plus density" in winter was 50.9. This value is close to the critical value of 62 which probably causes the feeling of crowding. Photo VI-3 shows a grand occasion at the Rockefeller Center Plaza during the Fifth Avenue Street Festival before Christmas. The whole promenade and the terraces surrounding the sunken plaza were all packed with people. Obviously, this plaza was filled to its capacity and it was impossible for one observer to count the number of the people there. At that moment, the actual "use plus density" was far beyond 62 people per thousand square feet. A similar phenomenon was also observed at the General Motor's Plaza during the holiday seasons. People were waiting in a long line in order to enter the toy store —FAO Schwarz. Sometimes there were so many people on line that the line had to be turned back along 58th Street to the east for up to 200 feet. Based on Photo III-9 and Photo III-10 (p.3.4), it was estimated that there were nearly 500 people on the south terrace. The area of the south terrace is just about 2500 square feet, so the actual "use plus density" here is about 200. It is far beyond the critical value (62) which causes crowding. However, as some researchers have pointed out, crowding depends not only on high density, but also on people's spatial and social needs, and the environmental

Photo VI-3 A Grand Occasion at Rockefeller Center Plaza characteristics of a particular situation. In the examples of my study, it is believed that the feeling of crowding should also be related to climatic factors. A density which causes feeling of crowding at 90°F may not cause the same response at 20°F. We can see the atmosphere of celebration in these photos, however, we are not sure whether people feel crowded or uncomfortable under such a high spatial density. How the feeling of crowding varies with temperature change is a very interesting question which needs further exploration and this is already beyond the extent of my current study. However, during my users' interview, at least one interviewee did mention that General Motor's Plaza is big enough in other seasons but too congested during Christmas season. It seems that some users have sensed this issue.

C. The Categories of Passing and Passing Generators

Passing activities can be mainly classified into three categories: (1). passing for entering or exiting the dominant building of an urban space; (2). passing through an urban space; (3). passing for entering or exiting the commercial, recreational and other service facilities either located within the dominant building of an urban space or within the building directly adjacent to the space. The first category exists in all the corporate plazas. In the second category, people simply use an urban space as a pedestrian traffic path for taking a short cut, or reaching certain destinations. Exxon Plaza and McGraw Hill Plaza both have a cross block path between the dominant building and the front area of the plaza (Figure IV-6, IV-7, see p. 4.4, 4.5). Many people use these paths every day. Actually these two paths function as a cross block short cut. Some urban spaces are located on the major pedestrian routes of the city such as the Herald Square Park and the Greeley Square Park in midtown Manhattan or serve as a connection between major destinations such as the Police Plaza in downtown Manhattan. They are another type of urban spaces frequently used as pedestrian traffic paths. Herald Square Park and Greeley Square Park are both located at where Broadway and Sixth Avenue meet on the extension of the sidewalks. Herald Square Park leads the south bound pedestrians going through the park to 34th street and then to other directions (Figure VI-1). Greeley Square Park does the same for the north bound pedestrians of these two streets. People pass through these two parks in an endless stream everyday. Police Plaza connects the NYC Police Headquarters and the Municipal Building --- two important destinations in downtown Manhattan. It is actually a bridge plaza spanning over an arterial road--Park Row. The Brooklyn Bridge is located to

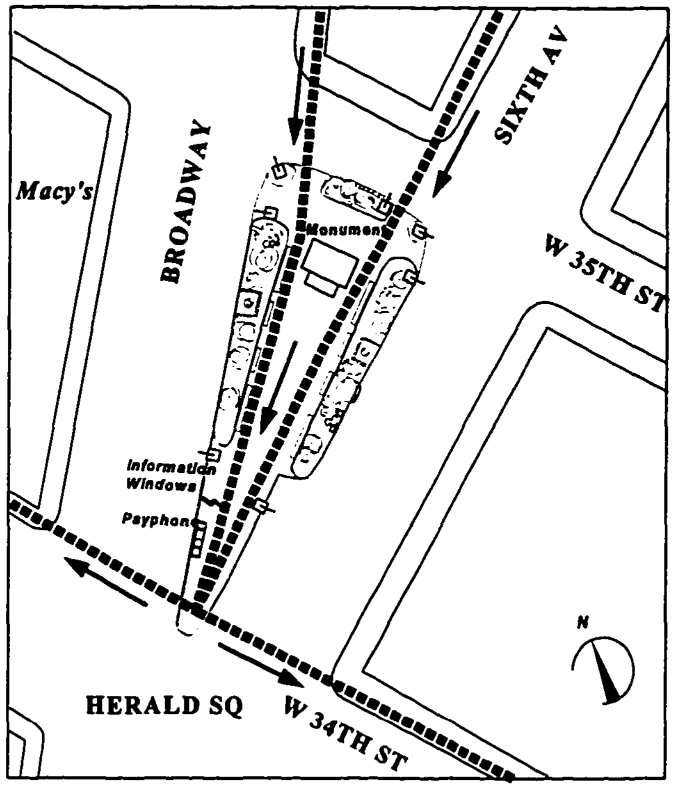


Fig.VI-1 South Bound Pedestrian Movement In Herald Square Park

Photo VI-4 Subway Entrance at Time & Life Plaza its south blocking pedestrians' west-east movement. Another west-east path is Frankfort Street which is 800 feet away south. Therefore, Police Plaza becomes the most frequently used west-east pedestrian path within the blocks nearby. A typical example for the third category of passing is the General Motor's Plaza. The toy store in the plaza (FAO Schwarz) attracted thousands of people everyday during the holiday seasons. People had to wait in a long line in order to enter the store. (Photo III-10) The GM new car exhibition on the first floor, the restaurant (Houlihan's) and other services provided in the sunken area of this plaza also generate a large passing volume. (Photo VI-2 and Photo III-9) In the front part of Time & Life Plaza, there is a subway entrance within the plaza boundary. People have to pass through the plaza for either entering or exiting this entrance (Photo VI-4). The Chemical Bank Branch located on the first floor of the north wing building also generates a lot of passing activity in this plaza (Photo VI-5). The small shops on both sides of the promenade of Rockefeller Center Plaza not only generate a lot of passing activities but also attract many people for window shopping (Photo VI-6). In general, restaurants (such as those in J.

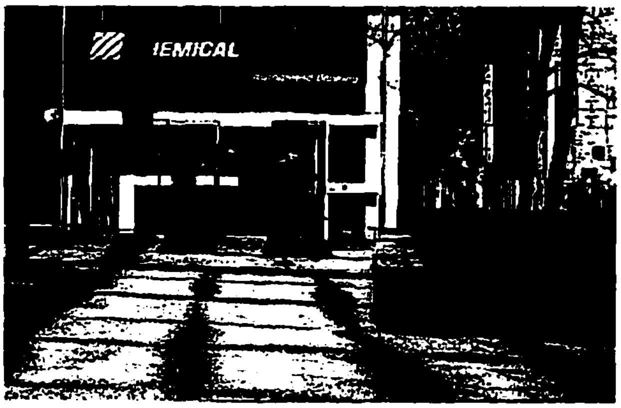


Photo VI-5 Bank at Time & Life Plaza


Photo VI-6 Shop at Rockefeller Center Plaza

C. Penny North Plaza, General Motor's Plaza and Urban Plaza), stores (such as those in General Motor's Plaza, Rockefeller Center Plaza, Burlington Plaza, etc.), banks (Time & Life Plaza, 345 Park Avenue Plaza), subway entrances (Time & Life Plaza, McGraw Hill Plaza), and other commercial or recreational facilities (such as General Motor's new car exhibit) are the most popular passing activity generators in urban spaces.

D. Passing and Climate

As a kind of necessary activity, passing was influenced by climatic conditions to a certain extent. Extreme weather conditions, such as a winter blizzard, definitely decreased passing activities dramatically. However, the general variations in temperature, wind speed (within force six based on Beaufort Wind Comfort Chart) and sunlight had a limited impact on passing.

To compare the passing variation in winter and in summer, passing counts were conducted at Time & Life Plaza, General Motor's Plaza, Police plaza, Herald Square park and Greeley Square park. For winter, the counts were conducted in January and February on sunny, low wind days with the temperature in the low the 30s (F). For summer, the counts were taken in July and August on sunny, low wind days with the temperature around 80 degrees (F). The findings are as follows:

* The passing volume increased by about 30% in summer compared with winter at three urban spaces: Time & Life Plaza (28.7%), Herald Square Park (28.6%), and Greeley Square Park (31.7%).

* At Police Plaza, the passing volume only increased by 5.7% in summer. This is

because its special location, a very convenient west-east passageway within several blocks nearby, which helped keep a stable passing volume for the plaza both in winter and in summer.

* The counts for General Motor's Plaza include two parts: the counts of passing for entering and exiting the main entrance of the GM building and the counts for entering and exiting FAO Schwarz --- the toy store. The former increased 44.3% in summer, whereas the latter decreased 32% in summer. The total passing volume of the plaza decreased by 4% in summer. If the winter counts at General Motor's Plaza had been conducted during the holiday seasons, the number of passing for entering or exiting the FAO Schwarz Store would have been much higher, which means that the decrease would have been much greater. This is a special case.

In general, passing volumes in urban spaces increased slightly in summer compared with winter. Most of them increased by about 30%. Let us take a look at the variation of the grand means of "passing density" of 32 urban spaces in the three seasonal periods (winter, the sub-marginal and the marginal), and compare them with the variation of "use density" in the corresponding seasonal periods, in order to get a further understanding of the relationship between passing and climate (see Figure VI-2).

From Figure VI-2 , we can see that:

* The "passing density" in different seasonal periods fluctuated within a very narrow range of around 0.5. The grand mean of "passing density" of 32 urban spaces was 0.56 in winter, 0.62 in the sub-marginal, and 0.71 in the marginal.

* When the temperature is around the 30s (F), the grand mean of "passing density"

was about 0.6, and when it was around 60°F, the grand mean of "passing density" was about 0.78. It was very interesting that the increase was also about 30%: (0.78 -0.6)/0.6 = 0.3. Observations show that around 60°F in spring, the use or "use density"of urban spaces was close to the summer level. Therefore, the passing volume percentage increase at Time & Life Plaza, Herald Square Park and Greeley Square Park was rather representative.

* When the temperature was lower than 20°F, the grand mean of "use density" was lower than the grand mean of "passing density", and it became higher than that of "passing density" when the temperature reached the mid 20s (F). However, the difference was not significant until the temperature reached about 40°F, then the "use

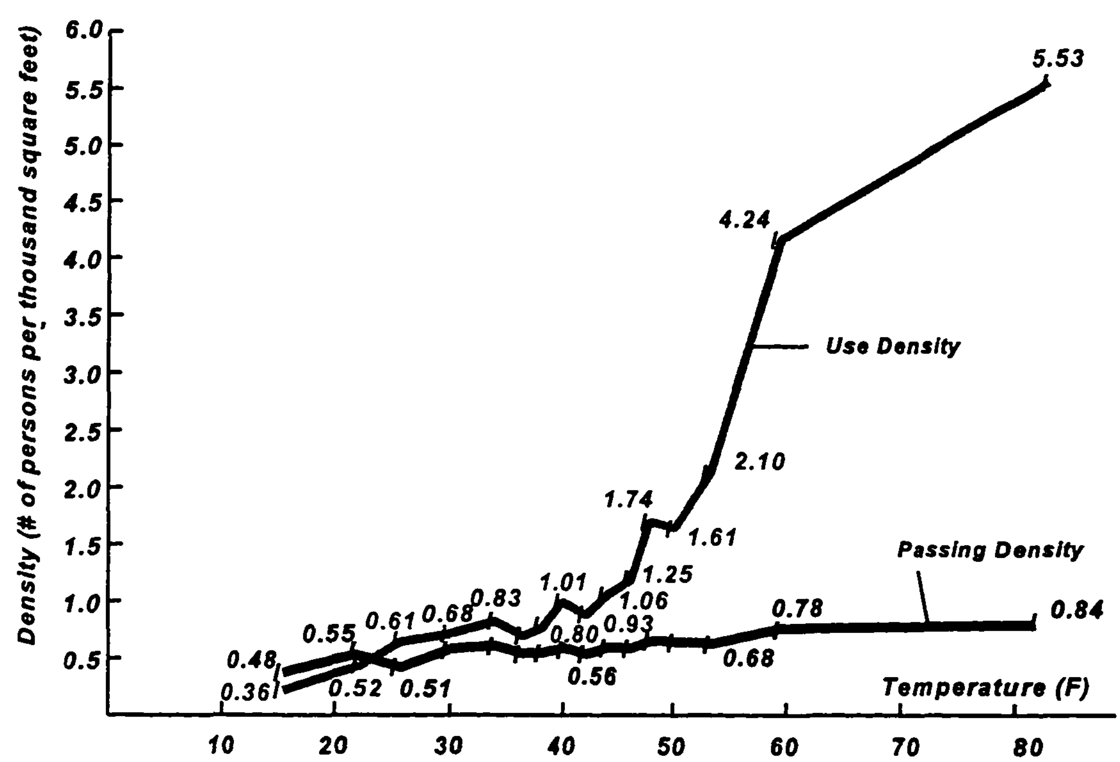


Figure VI-2 Comparasion of Use Density and Passing Density

density" went up dramatically whereas the "passing density" still fluctuated between 0.5 and 1. (This also indicates that 40°F is a critical temperature level). When the temperature went up from 30°F to 60°F, "use density" increased by seven to eight times compared with the "passing density" increase which was just about 30% within the same temperature range.

The above findings show that passing is a stable element in keeping urban spaces vital in winter, therefore, by increasing passing activities in an urban space in winter, the vitality of that urban space could be improved . But how this can be done together with the use of other methods in order to increase "use density" of urban spaces is an important direction for further research.

The multiple regression analysis for 32 urban spaces (Model 1- with Rockefeller Center), in which "passing density" was used as the dependent variable, shows that climatic variables were not significant in predicting "passing density" in all the three seasonal periods at the 0.05 level with the only exception of temperature in winter.

From Table VI-2, we can see that the correlation between the climatic variables and the "passing density" was very weak, usually less than 10%, positive or negative. And the variance of "passing density" accounted for was usually less than 1%. Only in winter, "temperature" was significant; it accounted for 1.65%of the variance in "passing density". Therefore, the result of the multiple regression analysis has also verified that climatic variables had very limited influence on "passing density." In the marginal seasons, or even the sub-marginal periods, they did not significantly influence "passing density."

Table VI-2
Passing Density and Climatic variables (Model 1-with Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
TEMPERATURE	Winter	0.0929	4.98	<0.0027	Yes	0.0107532	1.65%
	Sub-mar.	-0.0589	0.00	<0.9557	No	-0.1968316	0.00%
	Margin.	0.0343	1.52	<0.2198	No	0.0079229	0.60%
SUN EXPOSURE	Winter	-0.0447	3.09	<0.0809	No	0.0022618	1.01%
	Sub-mar.	-0.0261	0.71	<0.4017	No	0.0215243	0.27%
	Margin.	0.0666	0.64	<0.4267	No	0.0009207	0.25%
WIND	Winter	-0.0852	2.53	<0.1140	No	0.0633020	0.82%
	Sub-mar.	0.0254	0.98	<0.3227	No	0.0383726	0.38%
	Margin.	-0.1156	0.42	<0.5177	No	0.0360917	0.17%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance accounted for in the outcome variable

In Model 2 (without Rockefeller Center), "temperature" came out not significant in winter (see Table VI-2A). This means that with or without Rockefeller Center, the roles climatic variables played in influencing "passing density" had no significant difference. However, we should notice in this Model that although climatic variables were not significant in winter, their F values, (3.64 for "temperature", 3.11 for "sun exposure" and 2.53 for "wind") were all not far away from the marginal value 3.90. The variance in "passing density" they accounted for in winter was also significantly higher than that in other seasonal periods. All these results mean that climatic variables had a stronger influence on "passing density" in winter than in other seasonal periods. In Model 1 we can see a similar phenomenon. This is a very interesting phenomenon, quite in contrast with the roles climatic variables played in influencing "use density" (see Chapter VII for details). By synthesizing Model 1 and Model 2, we can interpret the roles climatic variables played in influencing "passing density" as this: they had very limited influence in warm seasonal periods, but noticeable influence in winter--serious winter weather conditions such as bitter cold temperature discouraged passing to some extent.

Table VI-2A
Passing Density and Climatic variables (Model 2-without Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
TEMPERATURE	Winter	0.1060	3.64	<0.0583	No	0.0080004	1.66%
	Sub-mar.	-0.0304	0.08	<0.7783	No	-0.0046984	0.04%
	Margin.	0.0547	0.90	<0.3436	No	0.0060600	0.42%
SUN EXPOSURE	Winter	0.0066	3.11	<0.0800	No	0.0019552	1.40%
	Sub-mar.	0.0368	1.00	<0.3198	No	0.0012688	0.50%
	Margin.	0.0878	1.53	<0.2175	No	0.0012419	0.71%
WIND	Winter	-0.0143	2.74	<0.1001	No	0.0565720	1.22%
	Sub-mar.	-0.0166	0.32	<0.5709	No	0.0211542	0.16%
	Margin.	-0.0843	0.53	<0.4671	No	0.0419657	0.25%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance accounted for in the outcome variable

E. Passing Density and Other Explanatory Variables

Since climatic variables did not influence "passing density" significantly, it is important to find out which ones were significant, especially in winter. Only then could we figure out how to increase passing activity in urban spaces in order to improve their vitality.

Table VI-3
Passing Density and Other Explanatory Variables (Model 1 with Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
ACTIVITY	Winter	0.6813	142.70	<0.0001	YES	0.0692979	46.42%
	Sub-mar.	-0.5977	47.89	<0.0001	YES	0.0508947	35.73%
	Margin.	0.5503	36.97	<0.0001	YES	0.0471754	30.28%
LAND USE DIVERSITY	Winter	0.4368	1.73	<0.1903	NO	0.0026777	0.56%
	Sub-mar.	0.4472	6.86	<0.0097	YES	0.0057903	1.69%
	Margin.	0.3894	7.06	<0.0087	YES	0.0619622	2.84%
SEATING DENSITY	Winter	0.0346	0.01	<0.9042	NO	0.0002836	0.01%
	Sub-mar.	0.1274	4.39	<0.0378	YES	0.0051158	0.38%
	Margin.	0.2027	10.45	<0.0015	YES	0.0083290	4.20%
VISUAL DIVERSITY	Winter	0.4715	0.89	<0.3467	NO	0.0143036	0.29%
	Sub-mar.	0.3711	0.24	<0.6280	NO	0.0083715	0.09%
	Margin.	0.3936	1.96	<0.1631	NO	0.0249868	0.79%
POTENTIAL FOOTAGE	Winter	0.3642	0.74	<0.3902	NO	-0.0000579	0.24%
	Sub-mar.	0.3182	0.10	<0.7520	NO	-0.0000245	0.04%
	Margin.	0.2136	2.29	<0.1326	NO	-0.0001212	0.91%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance accounted for in the outcome variable

Observations show that various commercial and entertainment activities provided within the space or within the ground floor of the buildings directly adjacent to the space ("activity") were the most significant elements which generated passing in the space. And the multiple regression analysis for 32 urban spaces has also confirmed this. From Table VI-4 we can see that "activity" was the most significant variable in predicting "passing density" in all the three seasonal periods. And it accounted for 46.42% of the variance in "passing density" in winter, 35.73% in the sub-marginal periods, and 30.28% in the marginal seasons.

"Land use diversity" was not significant in winter, but significant in both the sub-marginal periods and the marginal seasons. What we should notice is that the variable "activity" actually also refers to a kind of "land use diversity" based on its definition: "the commercial and entertaining activities provided directly within an urban space or within the ground floor of the buildings directly adjacent to the urban space." Actually only in Rockefeller Center Plaza was the skating activity within the urban space itself; at all other urban spaces, "activities" were provided indoors. If we regard this as "the primary land use diversity" around the urban space then "the ground floor land use of the six 200 by 200 feet lots of the six blocks around the urban space" ("land use diversity") can be regarded as "the secondary land use diversity". Therefore, the result of the regression analysis can be interpreted that the "land use diversity" at both the primary and the secondary level around an urban space are the most significant elements in generating passing activity and predicting "passing density" within the urban space.

In the Section of "The Category of Passing and Passing Generators" I have already mentioned that if an urban space is located on the major pedestrian routes of the city (like Herald Square Park and Greeley Square Park), or if it connects different major destinations (like Police Plaza), then a stable and a large amount of passing volume will be generated. Now we know that by introducing the most diversified land use at both the primary and the secondary level around an urban space, similar passing volume also can be generated (such as at General Motor's Plaza and Rockefeller Center Plaza).

"Seating density" was significant in both the sub-marginal periods and the marginal seasons, and this is not what I expected. From my observations there seemed to be no strong relationship between "seating density" and "passing density". However, the regression analysis based on the 32 urban spaces data set showed just such a result. If we examine the correlations between "seating density" and "passing density" in different seasonal periods carefully, we can see that these correlations were very weak (-0.0346 in winter, 0.1274 in the sub-marginal and 0.2027 in the marginal), much lower than the corresponding correlations between "passing density" and "visual diversity"or "potential footage", which were not significant at all in any seasonal periods. Therefore, we should be very careful in the interpretation of the effects of "seating density" on "passing density". Based on my observations and the correlations, my opinion is that there is no causal relationship between "seating density" and "passing density".

"Visual diversity" and "potential footage" were both not significant at the 0.05 level in predicting "passing density"in all the three seasonal periods. When Rockefeller Center was taken out of the regression model, there was not much difference with respect to the significance of the explanatory variables in influencing "passing density", with the single exception of "potential footage": it became significant in all the three seasonal periods. Its parameters in the regression equations were still negative, however, its correlations to "passing density" in the three periods all changed from positive into negative. This means that in the regression model, "potential footage" was a discouraging element in influencing "passing density" even with Rockefeller Center in the model. Because of the high "passing density" and high "potential footage" of Rockefeller Center, the negative influence of "potential footage" was somewhat concealed. When it was out, this negative influence became clearer (see Table VI-3A).

Table VI-3A
Passing Density and Other Explanatory Variables (Model 2 without Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
ACTIVITY	Winter	0.4870	62.70	<0.0001	YES	0.0524244	23.71%
	Sub-mar.	0.3895	27.37	<0.0001	YES	0.0508947	15.17%
	Margin.	0.4278	34.27	<0.0001	YES	0.0501612	18.30%
LAND USE DIVERSITY	Winter	0.2372	0.52	<0.4706	NO	0.0012804	0.23%
	Sub-mar.	0.2771	4.32	<0.0393	YES	0.0043735	1.69%
	Margin.	0.3155	5.61	<0.0192	YES	0.0054732	2.69%
SEATING DENSITY	Winter	0.2009	1.65	<0.2012	NO	0.0025389	0.73%
	Sub-mar.	0.2755	4.39	<0.0378	YES	0.0051158	0.38%
	Margin.	0.3069	13.33	<0.0004	YES	0.0095295	6.59%
VISUAL DIVERSITY	Winter	0.2462	0.09	<0.7638	NO	0.0040278	0.04%
	Sub-mar.	0.2014	0.24	<0.6280	NO	0.0083715	0.09%
	Margin.	0.2878	1.24	<0.2681	NO	0.0293407	0.04%
POTENTIAL FOOTAGE	Winter	-0.0716	12.63	<0.0005	YES	-0.0002275	5.85%
	Sub-mar.	-0.0494	4.12	<0.0442	YES	-0.0001573	2.11%
	Margin.	-0.0513	5.89	<0.0164	YES	-0.0002020	2.74%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance accounted for in the outcome variable

The role "potential footage" played in influencing "passing density" was also not what I expected. Based on the definition of "potential footage", we can see that what "potential footage" refers to is not <u>the actual built square footage</u> of the six 200 feet by 200 feet lots within the six blocks surrounding an urban space, but <u>the permitted maximum square footage by the New York City Zoning Resolution</u> on these lots. I had expected that a higher "potential footage" could indicate a higher amount of day time working population, and this, in turn, means a higher number of potential passers-by for the urban space.

However, in some cases, there is a big difference between the actual built square footage and the permitted square footage, such as Grace Plaza. One of its six 200 feet by 200 feet surrounding lots which is located on the west side of Sixth Avenue between 42nd Street and 43rd Street is within the C6-6 zoning area and the permitted floor ratio is 15 for commercial land use . In fact, all the buildings within this lot are one or two story commercial ones with very low built square footage. In some other cases, a group of plazas are all within the same zoning area, such as the plazas located along the west side of Sixth Avenue (Celanese, McGraw Hill, Exxon, Time & Life, Webber's South, Webber's North, J. C. Penny South, J. C. Penny North, Burlington). It means that their "potential footage" are almost the same although their "actual built square footage" and "passing density" are totally different. It may be because of these reasons that the variable "potential footage" could not function as expected as an indicator of the day time working population within the surrounding lots and also of the potential passers-by of the urban space. Therefore, the selection of this variable is problematic. The "actual built square footage" of the six surrounding lots could be a better variable. A similar phenomenon also happened to the relationship between "potential footage" and "use density". This will be discussed in the next chapter.

F. Passing Density and Use Density

When "use density" was used as the dependent variable, "activity", "visual diversity", "land use diversity", "potential footage", "seating density", "passing density", "temperature", "wind", and "sun exposure" as the explanatory variables, the multiple regression analysis was done with the data sets of winter, sub-marginal periods and marginal seasons respectively.

"Passing density" is the most significant variable in predicting "use density" at the 0.05 level in all the three seasonal periods. In winter, it accounted for 58.69% of the variance in "use density", and the Pearson correlation between "passing density" and "use density" was 0.7660. In the sub-marginal periods, "passing density" accounted for 52.64% of the variance in "use density", and the Pearson correlation between "passing volume" and "use density" was 0.7255. In the marginal seasons, it accounted for 43.93% of the variance in "use density", and the Pearson correlation was 0.6628. These results suggest that "passing density" had an overwhelming significance in predicting "use density", especially in winter (see Table VII-2 in the next chapter). It is safe to say that its influence on the "use density" in winter and the winter vitality of an urban space is not just "helpful" but "essential".

The results also show that as the weather was getting warmer, "passing density" had slightly less influence on "use density". This was because other variables such as "seating density" and climatic-variables ("temperature", "sun exposure" and "wind") became increasingly significant and accounted for a greater percentage of the variance in "use density" than they did in winter.

Up to now, the findings have already verified the second hypothesis that "passing density" is positively and highly correlated with "use density" and is significant in predicting "use density" in winter.

CHAPTER VII

USE DENSITY AND OTHER EXPLANATORY VARIABLES

In the section on "Passing density" and "Use density" in last chapter, we discussed how "passing density" influenced "use density". In this chapter we will discuss the relationships between "use density" and other explanatory variables.

Findings

When "use density" was used as the dependent variable, and "activity", "visual diversity", "land use diversity", "potential footage", "seating density", "passing density", "temperature", "wind", and "sun exposure" as the explanatory variables to run the multiple regression analyses, with the data sets for winter, sub-marginal periods and marginal seasons, three regression functions have been obtained.

Winter

In winter only "passing density" and "potential footage" were significant at the 0.05 level in predicting "use density." The regression equation is:

$$USD = -3.84148 + 2.04035\ PSD + 0.00092\ PTF$$

$R_2 = 0.5869$ $\quad$ $p<0.0001$

Here: USD --- use density

PSD --- passing density

PTF --- potential footage

The regression means:

1. Holding other explanatory variables constant, when "passing density" increases by 1 person per thousand square feet, then the number of users within one thousand

square feet of an urban space will increase by 2.04;

2. Holding other explanatory variables constant, when "potential footage" increases by one million square feet, then the number of users within one thousand square feet will increase by 0.92;

This model can account for 58.69% of the variance in the outcome variable: "use density".

Sub-marginal periods

In sub-marginal periods, "activity," "land use diversity," "temperature" and "passing density" were significant at the 0.05 level in predicting "use density." The regression equation is:

$$USD = -3.27324 + 0.05297ACT + 0.01252LUD + 0.06095TMP + 1.15504PSD$$

$$R_2 = 0.6154 \qquad p<0.0504$$

Here: USD --- use density

ACT --- activity

LUD --- land use diversity

TMP --- temperature

PSD --- passing density

The regression equation means:

1. Holding other explanatory variables constant, when "activity" increases by one scale point, then the number of users within one thousand square feet area will increase by 0.0530;

2. Holding other explanatory variables constant, one scale unit increase in land use

diversity means that the number of users within one thousand square feet area will increase by 0.0125;

3. Holding other explanatory variables constant, when temperature increases by one degree (F), then the number of user within one thousand square feet area will increase by 0.0610;

4. Holding other explanatory variables constant, when "passing density" increases by one person per thousand square feet, then the number of user within one thousand square feet area will increase by 1.1550.This model can account for 61.54% of the variance in the outcome variable: use density.

Marginal seasons

In marginal seasons, "passing density", "activity", "temperature", "land use diversity", "seating density", "sun exposure" and "wind" were significant at the 0.05 level in predicting "use density". The regression equation is:

$$USD = -7.16274 + 0.02119LUD + 0.13346TMP + 0.00860SUN - 0.38452WND + 0.01664STD + 2.01361PSD$$

$R^2 = 0.6610$ $\quad$ $p<0.0275$

Here: USD --- use density

LUD --- land use diversity

TMP --- temperature

SUN --- sun exposure

WND ---wind

STD ---seating density

PSD --- passing density

This regression equation means:

1. Holding other explanatory variables constant, one scale unit increase in land use diversity means that the number of users within one thousand square feet area will increase by 0.02119;

2. Holding other explanatory variables constant, an increase of one degree Fahrenheit in temperature means the number of users within one thousand square feet area will increase by 0.13346;

3. Holding other explanatory variables constant, when "sun exposure" increases by one percent, then the number of users within one thousand square feet area will increase by 0.00860;

4. Holding other explanatory variables constant, when the Beaufort wind force increases by one, then the number of users within one thousand square feet area will decrease by 0.38452;

5. Holding other explanatory variables constant, when "seating density" increases by one linear foot within per thousand square feet area corresponds to 0.0167 users increase within the same amount of area;

6. When "passing density" increases by one person per thousand square feet, then the number of users within one thousand square feet area will increase by 2.01361.

This model can account for 66.10% of the variance in use density.

Discussion

Now, let us discuss the roles of these variables in different seasonal periods in detail.

We will begin the discussion with climatic variables. The discussion will be mainly based on the regression analysis results form running the 32 urban spaces data set (identified as Model I, see Table VII-1 and Table VII-2). As a comparison, the regression results from running 31 urban spaces data set (Rockefeller Center was eliminated, identified as Model II) are also provided (see Table VII-1A and Table VII-2A).

A. Climatic Variables

Climatic variables ("temperature," "sun exposure" and "wind") play very different roles in different seasonal periods with respect to use density. In the winter, "temperature," "wind," and "sun exposure" together account for only 0.12% of the variance in use density. In sub-marginal periods, this percentage increases to 1.10%, and in marginal seasons, it increases tremendously to 18.52%. See Table VII-1.

Table VII-1
Use Density and Climatic Variables

VARIABLE	SEASON	R	F	P	S	B	V
TEMPERATURE	Winter	0.0723	0.46	<0.5004	No	0.008184	0.10%
	Sub-mar.	0.0384	3.89	<0.0504	Yes	0.061855	0.96%
	Margin.	0.3974	52.54	<0.0001	Yes	0.144513	14.07%
SUN EXPOSURE	Winter	-0.0676	0.02	<0.8472	No	-0.000514	0.01%
	Sub-mar.	-0.0315	0.00	<0.9949	No	-0.000017	0.00%
	Margin	0.2755	12.80	<0.0005	Yes	0.001114	3.19%
WIND	Winter	-0.1056	0.04	<0.8488	No	-0.020173	0.01%
	Sub-mar.	-0.0439	0.54	<0.4622	No	-0.051731	0.14%
	Margin.	-0.2769	5.53	<0.0200	Yes	-0.386151	1.26%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance in the outcome variable accounted for

In winter, none of the three climatic variables was significant in predicting "use density" at the 0.05 level. In sub-marginal periods, only "temperature" is significant ($F=3.89$ $p<0.0504$). In marginal seasons, "temperature" ($F=52.54$ $p<0.0001$), "sun exposure" ($F = 12.80$ $p<0.0005$), and "wind" ($F=5.53$ $p<0.0200$) are all significant at the 0.05 level (see Table VII-1). It is apparent that climatic variables have almost no influence on "use density" in winter. In sub-marginal periods, they begin to influence "use density" to some degree. In marginal seasons, these three variables together play a very strong role in influencing "use density." In comparison with the relationship between climatic variables and "passing density," we can see the great difference here. Climatic variables did not significantly predict "passing density" at the 0.05 level in any of the three seasonal periods except "temperature" in winter (see Table VI-3). And the correlations between "passing density" and these variables were very weak in all the three seasonal periods. It seems that in winter, climatic variables had a relatively stronger influence on "Passing density", because they accounted for 3.48% of the variance in it compared with 0.65% in sub-marginal and 1.02% in marginal. These findings tell us that passing as a necessary activity is not significantly influenced by climatic variables. Only extreme weather conditions may discourage passing noticeably, such as bitterly cold temperatures. As an optional activity, "use density" is strongly influenced by climatic variables. When the weather conditions were not supportive, users simply disappeared from urban spaces and "use density" dropped tremendously.

1."Temperature" correlates with "use density" and its regression parameters in all the three seasons are positive (see Table VII-1). This means that "temperature" is an encouraging variable in influencing "use density" in all the three seasonal Periods. It was not significant at the 0.05 level in winter but significant in both sub-marginal periods and marginal seasons. When we examine Table VII-1 carefully, we can see that the F ratio for "temperature" in winter is 0.46 ($p< 0.5004$), and 3.89 ($p< 0.0504$) in sub-marginal. This has verified again that sub-marginal periods are no doubt critical seasonal periods. From then on, "temperature" began to influence "use density" significantly and climatic variables began to play more and more significant roles.

2. **"Sun exposure"** was significant in predicting "use density" at the 0.05 level in marginal seasons. However, the negative correlation of "sun exposure" and "use density," and the negative parameters of "sun exposure" in the regression equation for both winter and sub-marginal periods do not necessarily mean that sun light discourages "use density" during these seasonal periods. This phenomenon happened because the two most heavily used plazas in the winter and sub-marginal periods--Rockefeller Center Plaza and General Motors Plaza--had very low "sun exposure" scores. The mean of "sun exposure" was 0.05 for the former and zero for the latter in both winter and the sub-marginal periods. When either of these two plazas was removed from the regression model, the regression parameter for this variable and the correlation with "use density" all became positive in both seasonal periods (see Table VII-1A). This means that sun light still played a positive role in influencing "use density" in these two seasonal periods. However, its role was too weak, compared with other variables such as "passing density".

3., **"Wind"** was always negatively correlated with "use density" in all the three seasonal periods. This phenomenon and the negative regression parameters for "wind" all suggest that "wind" is a discouraging variable in influencing "use density". Why was wind not significant in winter and the sub-marginal periods? One reason could be that climatic variables, including wind, do not play significant roles during cold seasonal periods especially in winter. Even when Rockefeller Center was removed (Model 2), "wind" became significant in the sub-marginal but still not significant in winter. And another reason may be that all the observations were conducted on days when the wind was at force five or lower. Based on the Beaufort Wind Chart, wind speeds at force five or lower are within people's tolerable range. This means that in all my observations, "wind" was not strong enough to expel people out of urban spaces. Therefore, the results of the multiple regression analysis also support that it is people and people's activity that attract more people to come and to stay in urban spaces in cold seasons rather than ideal climatic conditions.

Table VII-1A
Use Density and Climatic Variables (without Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
TEMPERATURE	Winter	0.1912	8.63	<0.0038	Yes	0.089215	2.26%
	Sub-mar.	0.1978	11.29	<0.0010	Yes	0.053740	2.81%
	Margin.	0.4828	66.18	<0.0001	Yes	0.152128	20.47%
SUN EXPOSURE	Winter	0.0179	2.47	<0.1182	No	0.001270	0.63%
	Sub-mar.	0.1030	3.41	<0.0669	No	0.002116	0.69%
	Margin	0.3345	11.70	<0.0001	Yes	0.011989	4.93%
WIND	Winter	0.0105	0.54	<0.4628	No	0.018733	0.14%
	Sub-mar.	-0.1485	4.38	<0.0382	Yes	-0.064570	0.89%
	Margin.	-0.2732	6.31	<0.0131	Yes	-0.351061	1.37%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance in the outcome variable accounted for

When Rockefeller Center Plaza was eliminated from the regression model, some differences can be seen in the results. The overall difference is that in Model II, climatic variables played a stronger role in influencing "use density" than they did in Model I. This is reflected in several ways. First, "temperature" became significant in winter and "wind" became significant in the sub-marginal periods. Second, the correlations between climatic variables and "use density" increased slightly in Model II. Third, the variance in "use density" accounted for by climatic variables also increased in model II: from 0.12% to 3.03% in winter, from 1.10% to 4.39% in the sub-marginal periods and from 18.52% to 26.77 in the marginal periods (see Table VII-1A).

Rockefeller Center Plaza had extremely high "use densities" among all the 32 urban spaces studied. However, its micro-climatic conditions were not good as mentioned several times in this study. Therefore, it did not surprise me that when it was taken out of the model, climatic variables would play a stronger role. However, even from Model II, we still can conclude that climatic conditions play a limited role influencing "use density" in winter (only "temperature" was significant and three climatic variables accounted for only 3.03% of the variance in "use density"). The role of climatic conditions become more and more significant beginning with the sub-marginal periods ("sun exposure" became significant and the variance accounted for increased). In the marginal seasons climatic variables play a very significant role (all the three climatic variables were significant, their correlations with "use density" and the variance in "use density" accounted for by them all increased tremendously). We can see very clearly that Model II (without Rockefeller Center) did not change the roles of climatic variables fundamentally but only made their roles a little stronger in all the three seasonal periods. Similar phenomena also happened to some other explanatory variables. This will be explained later.

B. Land Use Diversity

"Land use diversity" is a variable describing the context of an urban space. For a specific urban space, it is a constant. It had positive and moderate correlations with "use density" in all three seasonal period "land use diversity" was not significant in winter, accounting for only 0.50% of the variance in "use density" because of the overwhelming significance of the variable "passing density." In sub-marginal periods and marginal seasons, it was significant and accounted for 5.49 and 2.58% of the variance in "use density" respectively--much higher than the case in winter. Observations showed that if the land use around an urban space is highly mixed with office uses and retail, and service uses, it usually has a relatively high "passing density" and "use density." The result of this kind of mixed land use can be seen clearly from a comparison of the four Rockefeller Center system plazas on Sixth Avenue (Time & Life, Exxon, McGraw Hill, and Celanese) and the three plazas on Park Avenue (Seagram, Fuji, and Lever House). The former have diversified retailing mixed with office uses whereas the latter have mainly office uses and very few retailing uses within the surrounding areas. The result is that the four Rockefeller Center system plazas have significantly higher "use densities" than the three Park Avenue plazas, especially in winter.

C. Seating Density

"Seating density" describes one of the physical characteristics of an urban space.

From Table VII-2, we can see that it was significant in predicting "use density" at the 0.05 level in marginal seasons (F=4.95) and accounted for 1.10% of the variance in "use density".

Table VII-2
Use Density and Other Explanatory Variables

VARIABLE	SEASON	R	F	P	S	B	V
PASSING DENSITY	Winter	0.766	224.45	<0.0001	Yes	2.3895756	58.69%
	Sub-mar.	0.726	175.62	<0.0001	Yes	1.6409570	52.64%
	Margin.	0.663	123.81	<0.0001	Yes	2.5169324	43.93%
LAND USE DIVERSITY	Winter	0.462	2.37	<0.1259	No	0.0076462	0.50%
	Sub-mar.	0.534	20.59	<0.0001	Yes	0.0181077	5.49%
	Margin.	0.431	11.02	<0.0011	Yes	0.0213124	2.58%
POTENTIAL FOOTAGE	Winter	0.546	38.86	<0.0001	Yes	0.0092190	8.20%
	Sub-mar.	0.367	0.06	<0.8070	No	0.0000342	0.02%
	Margin.	0.168	0.04	<0.8325	No	0.0000490	0.01%
SEATING DENSITY	Winter	-0.926	2.57	<0.1113	No	-0.0091430	0.53%
	Sub-mar.	0.776	0.27	<0.6038	No	-0.0020955	0.07%
	Margin.	0.527	4.95	<0.0275	Yes	0.0166358	1.10%
VISUAL DIVERSITY	Winter	0.457	0.03	<0.8566	No	-0.0068558	0.01%
	Sub-mar.	0.350	0.06	<0.8044	No	-0.0077751	0.02%
	Margin.	0.286	1.55	<0.2144	No	-0.0623715	0.41%
ACTIVITY	Winter	0.651	0.62	<0.4329	No	0.0180848	0.13%
	Sub-mar.	0.616	9.67	<0.0022	Yes	0.0477781	2.44%
	Margin.	0.393	1.03	<0.3128	No	0.0272697	0.23%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance in the outcome variable accounted for

However, "seating density" was not significant during both winter and the sub-marginal periods. It accounted for only 0.53% and 0.07% of the variance in "use density" in these two seasonal periods respectively. Its correlation with "use density" was negative in winter and its parameters in the regression equation were negative in both winter and the sub-marginal periods. This means that the higher the "seating density", the lower the "use density" in winter and the sub-marginal periods. explains why "seating density" was significant in the marginal seasons and why both its correlation with "use density" and its parameter in the regression model became positive when Rockefeller Center was eliminated from the regression model.

Table VII-2A
Use Density and Other Explanatory Variables (without Rockefeller Center)

VARIABLE	SEASON	R	F	P	S	B	V
PASSING DENSITY	Winter	0.6552	115.10	<0.0001	Yes	0.6181130	42.93%
	Sub-mar.	0.6555	115.24	<0.0001	Yes	0.9122366	42.96%
	Margin.	0.5703	73.75	<0.0001	Yes	2.0864967	32.53%
LAND USE DIVERSITY	Winter	0.3255	11.66	<0.0008	Yes	0.0045516	3.21%
	Sub-mar.	0.4456	23.18	<0.0001	Yes	0.0109969	7.55%
	Margin.	0.3098	9.15	<0.0029	Yes	0.0179321	2.13%
POTENTIAL FOOTAGE	Winter	-0.1722	16.96	<0.0001	Yes	-0.0002132	5.33%
	Sub-mar.	-0.2814	34.86	<0.0001	Yes	-0.0004348	9.28%
	Margin.	-0.1560	5.83	<0.0170	Yes	-0.0004954	1.32%
SEATING DENSITY	Winter	0.2193	3.08	<0.0813	No	0.0025722	0.80%
	Sub-mar.	0.3659	7.45	<0.0071	Yes	0.0061732	1.63%
	Margin.	0.3504	15.17	<0.0001	Yes	0.0279805	3.86%
VISUAL DIVERSITY	Winter	0.0676	10.88	<0.0001	Yes	-0.0314711	3.21%
	Sub-mar.	0.1082	8.12	<0.0050	Yes	-0.0412126	1.70%
	Margin.	0.1449	6.53	<0.0127	Yes	0.1184933	1.56%
ACTIVITY	Winter	0.4995	12.29	<0.0006	Yes	0.0205401	4.27%
	Sub-mar.	0.3659	14.59	<0.0002	Yes	0.0322312	4.34%
	Margin.	0.1813	0.00	<0.9555	No	0.0014617	0.06%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance in the outcome variable accounted for

It is believed that this was attributed to the influence of Rockefeller Center Plaza. It has a very low "seating density" and a very high "use density" during the winter and the sub-marginal periods. The "use densities" of other spaces in these two seasonal periods were much lower. Rockefeller Center Plaza accounted for 50.1% of the total "use density" of the 32 urban spaces in winter, 22.7% in the sub-marginal periods and 10.8% in the marginal seasons. This With its removal, "seating density" was still not significant in winter. However it was significant in both the sub-marginal periods and the marginal seasons. And its correlation with "use density" and its parameters in the regression model all became positive in both the sub-marginal periods and winter (See Table VII-2A).

From the above analyses, we can draw the following conclusions: first, "seating density" had a very limited influence on "use density" and was not significant in winter. Second, from the sub-marginal periods, its influence on "use density" increased rapidly. Third, it was significant in the marginal seasons and had a very strong influence on the outcome variable. We can see that the influence of "seating density" on "use density" was very similar to that of climatic variables. These findings are consistent with those from my field observations, i.e. there were very few users sitting in urban spaces in winter. The colder the weather, the fewer the users who sat. From the sub-marginal periods onward, the percentage of users who sat began to increase rapidly. In some urban spaces (such as Seagram Plaza), sitting percentages began to exceed the standing percentages (Li, 1994). In marginal seasons, most of the users sat and "seating density" began to become a determinant of the popularity of an urban space.

D. Activity

The regression analysis with "passing density" as the outcome variable shows that "activity" is the most significant variable in predicting “passing density” in the all three seasons. "Activity" is defined as "the recreational, commercial or cultural activity provided either within an urban space or within the ground level of the buildings directly adjacent to the urban space.” In my study, only Rockefeller Center Plaza provides activity (skating) within the plaza itself. In all the other urban spaces, activities are provided indoors, such as restaurants, banks, stores, galleries, subway stations, and so on. These activities are necessary ones. To participate in these activities, people must pass through the urban spaces. They are passers-by of these spaces. In fact, all these facilities are necessary activity generators. In my previous study (Li, 1991), I found that activity was the most significant variable in predicting "use density" in New York City in winter. In the current study, I have introduced a new variable--“passing density.” “Activity” is a variable which is highly correlated with "passing density" and also the most significant variable in predicting "passing density." It accounted for 46.42% of the variance in "passing density" in winter, 35.73% in sub-marginal periods and 30.28% in marginal seasons. However, when the nine explanatory variables were used to run the regression analysis for “use density”, "activity" was not significant in predicting“use density” in the winter (although its correlation with “use density” was 0.651 in winter) or in the marginal seasons, and the second least significant in sub-marginal periods. Technically, “passing density” mediated the effects of “activity.” From the previous chapter, we could see that “activity” was highly correlated with “passing density” (0.6813 in winter, 0.5977 in the sub-marginal periods and 0.5503 in the marginal seasons), and was the most significant variable in predicting “passing density”in all the three seasonal periods. Since the significance of "passing density" in influencing "use density" was so overwhelming that the role of "activity" was actually overshadowed. When "passing density" was taken out of the regression model, "activity" became the most significant variable in predicting "use density" in all the three seasons (winter: F=117.10, it accounts for 42.6% of the variance in "use density"; sub-marginal periods: F=92.94, it accounts for 37% of the variance in "use density"; marginal seasons: F=47.13, it accounts for 19% of the variance in "use density"). So, the current research finding of the role "passing density" played in predicting "use density" is actually consistent with the finding of my previous study (Li, 1991) of the role "activity" played in predicting "use density."

E. Visual Diversity

"Visual diversity" is another variable which describes the physical characteristics of an urban space. It had been expected that high "visual diversity" would generate more optional activities, i.e. it should be significant in predicting "use density" directly. However, the data from the current samples show that "visual diversity" was not significant in predicting "use density" at the 0.05 level in all the three seasonal periods in Model 1. In Model 2 when Rockefeller Center was out, "visual diversity" became significant in all the three seasonal periods but its regression parameters in winter and the sub-marginal periods were both negative. This means that during these two seasonal periods, the higher the "visual diversity", the lower the "use density". This is divergent with the findings from my field observations.

Rockefeller Center had a very high "visual diversity," and very high "use densities" in all the three seasonal periods. With or without it in the model, "visual diversity" played a very different role in influencing "use density." If we examine Table VII-2 and Table VII-2A carefully, we can see that although the parameters of "visual diversity" are negative, their corresponding correlations are all positive in both models. In Model 1 the correlation is even as high as 0.4574 in winter, a positive and moderate one. Therefore, we should be very careful about interpreting the role "visual diversity" played on "use density". Based on the findings of my field observations and the positive correlation between "visual diversity"and "use densities," my opinion is that "visual diversity" should be considered as a positive element in influencing "use density." The real role it plays needs further investigation.

F. Potential Footage

"Potential footage" is another contextual variable relevant to an urban space. It refers to the maximum square footage permitted by the New York City Zoning Resolution of the six 200 feet by 200 feet lots of the surrounding blocks. It was hoped that this variable would also function as an indicator of the day time working population of these six lots. In Model 1 (Table VII-2), it was significant at the 0.05 level in predicting "use density" in winter only, and it accounted for 8.20% of the variance in "use density". However, it was not significant in both the sub-marginal periods and the marginal seasons. Its correlation with "use density" and its regression parameters were all positive in the three seasonal periods. Therefore, in Model 1 we can say that "potential footage" was an encouraging element with respect to influencing "use density." In Model 2, when Rockefeller Center was out, "potential footage" was significant in all the three seasonal periods and its regression parameters and its correlations to "use density" were all negative in the three seasonal periods (see Table VII-2A). It seems that without Rockefeller Center, "potential footage" played very different roles. It is believed that this happened also because of the unique characteristics of Rockefeller Center--- very high "use density" and the highest "potential footage"among all the 32 urban spaces.

From the definition we can see that what "potential footage" refers to is not the actual built square footage of the six 200 feet by 200 feet lots surrounding the urban space but the permitted maximum square footage by the New York City Zoning Resolution on these lots. For some urban spaces with low "use density" the permitted square footage might be much higher than the actual built ones, such as the case of Grace Plaza. The 200 feet by 200 feet lot between 42nd and 43rd street facing the Grace Plaza across Sixth Avenue is located in the C6-6 district and the permitted floor ratio is 15 for commercial land use. However, the existing buildings on this lot are all one or two story ones waiting for demolition because of the Time Square new development project. Therefore, the actual built square footage is far lower than the maximum permitted square footage. This might be the main reason why "potential footage" was a discouraging element in Model 2. If we had used the actual built square footage instead of the "potential footage" in the regression models, the results might not have been so confusing.

CHAPTER VIII

HOLDING POWER

After the fall marginal season, with the temperature dropping, some outdoor urban spaces began to lose their users very rapidly whereas others did not. The ability to retain users after the fall marginal season differs from one urban space to another. To study this ability of urban spaces, a new concept--"holding power" has been introduced.

A. Definition & Calculation of "Holding Power"

$$H = 1 - \frac{U_{t1} - U_{t2}}{U_{t1}(t_1 - t_2)} \qquad (1)$$

"Holding power"can be measured as:Here, H --- the "holding power" of an urban space

U_{t1} --- the use (or "use density") of the space at temperature t_1

U_{t2} --- the use (or "use density") of the space at temperature t_2

So,

$$\frac{U_{t1} - U_{t2}}{U_{t1}(t_1 - t_2)} \qquad (1)a$$

represents the changing rate of use (or use density) of an urban space with one degree (F) temperature change. This is a percentage, and

$$1 - \frac{U_{t1} - U_{t2}}{U_{t1} t_1 - t_2)}$$

expresses the retained percentage of use or "use density"--"holding power". In equation (1), U can represent either use or "use density". This is because if we express "use density" as

$$U_d = \frac{U_{ti}}{A}$$

(Here A is the area of an urban space; U_d is use density; U_{ti} is use at temperature t_i), then

$$\frac{U_{d1} - U_{d2}}{U_{d1}(t_1 - t_2)} = \frac{\frac{U_{t1}}{A} - \frac{U_{t2}}{A}}{\frac{U_{t1}}{A}(t_1 - t_2)} = \frac{U_{t1} - U_{t2}}{U_{t1}(t_1 - t_2)}$$

This equation reduces to equation (1)a. Therefore, "holding power" can be defined as: "the percentage of use (or "use density") an urban space can retain with each degree (F) temperature decrease within a specific temperature range after the fall marginal season".

For example, if the use of an urban space is 40 people at 50°F and 20 people at 40°F, then its "holding power" within this period is:

$$H = 1 - (40 - 20)/40(50\text{-}40) = 1 - 20/400 = 1 - 0.05 = 0.95$$

It means that during the period when the temperature drops from 50°F to 40°F, with each degree (F) temperature decrease, this urban space can retain 95% of its users.

B. Multiple Regression Analysis

Now let us examine the 32 Midtown and Downtown Manhattan urban spaces studied to see which urban spaces have the stronger "holding power" than the others, and which variables are significant in predicting the "holding power" of an urban space.

The analysis has been done for two periods:

1. From the fall marginal season to the fall sub-marginal period (m-s);

2. From the fall sub-marginal period to winter (s-w).

The "holding power" of each of the 32 urban spaces in these two periods was calculated by using the following functions

$$H_{m-s} = 1 - \frac{\overline{U_m} - \overline{U_s}}{\overline{U_m}(\overline{t_m} - \overline{t_s})} \qquad (2)$$

$$H_{s-w} = 1 - \frac{\overline{U_s} - \overline{U_w}}{\overline{U_s}(\overline{t_s} - \overline{t_w})} \qquad (3)$$

Here, H_{m-s}, and H_{s-w} express the holding power of the marginal to the sub-marginal, and the sub-marginal to winter periods respectively, $\overline{U_m}$, $\overline{U_s}$, $\overline{U_w}$ represent the mean use (or use density) of the urban space in the marginal season, the sub-marginal period and the winter respectively; $\overline{t_m}$, $\overline{t_s}$, $\overline{t_w}$ represent the mean temperatures when the observations were conducted in the marginal season, the sub-marginal period and the winter respectively.

Table VIII-1 summarizes the "holding power" for each of the 32 urban spaces.

"Holding power" was then used as the dependent variable, while "activity", "visual diversity", "land use diversity", "potential footage", "seating density", and "mean passing density" were used as the explanatory variables for a multiple regression analysis to see which variables could predict "holding power" significantly.

Table VIII-1
Holding Power of 32 urban spaces in Two Seasonal Periods

	Urban Space	Hm-s	Hs-w
1	NYC Public Library	0.9422	0.9496
2	Greeley Square Park	0.9434	0.9540
3	Herald Square Park	0.9474	0.9559
4	Bell Plaza	0.9540	0.9412
5	Grace Plaza	0.9311	0.9529
6	1155 6th Ave Plaza	0.9560	0.9563
7	International Paper Plaza	0.9364	0.9584
8	W.P. Stevens Plaza	0.9858	0.9644
9	Celanese Plaza	0.9243	0.9630
10	McGraw Hill Plaza	0.9280	0.9683
11	Exxon Plaza	0.9297	0.9707
12	Time & Life Plaza	0.9259	0.9767
13	Webber's Plaza S.	0.9281	0.9737
14	Webber's Plaza N.	0.9564	0.9594
15	J. C. Penny Plaza S.	0.9331	0.9672
16	J. C. Penny Plaza N.	0.9447	0.9761
17	CBS Plaza	0.9341	0.9667
18	Deutsche Bank Plaza	0.9373	0.9557
19	Burlington Plaza	0.9416	0.9565
20	Elson's News Plaza	0.9565	0.9539
21	Grand Army Plaza S.	0.9220	0.9570
22	Grand Army Plaza N.	0.9341	0.9557
23	General Motor's Plaza	0.9852	0.9942
24	Paley Park	0.9368	0.9527
25	Urban Plaza	0.9449	0.9696
26	Lever House Plaza	0.9442	0.9686
27	Seagram Plaza	0.9190	0.9545
28	345 Park Ave Plaza	0.9295	0.9476
29	Police Plaza	0.9324	0.9718
30	Federal Plaza	0.9246	0.9525
31	Collect Pond Park	0.9163	0.9370
32	Rockefeller Center Plaza	0.9848	1.0327

Hm-s--Holing Power from the fall marginal season to the fall sub-marginal period;
Hs-w--Holing Power from the fall sub-marginal period to winter.

For H_{m-s}, the mean "passing density" is the grand mean of "passing density" in the marginal season and the sub-marginal period.

For H_{s-w}, the mean "passing density" is the grand mean of "passing density" in the sub-marginal period and winter.

Since the mean temperature is the same in all urban spaces during the same seasonal period (m-s or s-w), it was not included as an explanatory variable. Rockefeller Center Plaza is the only urban space whose mean use density in winter was higher than those in the marginal season and the sub-marginal period and is also the only one whose "holding power" in the s-w period was larger than 1.0. For these reasons, it was not included in the multiple regression model.

Findings:

For the two seasonal periods (m-s and s-w), two regression equations have been obtained:

For the "m-s" period, "activity", "passing density", "visual diversity", the mean of "sun exposure" of the m-s period and "seating density"are significant in predicting "holding power" at the 0.05 level. The regression equation is:

$$H_{m\text{-}s} = 0.96209 + 0.00147ACT + 0.01269PSD - 0.00319VIS - 0.00025SUN - 0.00059STD$$

$R^2 = 0.5214$ $\quad$ $p < 0.0016$

Here, $H_{m\text{-}s}$ --- "holding power" (m-s period)

ACT --- "activity"

PSD --- "passing density"

VSD --- "visual diversity"

SUN --- mean of "sun exposure" (m-s period)

STD --- "seating density"

This equation means that holding other variables constant, when "activity" increases by one scale point, the 'holding power" of an urban space during the "m-s" period will increase by 0.147%; Holding other variables constant, when "passing density" increases by one passer per thousand square feet area, the 'holding power" during the "m-s" period will increase by 1.27%;

Holding other variables constant, when "visual diversity" increases by one scale point, then the 'holding power" will decrease by 0.319%;

Holding other variables constant, when the mean of "sun exposure" of the m-s period increases by one percent, then the 'holding power" will decrease by 0.025%;

Holding other variables constant, when "seating density" increases by one linear foot per thousand square feet area, the 'holding power" during the "m-s" period will decrease by 0.059%.

This model accounts for 52.14% of the variance in the "holding power" during the m-s period.

For the s-w period, only "activity" is significant in predicting the "holding power" at the 0.05 level. The regression equation is:

$$H_{s\text{-}w} = 0.95496 + 0.00148ACT$$

$R^2 = 0.3472$ $\qquad$ $p < 0.0005$

Here, $H_{s\text{-}w}$ --- "holding power" (s-w)

ACT --- "activity"

This equation means that holding other variables constant, when "activity" increases by one scale point, the 'holding power" during the s-w period will increase by 0.148%. This model can account for 34.72% of the variance in the "holding power" during the s-w period.

C. Grouping Correlation Analysis

From Table VIII-1 we can see that a well working urban space does not necessarily have a high "holding power", such as Time & Life Plaza. Its "holding power" during the m-s period was only 0.9259, much lower than Bell Plaza's 0.9540. The latter was the lowest used urban space among all the 32 spaces studied. Therefore, comparing the "holding power" of two urban spaces alone cannot reflect the real working state of them, "use" or "use density" at the starting temperature must be taken into consideration. For this reason, I divided the 31 urban spaces studied (without Rockefeller Center) into three groups based on their marginal "use density" and four groups based on their sub-marginal "use density" respectively, and ran a correlation analysis for each group.

For the m-s period:

Group 1, the "use density" was higher than 2.00 (total 16 Urban spaces)

Group 2, the "use density" was between 1.00 and 1.99 (total 6 Urban spaces)

Group 3, the "use density" was 0.99 and lower (total 9 Urban spaces)

For the s-w period:

Group 1, the "use density" was higher than 1.00 (total 7 Urban spaces)

Group 2, the "use density" was between 0.50 and 0.99 (total 10 Urban spaces)

Group 3, the "use density" was between 0.20 and 0.49 (total 9 Urban spaces)

Group 4, the "use density" was 0.19 and lower (total 5 Urban spaces)

Because of the limited sample size of each group, it was impossible to conduct multiple regression analysis. Instead, correlation analysis was done to see which variable had the highest correlation to the "holding power" in each group and how such variables changed from group to group. And the findings are as follows:

During the m-s period, for Group 1, the group with the highest "use density" level, "activity" (0.43061) had the highest positive correlation to the "holding power", followed by "passing density" (0.37167) and "land use diversity" (0.36420). And "sun" (-0.29396) had the highest negative correlation to the "holding power"; for Group 2, "seating density" (0.73426) had the highest positive correlation followed by "potential footage" (0.37198), and "visual diversity" (-0.79337) had the highest negative correlation followed by "activity" (-0.42913); for Group 3, "passing density" (0.69130) had the highest positive correlation followed by "wind" (0.52796) and "activity" (0.41560), and "potential footage" (-0.64200) had the highest negative correlation followed by "visual diversity" (-0.57392) and "wind" (-0.52796) Therefore, "activity", "seating density" and "passing density" were the variables which had the highest positive correlation to the "holding power" respectively for the three different groups with different "use density" level during the m-s period. (See Table VIII-2A).

Table VIII-2A
Correlation with Holding Power for Different Use Density Groups (M-S Period)

Explanatory Variables	Correlation with Holding Power		
	Group 1	Group 2	Group 3
ACT	0.43061	-0.42913	0.41560
VSD	0.05579	-0.79337	-0.57392
PFT	-0.05694	0.37198	-0.64200
LUD	0.36420	0.03266	-0.17037
STD	-016769	0.73426	-0.51995
PSD	0.37167	0.02049	0.69130
SUN	-0.29396	-0.62644	-0.50975
WND	0.10314	-0.02457	0.52796

ACT— Activity; VSD— visual diversity; PFT— potential footage; LUD— land use diversity;
STD— seating density; PSD— passing density; SUN— sun exposure; WND— wind.

Table VIII-2B
Correlation with Holding Power for Different Use Density Groups (S-W Period)

Explanatory Variables	Correlation with Holding Power			
	Group 1	Group 2	Group 3	Group 4
ACT	0.85278	0.45280	0.38150	0.38164
VSD	0.09684	0.17720	0.65505	-0.42208
PFT	0.35135	0.03256	0.52769	0.24528
LUD	0.19790	-0.48693	0.37583	-0.57469
STD	-0.20643	0.51994	-0.34695	0.09973
PSD	0.29661	0.40568	0.50348	-0.57469
SUN	-0.22921	-0.60206	-0.44496	0.10679
WND	-0.2671	0.11145	0.38641	-0. 71961

ACT— Activity; VSD— visual diversity; PFT— potential footage; LUD— land use diversity; STD— seating density; PSD— passing density; SUN— sun exposure; WND— wind.

During the s-w period (see Table VIII-2B), for Group 1, the group with the highest "use density" level, "activity" (0.85278) had the highest positive correlation to the "holding power", followed by "potential footage" (0.35135) and "passing density" (0.29661). And "sun" (-0.22921) had the highest negative correlation to the "holding power", followed by "seating density" (-0.20643). For Group 2, "seating density" (0.51944) had the highest positive correlation followed by "activity" (0.45280) and "passing density" (40568). And "sun" (-0.60206) had the highest negative correlation followed by "land use diversity" (-0.42913). For Group 3, "visual diversity" (0.65505) had the highest positive correlation followed by "potential footage" (0.52769) and "passing density" (0.50348). And "sun" (-0.44496) had the highest negative correlation followed by "seating density" (-0.34695). For Group 4, "activity"(0.38164) had the highest positive correlation followed by "potential footage" (0.24528). And "wind" (-0.71961) had the highest negative correlation followed by "land use diversity" (-0.60199). Similar to the m-s period, different variables had the highest positive correlation to the "holding power" in different groups. Though Group 4 and

Group 1 had the same variable "activity", we can see that the correlation was very weak (0.38164) in Group 4 compared with Group 1 (0.85278). However, it was "activity" that had the highest correlation to the "holding power" for the groups (Group 1) with the highest "use density" during both the m-s and the s-w periods. This is a very interesting finding that is consistent with the results of the multiple regression analysis.

D. Discussion

1. From the definition of "holding power" and its computational formula, we can see that "holding power" is a percentage which describes the ability of an urban space to retain its users or "use density", or an indicator to measure the speed of losing its users or "use density" (the lower the "holding power", the more rapidly the "use density" is lost) within a specific range of temperature changes. It is the result of the comparison between an urban space and itself at two temperatures. We must understand that "holding power" is not the equivalent of "use density", and a high "use density" does not necessarily mean a high "holding power" and vice versa. The SAS PLOT analysis also shows that there is virtually no relationship between 'holding power" and "use density". The determinant here is the difference between the two "use densities" at the two corresponding temperatures considered (U_{t1} - U_{t2}). The higher the difference, the higher the "holding power". If the value is negative, then it means that the urban space is gaining users instead of losing them when the weather turns cold. Therefore, its "holding power" is bigger than 1.0. This is the case with the Rockefeller Center Plaza during the s-w period. Its "holding power" is 1.0327 . It is the only urban space that had a "holding power" larger than 1.0 among all the urban spaces

studied.

When we use "holding power" to measure the goodness of an urban space, we must take other elements into consideration at the same time, especially the "use" or "use density" at the starting temperature (t_1). For example, the mean of the "use density" of Exxon Plaza in the marginal season (50°F) is: Um =2.37, and Us = 0.67 in the sub-marginal period (40°F). The differences in the temperatures in these two seasonal periods is 10 degrees (F). Then within this period the "holding power" of Exxon Plaza was:

$$H(m\text{-}s) = 1 - (2.37 - 0.67)/2.37\ (50 - 40) = 1 - 0.0717 = 0.9283$$

and the "holding power" of Bell Plaza within the same period was:

$$H(m\text{-}s) = 1 - (0.15 - 0.08)/0.15\ (50 - 40) = 1 - 0.0467 = 0.9533$$

It is obvious that the "holding power" of Bell Plaza (0.9533) is significantly higher than that of Exxon Plaza (0.9283)within the m-s period. But can we say that the working state of the Bell Plaza was better than that of the Exxon Plaza within this period? The answer is no because the "use densities" of the Exxon Plaza in the marginal season and the sub-marginal period are almost ten times higher than that of the Bell's in the corresponding seasonal periods respectively. When we compare two urban spaces, there should be some common ground, i.e. some variables should be controlled. The comparison of "holding power" alone does not make much sense. However, if we compare the "holding power" of two plazas with similar "use density" at the starting temperature (t_1), such as the General Motor's Plaza and the Exxon Plaza, then this comparison is meaningful. The "use density" of the General Motor's Plaza was 2.18 (slightly lower than Exxon's 2.37) in the marginal seasons and 1.86 in the sub-marginal periods. So its "holding power" during the m-s period was:

H (m-s) = 1 - (2.18 - 1.86)/2.18 (50 - 40) = 0.9853.

And Exxon's was only 0.9283. Now we can see clearly that although The General Motor's Plaza had a similar "use density" level as the Exxon did during the marginal season, it could retain much more of its use than the Exxon did during the m-s period. Thus we can say that the General Motor's Plaza had a better working state than the Exxon Plaza during this period.

The ideal urban space is the one which has a high "use" or "use density" at the starting temperature and a high "holding power" when the weather turns cold, such as the General Motor's Plaza. To study this kind of urban space carefully and to find out the real elements which significantly influence the "holding power" is the purpose of studying this new concept.

2. The multiple regression analysis for the 31 urban spaces (without Rockefeller Center Plaza) shows that "activity" is the only explanatory variable which is significant in predicting "holding power" in both the m-s and the s-w period. It accounts for 23.40% of the variance in "holding power" in the m-s period and 34.72% in the s-w period.(see Table VIII-3)

During the m-s period, "passing density" is another explanatory variable which is positively correlated with "holding power" and significant in predicting it at the 0.05 level. And "activity" and "passing density" together account for 32.18% of the variance in "holding power". During the s-w period, "activity" was the only significant variable in predicting "holding power". Although "passing density" is not significant (F=1.58), it is still positively and moderately correlated with "holding power" (R=0.4722), just next to "activity's" 0.5892.

They accounted for 37.95% of the variance in the "holding power".

Table VIII-3
The Influence of Explanatory Variables on Holding Power

VARIABLE	SEASON	R	F	P	S	B	V
ACTIVITY	M-S	0.2033	5.50	<0.0272	Yes	0.001465	14.15%
	S-W	0.6892	15.42	<0.0022	Yes	0.001484	34.72%
PASSING DENSITY	M-S	0.1897	4.44	<0.0453	Yes	0.012687	8.78%
	S-W	0.4722	1.58	<0.2200	No	0.005975	3.23%
LAND USE DIVERSITY	M-S	0.1152	3.69	<0.0674	No	0.000396	1.48%
	S-W	0.1823	2.55	<0.1232	No	0.018108	4.89%
POTENTIAL FOOTAGE	M-S	-0.2167	3.38	<0.0782	No	-0.015568	5.92%
	S-W	0.3943	2.18	<0.1513	No	0.009297	4.70%
SEATING DENSITY	M-S	-0.2100	6.27	<0.0192	Yes	-0.000588	6.78%
	S-W	0.0806	1.98	<0.1710	No	-0.000237	0.27%
VISUAL DIVERSITY	M-S	-0.3335	8.47	<0.0075	Yes	-0.003186	6.57%
	S-W	0.3331	0.85	<0.3659	No	-0.000743	1.61%
MEAN OF SUN	M-S	-0.3763	5.45	<0.0279	Yes	-0.000253	9.25%
	S-W	-0.3077	0.08	<0.7773	No	-0.000031	0.16%
MEAN OF WIND	M-S	0.1670	0.00	<0.9629	No	0.000321	0.00%
	S-W	0.0120	2.73	<0.1103	No	0.005456	4.17%

R: Pearson's Correlation Coefficient
F: F Test Value
P: Probability
S: Significant at 0.05 level
B: Regression Parameter
V: Variance in the outcome variable accounted for

These results mean that the necessary activities provided within the ground floor of the buildings directly adjacent to the urban space and the passing activity generated by them are the most important elements which positively influence "holding power." This is consistent with the role they play in influencing "use density." It provides us with another angle to understand the importance of necessary activity and passing in influencing the life of an urban space. These are the most important results we have obtained from the multiple regression analysis regarding "holding power." Since "holding power" is not the equivalent to "use density", we cannot expect the influences of all the explanatory variables on the "holding power" to be consistent with their influences on the "use density". During the m-s period, "visual diversity" is significant (F=8.47) in predicting the "holding power". However, its correlation with the "holding power" (-0.33346) and its parameter in the regression equation were both negative (-0.003867). This means that the higher the "visual diversity" of an urban space, the lower its "holding power" during the m-s period. This seems to contradict with what we had expected. However, if we compare two representative groups of the urban spaces, it is not difficult to understand why this could happen. The urban spaces in Group A had relatively lower "holding power" during the m-s period and higher "holding power" during the s-w period, and relatively higher "visual diversity" in both the marginal seasons and the sub-marginal periods compared with the urban spaces in Group B. (See Table VIII-4)

The five plazas in Group A are all located on the west side of the Sixth Avenue next to each other, and four of them belong to the Rockefeller Center system. Compared with Group B plazas, they had a higher mean of "use density" in both marginal seasons(2.85 vs 0.42) and sub-marginal periods (0.70 vs 0.23), and higher "visual diversity" (7.68 vs 2.52). Therefore the negative correlation between "visual diversity" and the "holding power" in the m-s period and the negative parameter of "visual diversity" in the regression equation are understandable.

Table VIII-4
The Comparison of Two Groups of Urban Spaces

Group A	Hm-s	Hs-w	Um	Us	Uw	Visdiver	Activity	Sun(m-s)	Wind(m-s)
Celanese	0.9243	0.9630	2.09	0.54	0.22	4.7	7	0.35	2.1
McGraw	0.9250	0.9683	1.60	0.46	0.24	8.5	12	0.41	2.1
Exxon	0.9297	0.9707	2.37	0.67	0.36	10.2	7	0.42	2.2
T & L	0.9259	0.9767	4.50	1.02	0.75	10.8	5	0.43	1.9
Webb's S.	0.9281	0.9737	3.70	0.80	0.47	4.2	0	0.19	2.5
Mean	0.9272	0.9705	2.85	0.70	0.41	7.68	8.2	0.36	2.2
Group B	**Hm-s**	**Hs-w**	**Um**	**Us**	**Uw**	**Visdiver**	**Activity**	**Sun(m-s)**	**Wind(m-s)**
Bell	0.9540	0.9412	0.15	0.08	0.01	1.5	2	0.02	3.5
Grace	0.9331	0.9529	0.56	0.17	0.04	3.7	2	0.01	2.5
Stevens	0.9858	0.9644	0.65	0.55	0.24	1.2	3	0.02	3.0
CBS	0.9341	0.9667	0.39	0.21	0.10	2.1	2	0.07	2.7
Lever	0.9442	0.9686	0.33	0.14	0.07	4.1	3	0.13	2.1
Mean	0.9502	0.9588	0.42	0.23	0.09	2.52	2.2	0.05	2.8

Um --Mean of Use Density in the Marginal Season
Us-- Mean of Use Density in the Sub-marginal period
Uw--Mean of Use Density in winter
Visdiver--Visual Diversity

Since the "holding power" cannot be used as an independent standard to measure the goodness of an urban space, we could not conclude from the above description that Group B Plazas worked better than Group A during the m-s period, or "visual diversity" was a discouraging element with respect to influencing "holding power" because exactly the same groups of plazas showed somewhat reverse results during the s-w period. For Group A, the mean of "holding power" was 0.9705 compared with Group B's 0.9588. The correlation between "visual diversity" and the "holding power" (0.33306), and the parameter in the regression equation (0.00743) all became positive even if not significant (F=0.85, see Table VIII-2). And some other variables which were negatively correlated with the "holding power" during the m-s period also became positive during the s-w period, such as "potential footage" (from -0.21673 to 0.39429), "seating density" (from -0.21003 to 0.08061).

Micro-climatic variables, the mean of "sun exposure" and "wind", play reverse roles in influencing the 'holding power" in both the m-s and s-w periods compared with their roles in influencing the "use density". From Table VIII-2 we can see that the mean of "sun exposure"is significant in the m-s period (F=5.45), but negatively correlated with the "holding power" (-0.3763), and its parameter in the regression function is also negative (-0.000253). This means that the higher the "sun exposure", the lower the "holding power". It plays a similar role in the s-w period and the only difference is that it is not significant (F=0.08). The mean of wind is not significant in both the m-s and the s-w periods, however it is positively correlated with the "holding power" and its parameters in the regression equations are both positive. This means that the higher the mean of "wind", the higher the "holding power" in both the m-s and s-w periods. All these seems to be in conflict with common sense. How should we understand this phenomenon?

The basic point is that we should not understand "holding power" in the same way as we understand "use density". A higher "use density" usually means a better urban space. However, a higher "holding power" does not necessarily mean a better urban space. Take W.P. Stevens Plaza for example (one of the Group B plazas), which is a gloomy and windy space without seating and visual attractions. Obviously, this is not a user friendly space. Nonetheless, such a plaza had a very high "holding power" in the m-s period. This is because there were always a few smokers staying in this plaza under almost any circumstances. Low "sun exposure" (0.02), high "wind" (3.3), low "visual diversity" (1.2) and low "seating density" (0), all these negative conditions of this plaza just happened to be there, but were not the reasons for it to have such a high "holding power". From Table VIII-3 we can also see that group A plazas had a significant higher mean of "sun exposure"(0.36 vs 0.05) and a significant lower mean of "wind" (2.2 vs 2.8) than Group B plazas, but a lower mean of "holding power" (0.9272 vs 0.9502).

From the above analyzes we know that the m-s and the s-w periods are two very different seasonal periods with respect to influencing "holding power". During the s-w period, only "activity" was significant whereas during the m-s period, five explanatory variables were significant, and three of them ("visual diversity", "seating density" and "sun exposure") influenced 'holding power negatively. This makes the interpretation of the influence of these variables' on 'holding power" very complicated and difficult. Among all the high use (Ud=2.0+) urban spaces in the marginal seasons, 14 of them (except Rockefeller Center and General Motor's) lost an average of 68.58% of their use during the m-s period, whereas the five low use (Ud=0.6-) urban spaces only lost an average of 52.93% within the same period. The temperature change during this period was the same (10°F) in all these spaces. This explains why some low use urban spaces had significantly higher "holding power" than high use ones. Thus, it is not difficult to understand why some explanatory variables which had a positive influence on "use density" in the marginal seasons could had a negative influence on "holding power"during the m-s period. During the s-w period, the same 14 spaces slowed down their losing speed. They lost an average of 61.27% whereas those same five low use spaces increased their losing speed. They lost an average of 67.75%. Some of the variables which negatively influenced "holding power" during the m-s period influenced it positively in the s-w period although they were no longer significant, such as "visual diversity." Some still negatively influenced it but not significant any more, such as "sun exposure" and "seating density." These tell us that all these variables were not stable elements in influencing "holding power" and only "activity" was an stable element in influencing it positively in both these two periods.

3. The grouping correlation analysis shows that for the groups with the highest "use density" level in both the m-s and s-w periods, it was still "activity" that had the highest, positive correlation to "holding power." This result is consistent with the findings of the multiple regression analysis. This is a very important result, because we are interested in the urban spaces which have the high "use density" at the starting temperature and high "holding power" when the weather turns cold, such as the General Motor's Plaza. Only an in-depth exploration into this kind of urban spaces can help us to reach useful conclusions that will help us to stimulate the winter life of small urban spaces. For roups with different "use density" levels, it was different variables that had the highest correlation with the "holding power" in different seasonal periods. This means that during a specific seasonal period, for urban spaces with different "use density" levels, there could be different elements which influenced the "holding power" significantly. This suggests that methods used to improve the "holding power" of an urban space and to improve its working state could be different from space to space and should be suitable to the specific situation of that space.

"Holding power" is a new concept in the study of the winter life in urban spaces. It helps us to understand comprehensively how "use density" of different urban spaces varied in different transitional climatic periods, and provides us with a useful tool to measure such variations dynamically. "Holding power" also provides us with a different angle for understanding the roles of necessary activities and the passing they generated in influencing "use density" and the life of urban spaces. It has convincingly showed again that necessary activities and passing are not only helpful, but also essential to the winter life of small urban spaces. However, "holding power" cannot be used alone to measure the goodness of an urban space or to compare the working state of two or more urban spaces. It must be considered together with some other variables especially the use or "use density" of the urban spaces at the starting temperature. This is its limitation. The current study is just an initial exploration of "holding power". It can not answer all the questions it has raised.

CHAPTER IX

CONCLUSIONS AND IMPLICATIONS

A widely accepted viewpoint is that "use" is not the only standard for measuring the success of an urban space. User control over space, opportunities to modify it, and the meanings attached to it are also important dimensions. While these issues are important, I still consider use as the most fundamental standard. Issues of control, modification by users, and meanings and attachment are less important in an under-utilized urban space, especially in winter when the problem we face is low or non-use of urban spaces. Therefore, our preliminary task is to find ways to attract people to urban spaces and have them stay there, that is, to improve use before other issues can be addressed.

A. Passing, Necessary Activity, and Urban Context

As a kind of necessary activity, passing through plays a very important role in influencing the public life of urban spaces. However, its significance has long been neglected and underestimated. Very little research literature touches on this topic. Even when mentioned in the literature, its role is just "helpful," not "essential" compared with "staying" (Back & Pressman, 1992). Much of the evidence obtained from this study has shown that passing is not just "helpful" but also "essential" with respect to the use and life of urban spaces, especially in winter.

Passing itself is a very important construct for understanding the public life in urban spaces. Its existence directly contributes to the vitality of an urban space. Passing provides potential users. In the multiple regression analysis, "passing density" was the most significant variable in predicting "use density". Its significance in winter is overwhelming (it accounted for 58.69% of the variance in "use density"). In the sub-marginal periods and the marginal seasons, it also accounted for 52.64% and 43.93% of the variance respectively.

However, as has already been pointed out, the use of an urban space is the result of an entire group of social, cultural, physical and climatic elements. Overemphasizing the role of any single element is one-sided. In fact, just as any other single element, passing has its own limitations. High "passing density"only partially explains high "use density," which also depends on the integrated impacts of other elements working at the same time, such as the land use around the space. Take New York City Police Plaza for example. Though there is a very high year-round passing volume in this plaza, its "use density" is not high in winter because there are no facilities which can generate supporting activities around the plaza and very few elements within the plaza can attract passers-by to stay in winter. It is mainly a plaza for pedestrian traffic.

The results of the multiple regression analysis showed that it was "activity" which was highly positively related with "passing density", and was the most significant variable in predicting "passing density" in all the three seasonal periods (see Chapter VI). According to the definition, "activity" is "any commercial, recreational, or cultural activity provided within an urban space or within the ground floor of the buildings directly adjacent to the urban space". Among all the urban spaces studied, Rockefeller Center is the only one that has both outdoor (ice skating) and indoor activities. All the other plazas have indoor activities only. These indoor activities are mostly shopping, banking, eating in restaurants, entering or exiting the subway station or the main building to do something, etc. Almost all these activities are necessary ones. To participate in these activities, one must pass through the urban space. In other words, it was these necessary activities that generated passing within an urban space. And further, it was "passing density" that predicted "use density" of the space. This hierarchical relationship shows clearly the importance of necessary activities to the public life of urban spaces. In addition, we found that "activity" was also the most significant variable in predicting "holding power" (see Chapter VIII). From another angle, this also verified the importance of necessary activities.

"Activity" actually refers to the land use at the primary level, the direct enclosure of the urban space (see Chapter VI). "Land use diversity" represents the land use at the secondary level: the ground floor land use of the six 200 feet by 200 feet lots within the six blocks surrounding the space. In the multiple regression model, "land use diversity" was also significant in predicting "passing density" and "use density". This means that it is the land uses around the urban space, i.e. the urban contextual elements, that influence passing and also the use of an urban space most significantly. Although the diversified secondary level land use ("land use diversity") does not generate passers-by or users directly within an urban space, it makes the surrounding areas become alive and provides potential passers-by and users for the space (see Chapter VII). This result is consistent with the viewpoint of some researchers, and emphasizes the importance of urban context in urban space planning and design.

Chidster (1986a) emphasizes the influence of urban context on the use of a plaza and concludes that the best used plaza is the one located in the area of greatest land-use diversity. Essentially, the land-use which Chidister thinks has positive influence on plaza use, such as offices, restaurants, retail stores, parking facilities, etc. can provide various kinds of necessary activities around the plaza.

Pressman (1985) emphasises the importance of mixed land-use and mixed building use, not only from economic considerations such as saving energy, increasing the efficiency of land-use and infrastructure use, reducing the amount of commuting and private car trips, etc., but also for the purposes of encouraging round-the -clock urban public life so as to enhance social coherence.

Jacobs (1961) challenged the existing zoning regulations more than three decades ago by calling for mixed use and exuberant diversity in city street and districts. She argued that city districts must serve more than one primary function, preferably more than two and must have a sufficiently dense concentration of people who live there.

However, the existing zoning regulations in North America which are based on simplistic single-purpose land use, discourage mixed use and the result is that the central areas in many cities have become ghost towns at night and on weekends. Nevertheless mixed use has gained more and more recognition world-wide. Some European cities are now demanding and achieving 50-75 percent residential floor space in all central area development (Tibbalds, 1992).

In my current study, owing to the specific situation of studying areas in midtown and downtown Manhattan (areas having very little residential use), the time frame of use issues of urban spaces is limited to weekdays only , during lunch hours, and the user focus is on the daytime working population. However, my perspective has never been limited to this kind of settings. I strongly support the mixed land use and mixed building use strategy that blends work place, residence and commercial activities, etc. And I firmly believe that it is only this strategy that can make urban spaces year round and round-the-clock, live places which encourage urban public life and social coherence.

B. The Roles of Micro-climatic Conditions

Although considerable research has been done in order to improve the micro-climatic conditions of urban spaces, there is a lack of a clear understanding of the true roles micro-climatic conditions play in influencing users' behavior and the public life of urban spaces. My study has shown that in different seasonal periods, the role of micro-climatic conditions' differs a great deal.

1. Winter

There is a considerable amount of winter development literature on climatic planning and design (Bosselman, 1984; Hough & Sijpesteijn, 1990; Matus, 1988; Pihlak, 1983, 1994; Westerberg, 1994). My research conclusions are not meant to deny the significance of the research done in the livable winter cities environmental studies. Rather I would like to clarify the misunderstanding that there is a causal relationship between micro-climatic conditions and the winter use of an urban space, that if these conditions are improved, there consequently should be a significant increase in the use of the space. My field observations showed that ideal micro-climatic conditions were not the reasons people came and stayed in an urban space in winter. Their influence on winter use is very limited. This finding is also supported by the results of the multiple regression analysis of the data from 32 New York City urban spaces: none of the three climatic variables ("temperature", "sun exposure" and "wind") was significant in predicting the "use density" of an urban space in winter and these three variables together only accounted for 0.12% of the variance in the outcome variable.

However, this does not imply that micro-climatic conditions have no influence on the winter use of an urban space at all. My field observations showed that where it was possible, people still preferred to stay in places where there was sunlight and which were free from wind. The role of ideal micro-climatic conditions of an urban space in winter is actually to enable people who are already in the space to have a less stressful thermal environment.

2. Sub-marginal periods

The sub-marginal period, a new concept with respect to winter city environmental studies, was first mentioned by the author in 1994 (Li, 1994). My studies showed that only from sub-marginal periods, did micro-climatic conditions begin to influence the "use density" of an urban space significantly. This can be seen from two aspects: first, one of the three climatic variables ("temperature") became significant in predicting "use density"; second, the variance of "use density" accounted for by these three climatic variables increased from 0.12% to 1.10%. The increase was about nine times. And during the sub-marginal periods, users' behavior patterns, average length of stay, sitting rate and hour use, and users' perception and attitudes toward this seasonal period were all significantly different from those in winter. All these clearly show that the sub-marginal periods are critical transitional climatic periods with respect to the public life of urban spaces.

The interests of micro-climatic design have long been focussed on two aspects: one is the improvement of the thermal comfort of urban spaces in winter (Hough & Sijpesteijn, 1990; Pihlak, 1983, 1994); the other is the efforts to extend the outdoor season during the marginal seasons (Culjat 1975; Culjat & Erskine, 1980). My study of the sub-marginal periods urges us to rethink these two strategies. Since climatic elements have a very limited influence on the winter use of urban spaces it is doubtful that the improvement of micro-climatic conditions alone would work to improve the winter use. The improvement of micro-climatic conditions during marginal seasons is not enough to promote the public life of urban spaces in the colder parts of the year. My study showed that from sub-marginal periods, climatic conditions began to influence users' behavior and the public life of urban spaces significantly.

The discovery of these seasonal periods points out a critical transitional climatic period in which users' behaviour begins to change significantly and provides researchers and practitioners with a theoretical framework with respect to how to maximize the positive influence of micro-climatic conditions on the use and the public life of urban spaces.

3. Marginal seasons

The concept of marginal seasons has been around for more than 30 years. Its creation was based mainly on observational evidence. My study has shown quantitatively that micro-climatic conditions play a very significant role in influencing "use density" of an urban space in marginal seasons. This was reflected in two aspects: firstly, all the three climatic variables were significant in predicting "use density at 0.05 level; secondly, together they accounted for 18.52% of the variance in the "use density". This has provided a solid foundation to support the argument that ideal micro-climatic design could extend outdoor seasons for up to six weeks during marginal seasons.

C. The Roles of Physical Characteristics

After the location and the urban context of an urban space have been decided, physical characteristics will be of great significance. Researchers have done a lot of work to study how physical characteristics influence the use and life of urban spaces. (Alexander et al, 1977; Ashihara, 1970; Gehl, 1987; Jondar, 1975; Whyte, 1980, 1988). However, not much attention has been paid to the relationship between these characteristics and users' behavior and the use of urban spaces in winter. In my study, analysis has been made based on extensive field observations in order to understand how physical characteristics of an urban space influence users' behavior and the public life **in winter and sub-marginal periods,** and thus to find ways to promote the public life during the cold months of the year.

1. Spatial Characteristics

The spatial characteristics of an urban space, such as the spatial scale, the "spatial hierarchy", the enclosure and openness of the space, etc., contribute to people's "spatial feelings" of the space. These feelings may not change people's thermal comfort physiologically. However, they can influence people's "psychological comfort" for staying in the space. For example, if a space has an intimate outdoor scale (70~80 feet in at least one dimension), people may feel a close sensory involvement existing among them. This kind of psychological closeness has particular significance for users in urban spaces in winter: by being close to other people, one can have a warmer feeling that makes the cold climate more tolerable. An urban space needs to have a human scale. This lies in two aspects. First, the space should have an intimate outdoor spatial scale. If the space is beyond this scale, it needs to be divided through various means based on functional or formal requirements. Second, the space components, such as the street level facade of the surrounding buildings, the amenities within the space or on the nearby sidewalks, and street signs, etc. need to have a scale related to pedestrians' scale and pace. An urban space needs to have both suitable spatial hierarchies and publicness-privacy hierarchies that provide people with hints and choices in terms of where to stay, what activities can be done and where. An urban space also needs to have a feeling of both enclosure and openness, connect different destinations, and lead to other spaces. The "urban pocket" style urban spaces are welcomed in winter cities not only because they can possibly provide people with ideal micro-climatic conditions, but also because, if suitably designed, they possess all the above spatial characteristics which make people sufficiently psychologically comfortable staying in the spaces in winter.

2. Visual Diversity

The physical characteristics of an urban space contribute to the "visual diversity " of the space. Observations showed that an urban space with a high level of "visual diversity" in winter would attract people to come and stay. Sometimes visual diversity would promote the "triangulation" process. This kind of social contact would vitalize the winter life of the space. It is suggested that diversified visual attractions be provided in an urban space in order to vitalize its monotonous winter environmental elements, such as Christmas decorations, works of public art, colored and patterned pavements, ecological substance (like conifers, water bodies) and other hard landscape amenities.

3. Edge Effects

The physical characteristics of an urban space contribute to the "edge effect" of the space. They not only create various activities in the edge area but also "borrow" and "meld" sidewalk life or nearby urban life into the public life of the urban space. "Edge effects" can be used to generate passing and other activities within an urban space or the indoor or outdoor spaces directly adjacent to it. Pay phones, information boards, newsstands, seating spaces, bus-stops, food vendors, etc. are some of the possible facilities to be provided at the boundary areas adjacent to the sidewalks. Retail stores, restaurants, banks, and various services can also be provided within the ground floor of the surrounding buildings. In winter, when there are few people who stay, various activities created by edge facilities can effectively keep an urban space lively, to some extent.

D. The Roles of Personal Control Mechanism

A successful urban space is not only a usable space but also a lovable one. Not only is it congruent with users' behavior, but also lets users have the right to get public control through participation and modification and by attaching meaning to the space (Francis, 1989). As a psychological construct, control is an important variable in reducing stress. Therefore, the planning, design and management of urban spaces in livable winter cities should support the personal control mechanism to mediate the stress caused by cold climate.

1. Behavioral Control

Although what people can do in urban spaces is very limited in terms of modifying the stressful situation in winter, the personal control mechanism is frequently used to keep warm, e.g. using something to insulate the cold before sitting down, jumping up and down to keep feet warm, blowing on one's mittens or gloves to warm up the hands, seeking protection from the cold wind by bunching together behind each other's bodies while waiting for a bus, etc. Therefore, how the planning, design and management of urban spaces can support users' behavior control over the cold climate is an issue that needs further study.

2. Cognitive Control

How people interpret the stress of cold climate determines their emotional control and behavioral responses to it: to challenge it and adapt to it actively, or simply to endure it passively, or even to escape from it temporarily. Therefore, "cognitive control" is a very important personal control mechanism in coping with the cold climate. Predictability can be considered as an example of cognitive control in that it provides a form of "information control" over a stressor (Holahan, 1982). To adapt to an unpredictable stressor would require spending more energy and incur greater psychological costs than to adapt to a predictable ones (Glass &Singer, 1992).

3. Decisional Control

"Decision control" refers to a range of choices available to an individual. By choice we mean the recognition of different physiological, psychological and social needs of different groups in coping with cold climate in urban public life.

This study has explored the use issues of small urban spaces in winter, sub-marginal periods and marginal seasons from a behavioral perspective with the emphasis on promoting the winter use. Essentially, the winter use of urban spaces is not related to winter climate only. It is just one aspect of the very comprehensive issue of urban space use. A successful urban space in winter must be a successful one in other seasons also. It must meet the general prerequisites of a successful urban space (the congruence between physical characteristics of the space and users' behaviors is just one aspect); and the special requirements for winter use (the ideal micro-climatic design is also one aspect only); only in this way can this space work in winter. We should also remember thinking winter within a year-round habitability perspective (Pressman, 1989b), namely, winter use promotion should not be at the price of sacrificing the use in other seasons.

In winter cities, how urban public life (especially the winter life in urban spaces) can survive and be promoted within the increasingly privatized and interiorized urban environments is a challenge that should be confronted in the future planning, design, and policy studies. It is time to consider the possibility of introducing urban spaces and most of the public life within them into the privately owned, sealed social spaces. For example, to introduce the courtyard urban spaces into the indoor shopping districts, the sunken plazas into the underground concourses, and the roof gardens into the skyway systems.

It is hoped that the new concepts and findings from this research could help to clarify some questionable points with respect to the winter use of urban spaces, to yield some insights for the practitioners in their planning and design processes, and also to inform further inquiries in the related areas. The multi-method approach adopted in this research is also a pilot methodological exploration in livable winter cities environmental studies.

Appendix 1 **Plaza Users Interview Questionnaire**

Date: Time: Location:

Weather Conditions: Temp: Wind: Sunlight: Humidity:

Age group: 17^-___ 18-34___ 35-49___ 50-64___ 65^+___ (M__ F__)

1. Could you tell me whether you have been here before? Yes____, No____

   * If yes, how often do you come here during the winter season?

   * What kind of things do you do in this place when it is winter?

   * How long do you usually stay here when you come on a winter's day?

2. Could you tell me why you have come here today?

3. I would like to ask you what you think about some of the features of this place:

   a. The Christmas decoration: Attractive___ O.K. ___ Not attractive___

   b. The pool: Attractive___ O.K. ___ Not attractive___

   c. The sculpture: Attractive___ O.K. ___ Not attractive____

   d. The pavement: Attractive___ O.K. ___ Not attractive____

4. What do you think about the size of this place:

   Too big___ O.K.___ Too small____

5. What do you like most about this place?

   What do you like least about this place?

6. Do you have any suggestion about things that might improve this place for use during the winter months?

7. If it was a wind free, sunny winter day,

   a. what would be your reaction to the three different temperatures listed bellow:

   20°F: very cold( ); a little cold( ); O.K.( ); not very cold( ); not cold at all( ).

   30°F: very cold( ); a little cold( ); O.K.( ); not very cold( ); not cold at all( ).

   40°F: very cold( ); a little cold( ); O.K.( ); not very cold( ); not cold at all( ).

   b. is it a pleasant day?

   20°F: yes( ); no( ). **30°F:** yes( ); no( ). **40°F:** yes( ); no( ).

   c. if it is a weekday, would you like to go out for a walk during lunch hours?

20°F: yes( ); no( ) **30°F:** yes( ); no( ). **40°F:** yes( ); no( ).

8. Now I would like to ask you four short questions about your attitudes toward winter:

a. "WINTER IS A DEPRESSING SEASON." Totally agree___;
Generally agree___; Generally disagree___; Totally disagree___;
No opinion___.

b."WINTER IS A SEASON WITH ITS UNIQUE BEAUTY". Totally agree___;
Generally agree___; Generally disagree___; Totally disagree___;
No opinion___.

c. "WINTER IS A SEASON OF INDOOR ACTIVITIES ONLY". Totally agree___;
Generally agree___; Generally disagree___; Totally disagree___;
No opinion___.

d. "PEOPLE HAVE DIFFERENT NEEDS FOR WINTER PUBLIC LIFE, BOTH INDOORS AND OUTDOORS".
Totally agree___; Generally agree___; Generally disagree___;
Totally disagree___; No opinion___.

9. If you had two weeks free and enough money, where you like to go for a winter vacation in January?

--- Go south, such as Caribbean Islands or other sunny resorts

--- Go north, such as Switzerland skiing mountains or other winter carnival resorts

--- Stay in New York City and take my vacation here

10. Do you have anything to add to this topic?

Appendix 2 **Urban Space Data Sheet**

	1. NYC Public Library			2. Greeley Square Park		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	45.50	45.50	45.50	11.50	11.50	11.50
Seating Density (1/K ft)	22.40	22.40	22.40	12.50	12.50	12.50
Land Use Diversity	76.00	76.00	76.00	88.00	8.080	88.00
Visual Diversity	6.90	6.90	6.90	5.20	5.20	5.20
Potential Footage (M ft²)	3.80	3.80	3.80	3.82	3.82	3.82
Temperature (°F)	26.10	42.00	52.90	26.10	42.00	52.90
Sun Exposure (%)	40.00	44.00	49.00	48.00	48.00	57.00
Wind	2.70	2.30	2.10	2.90	2.30	2.10
Activity	4.00	4.00	8.00	1.00	1.00	1.00
Passing Density	0.19	0.21	0.23	0.47	0.63	0.80
Use Density	0.16	0.80	2.04	0.25	0.93	2.42
Use Plus Density	0.35	1.00	2.27	0.69	1.56	3.28

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	3. Herald Square Park			4. Bell Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	6.60	6.60	6.60	15.40	15.40	15.40
Seating Density (1/K ft)	14.60	14.60	14.60	6.40	6.40	6.40
Land Use Diversity	77.00	77.00	77.00	39.00	39.00	39.00
Visual Diversity	5.70	4.60	4.60	1.50	1.50	1.50
Potential Footage (M ft²)	3.33	3.33	3.33	3.78	3.78	3.78
Temperature (°F)	26.10	42.00	52.90	24.40	40.50	50.70
Sun Exposure (%)	47.00	51.00	57.00	0.00	1.00	2.00
Wind	2.70	2.30	2.00	3.20	3.70	3.20
Activity	2.00	2.00	2.00	2.00	2.00	2.00
Passing Density	1.14	1.59	1.78	0.22	0.29	0.29
Use Density	0.55	1.84	4.31	0.01	0.08	0.15
Use Plus Density	1.69	3.43	6.10	0.22	0.36	0.45

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	5. Grace Plaza			6. 1155 6th Ave. Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	20.90	20.90	20.90	11.50	11.50	11.50
Seating Density (1/K ft)	16.70	16.70	16.70	12.50	12.50	12.50
Land Use Diversity	44.00	44.00	44.00	88.00	8.080	88.00
Visual Diversity	3.70	3.70	3.70	5.20	5.20	5.20
Potential Footage (M ft^2)	3.83	3.83	3.83	3.82	3.82	3.82
Temperature (°F)	24.40	40.60	50.70	26.10	42.00	52.90
Sun Exposure (%)	0.00	0.00	1.00	48.00	48.00	57.00
Wind	2.40	3.00	2.00	2.90	2.30	2.10
Activity	2.00	2.00	2.00	1.00	1.00	1.00
Passing Density	0.19	0.21	0.23	0.47	0.63	0.80
Use Density	0.16	0.80	2.04	0.25	0.93	2.42
Use Plus Density	0.35	1.00	2.27	0.69	1.56	3.28

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	7. International Paper Plaza			8. W. P. Stevens Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	17.00	17.00	17.00	9.60	9.60	9.60
Seating Density (1/K ft)	61.90	61.90	61.90	0.00	0.00	0.00
Land Use Diversity	62.00	62.00	62.00	32.00	32.00	32.00
Visual Diversity	6.90	6.90	6.90	1.20	1.20	1.20
Potential Footage (M ft^2)	3.65	3.65	3.65	3.18	3.18	3.18
Temperature (°F)	26.10	42.00	52.90	26.20	42.00	52.90
Sun Exposure (%)	29.00	30.00	44.00	0.00	0.00	3.00
Wind	3.00	2.40	2.30	3.70	2.90	3.00
Activity	2.00	2.00	2.00	3.00	3.00	3.00
Passing Density	0.43	0.65	0.83	0.48	0.56	0.63
Use Density	0.27	0.80	2.61	0.24	0.55	0.65
Use Plus Density	0.70	1.44	3.45	0.72	1.11	1.27

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	9. Celanese Plaza			10. McGraw Hill Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	9.50	9.50	9.50	19.10	19.10	19.10
Seating Density (1/K ft)	25.90	25.90	25.90	13.10	13.10	13.10
Land Use Diversity	52.00	52.00	52.00	69.00	69.00	69.00
Visual Diversity	7.00	7.00	7.00	12.00	12.00	12.00
Potential Footage (M ft^2)	3.87	3.87	3.87	3.87	3.87	3.87
Temperature (°F)	24.50	40.50	50.28	24.50	40.50	50.42
Sun Exposure (%)	3.00	15.00	55.00	5.00	23.00	58.00
Wind	2.40	2.30	1.80	1.70	2.30	1.80
Activity	7.00	7.00	7.00	12.00	12.00	12.00
Passing Density	1.01	1.07	1.02	0.49	0.47	0.59
Use Density	0.22	0.54	2.09	0.24	0.46	1.60
Use Plus Density	1.22	1.59	3.12	0.73	0.93	2.20

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	11. Exxon Plaza			12. Time & Life Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	19.10	19.10	19.10	12.60	12.60	12.60
Seating Density (1/K ft)	17.90	17.90	17.90	27.10	27.10	27.10
Land Use Diversity	76.00	76.00	76.00	65.00	65.00	65.00
Visual Diversity	10.20	7.20	7.20	10.80	10.80	10.80
Potential Footage (M ft^2)	3.87	3.87	3.87	3.87	3.87	3.87
Temperature (°F)	24.70	40.50	50.70	24.50	40.60	50.50
Sun Exposure (%)	5.00	18.00	66.00	10.00	21.00	65.00
Wind	1.70	2.50	1.90	1.70	2.20	1.60
Activity	7.00	7.00	7.00	15.00	15.00	15.00
Passing Density	0.35	0.49	0.43	1.09	1.02	1.75
Use Density	0.36	0.67	2.37	0.75	1.20	4.50
Use Plus Density	0.61	1.03	2.48	1.84	2.22	6.25

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	13. Webber's Plaza S.			14. Webber's Plaza N.		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	7.10	7.10	7.10	7.10	7.10	7.10
Seating Density (1/K ft)	29.60	29.60	29.60	29.30	29.30	29.30
Land Use Diversity	41.00	41.00	41.00	46.00	46.00	46.00
Visual Diversity	4.20	2.20	2.20	4.20	2.20	2.20
Potential Footage (M ft^2)	3.90	3.90	3.90	3.90	3.90	3.90
Temperature (°F)	26.30	42.00	52.90	26.10	42.00	52.90
Sun Exposure (%)	12.00	17.00	21.00	0.00	1.00	1.00
Wind	2.70	2.60	2.30	3.00	2.80	2.50
Activity	0.00	0.00	0.00	2.00	2.00	2.00
Passing Density	0.52	0.71	0.81	0.49	0.54	0.52
Use Density	0.47	0.80	3.70	0.23	0.65	1.24
Use Plus Density	0.99	1.49	4.51	0.73	1.18	1.75

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	15. J. C. Penny Plaza S.			16. J. C. Penny Plaza N.		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	7.10	7.10	7.10	5.90	5.90	5.90
Seating Density (1/K ft)	46.80	46.80	46.80	37.30	37.30	37.30
Land Use Diversity	40.00	40.00	40.00	40.00	40.00	40.00
Visual Diversity	6.70	6.70	6.70	10.00	10.00	10.00
Potential Footage (M ft^2)	3.78	3.78	3.78	3.78	3.78	3.78
Temperature (°F)	26.10	42.00	52.90	26.10	42.00	52.90
Sun Exposure (%)	4.00	2.00	4.00	2.00	1.00	1.00
Wind	2.90	2.80	2.60	3.10	2.70	2.90
Activity	2.00	2.00	2.00	10.00	10.00	10.00
Passing Density	0.37	0.38	0.46	0.58	0.76	1.00
Use Density	0.11	0.23	0.85	0.49	0.79	1.99
Use Plus Density	0.47	0.61	1.32	1.06	1.56	2.98

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	17.C. B. S. Plaza			18. Deutsche Bank Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	27.46	27.46	27.46	7.15	7.15	7.15
Seating Density (1/K ft)	10.90	10.90	10.90	39.60	39.60	39.60
Land Use Diversity	42.00	42.00	42.00	42.00	42.00	42.00
Visual Diversity	2.10	2.10	2.10	5.70	5.70	5.70
Potential Footage (M ft²)	3.60	3.60	3.60	3.55	3.55	3.55
Temperature (°F)	26.30	42.00	52.90	26.30	42.00	52.80
Sun Exposure (%)	3.00	5.00	8.00	4.00	6.00	12.00
Wind	2.70	2.40	2.90	3.60	2.80	3.30
Activity	2.00	2.00	2.00	4.00	4.00	4.00
Passing Density	0.17	0.17	0.24	0.86	1.03	1.25
Use Density	0.10	0.21	0.39	0.31	1.02	3.16
Use Plus Density	0.26	0.38	0.58	1.17	2.05	4.41

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	19. Burlington Plaza			20. Elson's News Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	12.50	12.50	12.50	7.70	7.70	7.70
Seating Density (1/K ft)	51.80	51.80	51.80	8.57	8.57	8.57
Land Use Diversity	54.00	54.00	54.00	45.00	45.00	45.00
Visual Diversity	9.00	6.00	6.00	5.3	4.30	4.30
Potential Footage (M ft²)	3.51	3.51	3.51	2.90	2.90	2.90
Temperature (°F)	24.70	40.60	50.30	26.30	42.00	52.90
Sun Exposure (%)	4.00	18.00	30.00	0.00	0.00	0.00
Wind	1.70	2.50	1.90	2.90	2.90	3.10
Activity	13.00	13.00	13.00	0.00	0.00	0.00
Passing Density	0.91	1.26	1.35	0.46	0.28	0.42
Use Density	0.40	1.30	3.00	0.08	0.29	0.55
Use Plus Density	1.31	3.32	4.34	0.53	0.57	0.96

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	21. Grand Army Plaza S.			22. Grand Army Plaza N.		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	18.50	18.50	18.50	18.50	18.50	18.50
Seating Density (1/K ft)	25.80	25.80	25.80	20.20	20.20	20.20
Land Use Diversity	52.00	52.00	52.00	50.00	50.00	50.00
Visual Diversity	5.10	5.10	5.10	6.10	6.10	6.10
Potential Footage (M ft^2)	36.00	36.00	36.00	29.95	29.95	29.95
Temperature (°F)	26.30	42.00	52.90	26.30	42.00	52.90
Sun Exposure (%)	13.00	22.00	44.00	28.00	52.00	49.00
Wind	3.20	3.00	2.90	3.40	2.90	2.70
Activity	0.00	0.00	0.00	2.00	2.00	2.00
Passing Density	0.02	0.08	0.20	0.03	0.11	0.18
Use Density	0.12	0.37	2.47	0.15	0.49	2.42
Use Plus Density	0.14	0.45	2.67	0.69	1.56	1.74

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	23.General Motor's Plaza			24.Paley Park		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	21.90	21.90	21.90	4.20	4.20	4.20
Seating Density (1/K ft)	19.60	19.60	19.60	37.20	37.20	37.20
Land Use Diversity	68.00	68.00	68.00	55.00	55.00	55.00
Visual Diversity	4.50	4.50	4.50	4.90	4.90	4.90
Potential Footage (M ft^2)	3.60	3.60	3.60	2.03	2.03	2.03
Temperature (°F)	24.70	40.60	50.50	26.30	42.10	52.90
Sun Exposure (%)	0.00	0.00	14.00	7.00	8.00	5.00
Wind	2.80	3.10	2.00	2.40	2.70	2.10
Activity	16.00	16.00	16.00	0.00	0.00	0.00
Passing Density	1.30	1.00	0.97	0.00	0.01	0.05
Use Density	1.69	1.86	2.18	0.34	1.35	4.25
Use Plus Density	2.99	2.86	3.16	0.34	1.36	4.31

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	25.Urban Plaza			26.Lever House Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	2.90	2.90	2.90	17.70	17.70	17.70
Seating Density (1/K ft)	46.00	46.00	46.00	8.50	8.50	8.50
Land Use Diversity	55.00	55.00	55.00	25.00	25.00	25.00
Visual Diversity	3.60	3.60	3.60	4.10	4.10	4.10
Potential Footage (M ft²)	2.03	2.03	2.03	3.41	3.41	3.41
Temperature (°F)	26.30	42.00	52.90	24.70	40.60	50.90
Sun Exposure (%)	9.00	9.00	9.00	0.00	8.00	17.00
Wind	2.70	2.60	2.30	2.00	2.40	1.80
Activity	2.00	2.00	2.00	3.00	3.00	3.00
Passing Density	1.48	1.62	1.90	0.23	0.21	0.23
Use Density	1.13	2.16	5.41	0.07	0.14	0.33
Use Plus Density	2.61	3.78	7.31	0.30	0.35	0.56

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	27. Seagram Plaza			28. Fuji Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft²)	24.10	24.10	24.10	24.40	24.40	24.40
Seating Density (1/K ft)	19.50	19.50	19.50	17.80	17.80	17.80
Land Use Diversity	28.00	28.00	28.00	28.00	28.00	28.00
Visual Diversity	7.60	5.60	5.60	4.70	4.70	4.70
Potential Footage (M ft²)	3.45	3.45	3.45	3.41	3.41	3.41
Temperature (°F)	24.90	40.60	50.70	25.10	40.60	50.80
Sun Exposure (%)	0.00	13.00	27.00	3.00	36.00	48.00
Wind	2.30	2.50	1.70	1.60	2.10	1.50
Activity	1.00	1.00	1.00	3.00	3.00	3.00
Passing Density	0.22	0.26	0.29	0.45	0.40	0.37
Use Density	0.04	0.14	0.77	0.07	0.37	1.32
Use Plus Density	0.26	0.40	1.06	0.52	0.77	1.69

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	29. Police Plaza			30. Federal Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	29.50	29.50	29.50	35.70	35.70	35.70
Seating Density (1/K ft)	11.20	11.20	11.20	15.40	15.40	15.40
Land Use Diversity	21.00	21.00	21.00	47.00	47.00	47.00
Visual Diversity	9.80	9.80	9.80	3.10	3.10	3.10
Potential Footage (M ft^2)	3.34	3.34	3.34	3.47	3.47	3.47
Temperature (°F)	25.10	40.70	51.80	25.10	40.80	51.70
Sun Exposure (%)	60.00	40.00	100.00	0.00	31.00	64.00
Wind	2.30	3.30	2.40	2.10	2.70	2.30
Activity	1.00	1.00	1.00	0.00	0.00	0.00
Passing Density	0.85	0.79	0.92	0.23	0.33	0.31
Use Density	0.14	0.25	1.00	0.03	0.12	0.64
Use Plus Density	0.99	1.04	1.92	0.26	0.45	0.95

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

	31. Collect Pond Park			32. Rockefeller Center Plaza		
	Means			Means		
	Win.	Sub.	Mar.	Win.	Sub.	Mar.
Space Area (K ft^2)	15.90	15.90	15.90	34.30	34.30	34.30
Seating Density (1/K ft)	35.10	35.10	35.10	10.30	10.30	10.30
Land Use Diversity	20.00	20.00	20.00	94.00	94.00	94.00
Visual Diversity	1.20	1.20	1.20	23.00	23.00	23.00
Potential Footage (M ft^2)	3.20	3.20	3.20	55.32	55.32	55.32
Temperature (°F)	25.40	40.80	51.70	25.08	40.60	50.60
Sun Exposure (%)	80.00	60.00	87.00	5.00	5.00	21.00
Wind	1.70	2.10	1.70	2.10	2.90	1.80
Activity	0.00	0.00	0.00	23.00	23.00	23.00
Passing Density	0.14	0.12	0.19	2.63	2.42	2.03
Use Density	0.21	0.39	2.41	9.69	6.43	7.58
Use Plus Density	0.35	0.51	2.60	12.32	8.85	9.61

Win.-- Winter; Sub.-- Sub-marginal Periods; Mar.-- Marginal Seasons.

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