THE EFFECTS OF SHORT-TERM CROWDING ON PERSONAL SPACE: A CASE STUDY ON AN AUTOMATIC TELLER MACHINE

A THESIS
SUBMITTED TO THE DEPARTMENT OF
INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN
AND THE INSTITUTE OF FINE ARTS
OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF FINE ARTS

By
Naz Kaya
June, 1997

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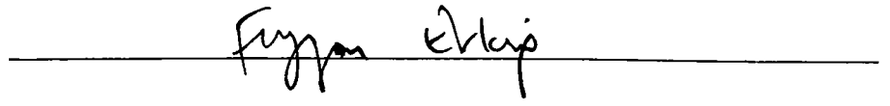

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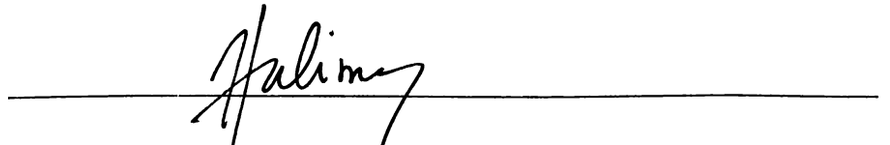

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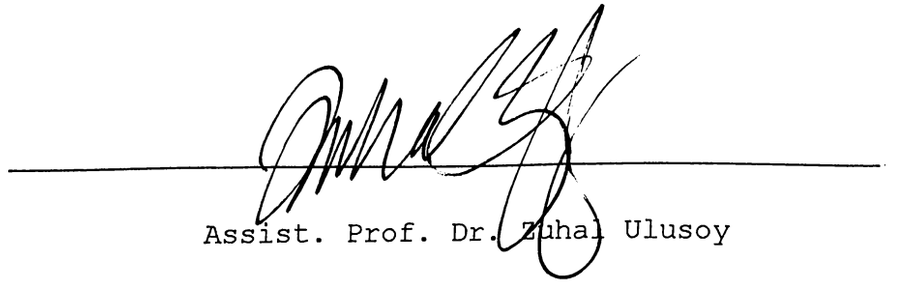

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ABSTRACT

THE EFFECTS OF SHORT-TERM CROWDING ON PERSONAL SPACE:

A CASE STUDY ON AN AUTOMATIC TELLER MACHINE

Naz Kaya
M.F.A. in Interior Architecture and Environmental Design
Supervisor: Assist. Prof. Dr. Feyzan Erkip
June, 1997

The aim of this study is to put forth the effects of short-term crowding on personal space. The analysis is planned to be carried out by means of a research on Automatic Teller Machine (ATM) users in Ankara. Initially, the conceptions and definitions of personal space and crowding are defined. The influences of crowding on personal space are discussed under the headings of personal space intrusion, withdrawal behaviors, and privacy reduction. The activity, withdrawing money from an ATM requires certain privacy needs which may vary with personal characteristics of the individuals. Among these, sex differences are considered as an important factor. In order to search for the effects of high density on interpersonal distance, two levels of density, low and high, are considered. The survey is carried out through observation and short interviews with the users in both density conditions. Finally, the clues about mismatches between space characteristics and user expectations are obtained through this study. Based on the findings of this survey as well as the literature review, appropriate design solutions for an indoor ATM hall are developed.

Keywords: Personal Space, Crowding, Automatic Teller Machine (ATM), Personal Space Intrusion, Density.

ÖZET

KISA SÜRELİ KALABALIKLIĞIN KİŞİSEL ALANA ETKİLERİ: BANKAMATİK ÜZERİNE BİR ÇALIŞMA

Naz Kaya
İç Mimarlık ve Çevre Tasarımı Bölümü
Yüksek Lisans
Tez Yöneticisi: Yrd. Doç. Dr. Feyzan Erkip
Haziran 1997

Bu tezin amacı, kısa süreli kalabalıklığın kişisel alan üzerine etkilerini ortaya koymaktır. Bunun için Ankara'da bankamatik kullanıcılarını kapsayan bir araştırma yapılmıştır. Önce, kişisel alan ve kalabalıklıkla ilgili kavramlar ve tanımlar belirtilmiştir. Kalabalıklığın kişisel alana etkileri ise, kişisel alan istilası, insanların davranışları ile gösterdikleri tepkiler ve mahremiyetin azalması başlıkları altında tartışılmıştır. Bankamatikte işlem yapanların kişisel özelliklerine göre, mahremiyet ihtiyaçları farklılık göstermiştir. Bu özellikler arasında cinsiyet farklılıkları önemli bir unsur olarak sayılabilir. Bu çalışmada, yoğunluğun, kuyrukta bekleyen kişiler arasındaki uzaklıklar üzerindeki etkilerini araştırmak için, düşük ve yüksek olmak üzere iki tip yoğunluk durumu göz önünde tutulmuştur. Bu amaçla, bankamatik kullanıcıları gözlemlenmiş ve onlarla kısa görüşmeler yapılmıştır. Sonuçta, mekan özellikleri ve kullanıcı beklentileri arasındaki uyumsuzluklar hakkında ipuçları elde edilmiştir. Bu araştırmanın sonuçlarına ve literatür taramasına dayanarak, iç mekanlardaki bankamatik alanları için uygun tasarım çözümleri geliştirilmiştir.

Anahtar Sözcükler: Kişisel Alan, Kalabalıklık, Bankamatik, Kişisel Alan İstilası, Yoğunluk.

ACKNOWLEDGEMENTS

I would like to thank, first of all, my supervisor Assist. Prof. Dr. Feyzan Erkip for her support and guidance throughout the study. I would never be able to complete this work without her patient supervision and constant encouragement.

In addition, I would like to send my special thanks to my family for being so thoughtful and wish to express my thanks to my grandmother, Şükran Günsoy, for her invaluable support.

Special thanks to all of my friends for their help and friendship. Finally, I would like to thank all the ones who have helped me and given me critics about this study.

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1. INTRODUCTION

In recent years, population growth and urbanization have increased the value of scientific understanding of human and spatial needs. While the scientific research has increased our understanding of the role of physical space on human behavior, little effort has focused upon the problems of applying this research to the design and planning process.

The purpose of the present study is to derive some design implications from spatial research on personal space and to obtain clues about the importance of proxemic research on environmental design. Environmental psychologists collaborate with researchers from other disciplines and with design professionals in architecture, interior design and related fields. Collaborative work with designers takes many forms, including the application of psychological principles, theories, and findings to design, and evaluations of the actual and predicted impact on human functioning of environmental changes. Research in environmental psychology considers a broad spectrum of topics, including perceptual and cognitive processes, orientations to places and settings, social and behavioral processes, environmental design and

environmental problems. These topics have been studied in relation to the built or designed environments of buildings, neighborhoods, cities, and regions, and in relationship to 'natural' environments of wilderness and parks. Moreover, various psychological processes have been investigated in relation to a variety of individuals or groups, including children, families, cultural groups, and special populations such as the handicapped, prisoners, etc. (Harre and Lamb, 1983).

Environmental psychology emphasize the interrelationship of environment and behavior. That is, it does not only conceptualize the physical environment as influencing people's behavior, but also considers people as either actively or passively, influencing the environment. It consists of two important terms: physical environment and human behavior. In its broadest sense, 'physical environment' connotes everything that surrounds a person (Veitch and Arkkelin, 1995). The physical environment discusses the relationship between human behavior and such features of the built environment as the rooms of buildings in which the behavior occurs, the design of institutions and how design characteristics may modify behavior, and the effects on behavior of living in cities.

This thesis considers one of the most widely studied areas of environmental psychology: personal space. A number of

researchers have examined the role of personal space in the built environment (Hayduk, 1978; Hall, 1966; Sommer, 1969; Evans and Howard, 1973). Hall (1966) has remarked that research on interpersonal distance can not tell an architect how to design a building, but it certainly can provide the information that can be worked into a design.

The human organism has certain spatial needs which may lead to stress when they are not satisfied. There are considerable individual differences in needs and preferences for physical space. In this study, the effects of short-term crowding are investigated in relation to personal space at an indoor Automatic Teller Machine (ATM) hall. Crowding is a negative experiential state associated with the spatial aspects of the environment. If the expectations about the use of space by the presence of others are violated, the feelings of being crowded are induced. Therefore, an emotional distress may arise and some behavioral adjustments aimed at preserving one's personal space can occur. This study examines these adjustments in a real life situation.

In the second chapter of the study, the conceptions and definition of personal space are mentioned. The factors influencing personal space such as individual differences, situational variables, and cultural variations are introduced. Measurement techniques of personal space are also examined.

In the third chapter, the information about the concept of crowding which provides basis for the empirical study is given. The factors influencing crowding are investigated through literature review and research examples. The influences of crowding on personal space are discussed under the headings of personal space intrusion, privacy reduction, and withdrawal behaviors. In addition to this, crowding theories in relation to personal space are examined.

In the fourth chapter, the effects of short-term crowding on personal space are analyzed and discussed through a case study at an ATM in Ankara in order to obtain clues for behavioral adjustments to provide personal space and privacy required for this activity. Based on the findings of this research as well as the literature review, appropriate design solutions are developed.

Lastly, in the conclusion, future researches to help bridge the gap between proxemic research and design are suggested.

2. PERSONAL SPACE

2.1. Definition and Conceptions of Personal Space

There has been a growing interest in the behavioral aspects of physical space considered as a part of the human-environment interface (Hall, 1966; Proshansky et al., 1970; Sommer, 1969). One aspect of physical space that has received increasing attention is personal space. People prefer to use various distances for social interaction depending on the people around and the activity in which they take place. People treat the physical space immediately around them as if it is a part of themselves: this zone is called their personal space (Sears et al., 1988). According to Sommer (1969):

> Personal space refers to an area with an invisible boundary surrounding the person's body into which intruders may not come. People like to be close enough to obtain warmth and comradeship but far enough away to avoid pricking one another. Personal space is not necessarily spherical in shape, nor does it extend equally in all directions . . . it has been likened to a snail shell, a soap bubble, an aura and breathing room (26).

Figure 1 illustrates the shape of personal space which reflects larger distances in face-to-face relationship.

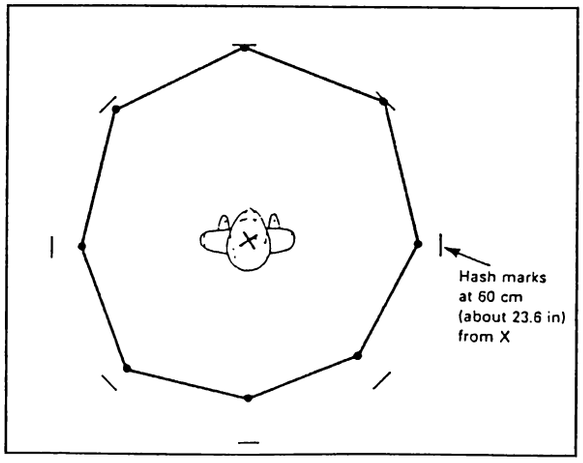

Figure 1. The Shape of Personal Space. From Robert Gifford. *Environmental Psychology: Principles and Practice.* (Boston: Allyn, 1987) 105.

Personal space can be thought of as an envelope around an individual that forms his portable territory. It is social because its existence can be directly observed only when one person unwittingly or purposefully intrudes into the personal space of another (Heimstra and McFarling, 1974). According to Hall (1966):

> Personal space is a small protective sphere or bubble that an organism maintains between itself and other (112).

Although, it is described as hidden, silent, and invisible, everyone possesses and uses personal space every day. The invisible bubble is a theoretical model developed to describe requirements for individual privacy, and/or the need for freedom of the person, or group, from unwanted intrusion by others (Wilson, 1984).

The concept of personal space refers to the preferred distance from other people that an individual maintains

within a given setting. It has three basic concepts. First, it is a personal, portable territory. Second, it is a spacing mechanism. Third, it is a communication channel.

1) A Personal, Portable Territory: Territories are places where entry is controlled by the individual; some outsiders are allowed in, others are not. Territoriality is a pattern of behavior and attitudes held by an individual or group that is based on perceived, or actual control of a definable physical space, or object. It may involve habitual occupation, defense, and marking of that space.

Territorial behavior is a way by which people regulate social interaction. It also contributes to the maintenance of privacy so that it controls the information about ourselves and the extent to which social contact occurs. Finally, territorial behavior provides a way to communicate information about ourselves and our interests (Sears et al., 1988).

At the first glance, the terms territoriality and personal space might appear synonymous, although they are entirely different concepts and can be distinguished in several ways. First, personal space is portable, whereas territory is relatively fixed. Second, territorial boundaries are usually marked such that they are visible to others, whereas the boundaries of personal space are invisible. Third, personal

space has the body as its focal point whereas the center of a territory is usually the home of the person (Veitch and Arkkelin, 1995). Intrusion into personal space usually leads to withdrawal, whereas territorial intrusion usually leads to threats and fights (Sommer, 1969).

2) A Spacing Mechanism: Environmental psychologists who consider personal space a spacing mechanism tend to refer to personal space as interpersonal distance. The Theory of Proxemics by Hall (1966) which can be found in section 2.1.2 explains this mechanism in detail. Some studies of interpersonal distance examine not only the distance between individuals, but also the angle of orientation between them such as side by side, and face to face (Gifford, 1987) (see Figure 1).

3) A Communication Channel: Hall is the primary social scientist who prefers to think of personal space as a way of sending messages. According to Hall (1959), interpersonal distance informs both participants and observers about the nature of the participants' relationship (see following section 2.1.2 for further detail).

The concept of personal space as a buffer between individuals does not completely cover all aspects of this phenomenon. There is another aspect of personal space that deals with the preference or desire for a place that is identified as one's

own. An important part of this feeling of possession is the right to personalize. To a large extent, what makes a space personal is the freedom of an individual to adapt it to his/her own needs and desires. Personalization is supported by territorial markers in different territories (Deasy and Lasswell, 1985).

2.1.1. The Functions of Personal Space

Formulations about the functions of personal space are generally arranged around the familiar notion of appropriate distance. In various approaches, inappropriate spacing is said to cause discomfort, a lack of protection, arousal, stress, stimulus overload, anxiety, poor communication, and constraints on freedom (Gifford, 1987).

Sommer's work (1959) on personal space is based on the belief that we seek the appropriate distance to preserve our comfort. It seems obvious that people feel uncomfortable when they talk to others who either stand too close or too far away.

Personal space serves two primary functions. It protects against possible psychological and physical uncomfortable social encounters by regulating and controlling the amount and quality of sensory stimulation. This function is the

avoidance of threat to the self. It is difficult for another person to physically attack us, if we maintain a distance between them and ourselves. In addition to protection from physical threat, personal space can be referred as a 'body buffer zone' that protects individual from stress and anxiety. We can only process a limited amount of information at any given time, and our information processing system might easily be overloaded. Information overload produces arousal and stress. Thus, maintaining personal space prevents excessive stimulation from social sources.

Second, it communicates information about the relationship between the interactants and the formality of the interaction by making available to others clues as to the preferred distance which has been chosen. For example, Hall (1959) has suggested that people carry around a series of spatial spheres wherein different types of interactions are allowed to occur. Hall (1959) considers personal space as a form of nonverbal communication. Thus, the distance that people maintain between themselves communicates information regarding the nature of activity. In general, close distances communicate an interest in the other person and a desire to continue the interaction, whereas far distances communicate a lack of intimacy or desire to avoid interacting with the other person. Although people usually do not give distancing much conscious thought, they do seem to respond at some level to these nonverbal clues.

The basis of communication lies in the sensation and perception of the other person's face, body, odors, vocal tone, and other channels.

2.1.2. Proxemics

The most important concept for the development of human spatial behavior research was Hall's Proxemic Theory (1963, 1966, 1974). Hall used the term proxemics to refer as:

> the interrelated observations and theories of man's use of space as a specialized elaboration of culture (1966:1) and the study of man's transactions as he perceives and uses intimate, personal, social and public space in various settings while following out of awareness dictates of cultural paradigms (1974:2).

Hall's comprehensive approach to the use of space clearly emphasizes how people make active use of and manipulate the physical environment in order to achieve preferred degrees of closeness and attain desired levels of involvement during interaction.

Proxemic patterns are the spatial patterns that constitute the norm for a culture in specific types of situations (Bechtel and Zeisel, 1990). Research over the past several years has demonstrated that different ethnic groups and subcultures have different proxemic codes (Hall, 1966). That is, people use their sensory receptors to structure the various proxemic zones differently during interpersonal encounters.

Hall hypothesized (1966) four spatial zones which reflect different relationship between the interactants and the types of activities and spaces corresponding to them. Hall (1966) observed that these distances often relate to the senses: whether we can smell the other person, feel body heat, reach out and touch, or see facial features. Each of these zones which contain a near and far phase, provides a different level of sensory information. These are the intimate, personal, social, and public distances.

1) Intimate Distance: The near phase of intimate distance (0-6 inch or 0-15 cm) is for protecting, lovemaking, and wrestling. The far phase of intimate distance interval is 6-18 inch or 15-45 cm. At this zone, vision is distorted. Heat and odor are detectable. The voice is normally held at a very low level or even at a whisper (Veitch and Arkkelin, 1995; Hall, 1966).

2) Personal Distance: The near phase (18-30 inch or 45-75 cm) is the zone that one can hold or grasp the other person. The far phase of personal distance (2.5-4 feet or 75-120 cm) extends from a point that is just touching distance by one person to a point where two people can touch fingers if they extend both arms. Vision is no longer distorted. Body heat and olfaction are undetectable, and voice level is moderate (Hall, 1966).

3) Social Distance: The near phase (4-7 feet or 1.2-2 m) is the distance that details of skin texture and hair are clearly perceived. At this distance no one touches or expects to touch another. The far phase of social distance (7-12 feet or 2-3.5 m) is used in more formal business. Voice level is louder. This zone is lack of bodily odor (Hall, 1966; Gifford, 1987).

4) Public Distance: This zone is used less often by two interacting individuals than by speakers and their audiences. The near phase of public distance interval is 12-25 feet or 3.5-7 m. The far phase of public distance (over 25 feet or 7 m) is used when ordinary people meet important public figures. The voice must be exaggerated or amplified (Gifford, 1987; Veitch and Arkkelin, 1995; Hall, 1966).

2.2. Factors Influencing Personal Space

In everyday interaction, a number of influences on distancing probably operate; various personal and social influences as well as influences due to the interactions between person and situation may work in the determination of distance and orientation preferences of socially involved individuals.

There are three factors that have influences on personal space. These are individual differences, situational variables, and cultural variations.

2.2.1. Individual Differences

Personal space is a function of an individual's characteristics that are carried from situation to situation, such as sex, age, personality, mental health, and past experiences. Each of these characteristics has an important role on personal space but they can not operate on their own. The personal characteristics of the other person and the situation will also have an effect (Altman and Chemers, 1989).

Some studies reported that males use larger distances than females (Evans and Howard, 1973; Gifford, 1982; Lott and Sommer, 1967; Kuethe, 1962; Fisher and Byrne, 1975). Females interacting with females have also been found to exhibit smaller personal space zones than males interacting with males (Sommer, 1959; Baxter, 1970). However, Becker (1973) failed to find support for sex effect. One possible reason is that sex differences occur from the socialization of males and females rather than their biological differences. According to Rüstemli (1986), another reason that may account for the inconsistent findings about sex effects on personal space may involve the cultural context in which these studies are conducted (see section 2.2.3). Rüstemli (1992) stated as:

> . . . For the female Turk, proximity to a male other in public, especially a male stranger, is not approved by the majority and has social, sexual, and moral implications. The traditional Turkish woman maintains a large distance from a man and is reserved in public. Therefore, gender-related interpretations and generalizations of proxemic behavior should be culture specific (57).

Hayduk (1978, 1983) found that personal space increases with age. Infant personal space is difficult to measure because infants have little independent mobility. Children use personal space approximately in the way adults do by about age twelve (Evans and Howard, 1973). It should be remembered that in any given social situation other factors may influence this generalization.

Buss and Craik (1983) conceptualize personality that an individual engages in behaviors within certain categories, such as warmth-coldness and extroversion-introversion. Most studies of extroversion or interpersonal warmth have shown that individuals with these tendencies have smaller personal space zones (Wiggins, 1979; Cook, 1970; Mehrabian and Diamond, 1971; Gifford, 1982). Patterson and Sechrest (1970) show differences in spatial regulation among extroverts and introverts, with introverts maintaining more distance between themselves and others.

Another factor is that, individuals having emotional problems, often have variable or inappropriate personal space zones. Sommer (1959) examined the interpersonal distances preferred by schizophrenics. He found that, compared to hospital employees and nonschizophrenic patients, schizophrenics sometimes chose comparatively much greater seating distances and sometimes chose much smaller ones.

2.2.2. Situational Variables

The situational variables consist of social and physical factors. Social situational factors focus on the quality of interpersonal relationship between the individuals in the situation whereas the physical situation, or setting, covers all nonhuman parts of the interaction.

2.2.2.1. Social Situation

The social aspects of a situation can be grouped as, attraction, cooperation-competition, and status. Attraction, acquaintance, and friendship refer to the degree of positive or negative attitude that one person holds toward the other. Many studies have shown that people use less space and approach others more closely when they like them or are friendly with them, compared with those they know less or with whom their experiences have been less positive (Rosenfeld, 1965; Little, 1965; Albas, 1991).

A second quality of the social situation concerns the competitive or cooperative nature of the interaction. Sommer (1969) perform a series of simulation studies on this topic. Individuals indicate that they would select closer distance when they are cooperating. In competitive situations, subjects claim that they would choose more direct orientations such as face to face, but in more cooperative situations they would choose less direct orientations such as

side by side. A third quality of a social situation refer to the status or dominance of the participants. Personal space is related more to differences in status than to the amount of status (Mehrabian, 1969); the greater the difference, the greater the interpersonal distance (Gifford, 1982).

2.2.2.2. Physical Situation:

The physical situation depends on both functional and physical attributes of the space. The most significant influence of a space on behavior is the purpose of the space. In many cases, a function of the space is defined by the purpose of a larger system, such as a classroom in a school building. When, however, a space is to encourage specific kinds of behavior, certain design considerations must be kept in mind. There are two potential modes of physical design that affect behavior. The first is those aspects of the built environment that must be incorporated into the design of a space if it is to fulfill its function; for example, a space for laboratory tables must be provided in a chemistry lab. The second mode is the physical attributes of a space that are not directly required by its function. These attributes include color, room size, shape, height, and furniture arrangements (Heimstra and McFarling, 1974). The experience of color in a space is visual. Heimstra and McFarling (1974) state that:

> Color is probably the one physical dimension of a room that suffers least from the restrictions imposed by the

> planned function of a room . . .One of the most common notions about room color is that colors toward the red end of the spectrum (yellows, oranges, and reds) are warm, while colors at the other end (blues and greens) are cool (30).

The size of most spaces is determined by their function. Generally, the size of a space is the minimum area required to serve its function. In that case, economic considerations take priority over possible psychological needs. It is important that reductions in room size create feelings of increased spatial restriction. Smaller room size may cause crowding, although some research has found slight or no effects of reduced room size on behaviors (Freedman, 1975). Smaller distances seem to be preferred in large rooms, compared to small rooms. When the physical setting is small, it seems that individuals want more interpersonal distance (Daves and Swaffer, 1971). Besides, people appear to use more space in corners of rooms than in the center (Tennis and Dabbs, 1975).

Furthermore, the shape of a room also has an effect on interpersonal distancing. Desor (1972) found that when people are instructed to place stick figures in an interior scale model up to the point at which the room would become crowded, they placed more figures in rectangular models than square ones with area held constant. On the other hand, it could be predicted that greater spacing would be used in the rectangular room. Worchel (1986) clarifies that subjects in the rectangular room chose the greatest distance.

Sommer (1969) suggests that room shape and size can be important variables in determining defensibility. He states that avoidance (passive defense) works best in a room with many corners, alcoves, and side areas hidden from view. On the other hand, defending an irregular area is more difficult than defending one of regular proportions. Size can also be a handicap. He (1969) points out that:

> ...a large homogeneous area, lacking lines of barriers, or obstructions, makes it difficult to mark out and defend individual territories (51).

In addition to this, the sense of enclosure is another factor which presumably varies between indoor and outdoor spaces. Little (1965) found that subjects tended to project smaller interaction distances in an open-air setting than in indoor settings. Also, people seem to need more personal space when the ceiling height is low. Cochran et al. (1984) support a spheroid model in which personal space extends in vertical as well as horizontal directions. A spheroid model of personal space might suggest that domed ceilings would produce less discomfort with close interpersonal distance than would traditional flat ceilings.

The last mode of the physical attributes of a space, the effects of furniture arrangements on the individual, is generally confined to its efficiency, comfort, beauty, and value. When two or more persons are interacting in a setting,

the behavioral effects of furnishings and their arrangement can be easily observed (Sommer, 1959, 1962).

Many components of the built environment are designed to meet both functional and behavioral objectives. The function of a chair, for instance, is obviously to provide something to sit on. At the same time, a chair may be designed to affect behavior. Sommer (1969) describes similar design considerations in the seating arrangements at a typical airport:

> In most terminals it is virtually impossible for two people sitting down to converse comfortably for any length of time. The chairs are either bolted together and arranged in rows theater-style, or arranged back to back, and even if they face one another they are at such distances that comfortable conversation is impossible. The motive for the arrangement is the same as in hotels and other commercial places-to derive people out of the waiting areas into cafes, bars, and shops where they will spend money (121-122).

According to Sommer, if the objective of the seating arrangements in airports is actually to discourage social interaction and promote financial gain, the arrangement is highly appropriate (1969).

The investigations by Sommer (1969) have shown that different physical environments produce different strategies and levels of success in establishing and maintaining control over the immediate environment. This knowledge should be helpful to planners of spaces where privacy is an important

consideration. The implications of furniture arrangements when two people were strangers to one another were also explored by Sommer (1969) both by considering the circulation path in a library and by observing the order in which seats taken up at library tables. In all cases, an attempt is made to sit away as far as possible from the person already sitting at the table and distance was reduced to use a side position which provides less possibility for an eye contact. Baum and Davis (1976) employed a projective modeling technique and found that the placement of pictures on a wall tended to decrease crowding only in a social situation such as a party as opposed to a less social setting such as an airport. This finding was further qualified by an interaction with wall brightness (light vs. dark green). Subjects placed significantly more figures in simulated dark rooms for social activities. When the space was not social, the combination of dark colors and visual complexity served to increase crowding intensity.

Furthermore, the presence of partitions might reduce stress since partitions would help cut down on visual exposure. Desor (1972) reported that people placed more stick figures in scale-model rooms when partitions were present. It made no difference whether the partitions were transparent or opaque, full or half height. According to Evans (1979), in situations wherein the individual does not desire or is not concerned with behavioral control, partitions may help to reduce

perceived spatial restriction. On the other hand, Stokols et al. (1975) demonstrated that partitions in a crowded area slightly increased feelings of crowding and significantly increased behavioral indices of tension. They (1975) suggested that individuals may have viewed the partitions as herding devices which restricted their behavioral options in the setting and this could have led to greater discomfort. Thus, the physical attributes of the environment may support or reduce the feeling of crowding in various situations.

2.2.3. Cultural Variations

Hall's thinking is based on anthropological observations that cultural norms and customs are reflected in the use of space. He notes how furniture arrangement, home design, and the distance and the angle of orientation between people varied with cultural values (1966).

The reason for focusing on group behavior than on that of the individual is that, certain variables associated with an individual can be studied only in social interactions. For example, a person's territorial behavior and his need for privacy are best observed in situations involving actual contact with others. The effects of environment on behavior have been obtained through observing people in a variety of activities in such places as classrooms, libraries, lounges, dormitories, and airports (Sommer, 1969; Deasy and Lasswell,

1985; Hayduk, 1983; Hall, 1966; Gifford, 1987). Both the activities and the spaces in which these activities take place are influenced by cultural norms and values.

One deduction from Hall's analysis (1966) concerns the use of space by 'contact' and 'noncontact' cultures. Hall (1966), portrays Arabic societies as 'contact' culture with people interacting at very close terms, such as nose to nose, breathing into another's faces, and touching. Based on his observations of Arabs, French, South Americans, Japanese, and English, Hall (1966) believes that his four zones retained their order but not their size. He (1959) describes Middle Eastern, Mediterranean, and Latin cultures as highly sensory, with people interacting very closely. On the other hand, 'non contact' cultures, like Northern Europeans and North American, are more reserved in their communications, at least in public settings and with strangers. Hall (1959) further observes that Germans are extremely sensitive to spatial invasion and achieve physical privacy in the form of private rooms and fences. For Germans, the physical environment is an important aspect of the self, and it provides a boundary that people use to separate themselves from others. Privacy is important also for English people, but the physical environment is not as important to regulate contact with others as it is for Germans. Hall (1966) also suggests that English maintain distance from others by verbal and nonverbal means, such as voice characteristics and eye contact.

According to Rüstemli (1986), although Turkish culture has been going through some changes in respect to social positions of the two sexes, the second class status of the woman is still an empirical fact as well as a widely shared belief. Rüstemli (1986) stated that a female's approach distance to a male is larger than to a female. Compared to a female approaching a male, a male's approach distance to a female is smaller. For same sex pairings, males use larger distances than females.

2.3. Measurement Techniques for Personal Space

The researchers have used several techniques to measure the size of a subject's personal space (Duke and Nowick, 1972; Pedersen, 1973; Kuethe, 1962). Preferred interpersonal distance can be measured by observing people unobstrusively in naturalistic settings, allowing the subject to indicate when an approaching person should stop, permitting free choice by the subject as to where to sit or stand when introduced into a social setting, and using abstract techniques whereby the subject indicates how far apart hypothetical individuals would sit or stand by placing dolls on a board or marking on a piece of paper (Coan, 1994).

Three techniques of measurement underlying many personal space research are projective or simulation methods, stop-distance or laboratory methods, and interactional or field/naturalistic observations.

2.3.1. Simulation Method

Projective or simulation methods require subjects to imagine an interactive situation and to project their possible behavior into that situation. They include such techniques as asking subjects to represent their spatial behavior in hypothetical situations by the manipulation of dolls, silhouettes of humans, abstract symbols, wooden or miniature figures, the placement of marks on a prepared form to indicate preferred distances from others, and the choice of sitting or standing positions represented in a photograph. Duke and Nowick (1972), using their Comfortable Interpersonal Distance Scale, asked subjects who are at the center, to place marks on the form at the distance that would begin to produce discomfort, and to stop someone's approach along each of the eight radiating lines (see Figure 2).

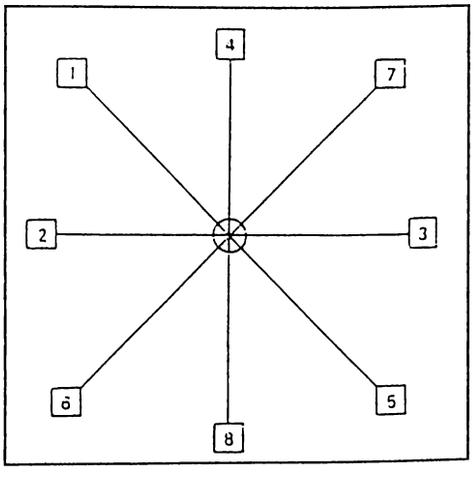

Figure 2. The Comfortable Interpersonal Distance Scale. From Robert Gifford. *Environmental Psychology: Principles and Practice.* (Boston: Allyn, 1987) 109.

The projective measures include Pedersen's (1973) silhouette placements, and Kuethe's (1962) felt figure placements. The felt-board technique requires subjects to place a silhouette representing themselves on a felt board already containing a silhouette representing some other identifiable person such as the subject's best friend, mother, or teacher. This technique also records interfigure distances by marking on a piece of paper rather than by placing a figure on a felt background. The ease of application is the most apparent benefit of this type of methods. The largest problem with both the paper-and-pencil procedures and the felt board techniques is their reliance on the subjects' cognitive capabilities. The subjects must imagine a physical setting and social situations which may be a difficult task for many individuals.

2.3.2. The Stop-distance Method

In the stop-distance method, subjects are asked to approach or be approached by another person-often an experimenter or confederate-and to stop approaching at the point where the subject begins to feel uncomfortable. Then, the distance between the subject and experimenter is measured. Different angles of approach have been included in some studies (Hayduk, 1983), but most have measured the distance of the two participants facing each other directly. However, one must note the variations among the approach distances at various angles (see Figure 1).

In sum, projective or simulation and stop-distance measures of personal space are both found to be lacking adequate assessment devices for human spatial behavior and their external validity is doubtful. The projective measures as they require subjects to imagine and reconstruct from memory how they would use space in a scaled down representation of themselves and others, lack face validity as well. The stop-distance measures, on the other hand, although they do not consist of actual interactions between participants, do at least involve some of the clues available to people engaged in real interaction (Aiello, 1987).

2.3.3. Observational Method

Naturalistic techniques involve the study of personal space in everyday environments classrooms, libraries, and playgrounds with distance measurements obtained in an unobtrusive fashion.

Participant observation is fully naturalistic, but allows the researcher minimal control of subjects. There are some reasons that this method has not been used widely. The first reason is that some environmental psychologists believe it is unethical to measure the behavior of people without their consent. Second, measurements taken under natural conditions are subject to many uncontrolled variables. Without knowing the status and relations of people, it would be difficult to

explain why some pairs stood at large interpersonal distances but others stood at small ones (Gifford, 1987). The structured approach allows researchers to overcome all of these problems; people can be informed that they are participating in a study, researchers can identify or control factors such as relationships or the content of the interaction. On the other hand, the subjects can change their behaviors since they may be influenced by the research.

However, further systematic research using direct observation of spatial behaviors is needed in order to understand the complex nature and various functions of personal space better. The research data indicate that less direct, more cognitive measurement techniques need to be generalized with caution (Aiello and Thompson, 1976).

This study utilizes naturalistic observation in order to investigate the use of personal space under the condition of short-term crowding rather than measuring real distances. The empirical survey can be found in Chapter 4. Before examining the details of this study, it is required to have information about the concept of crowding which will provide a further basis for the empirical study.

3. CROWDING

3.1. Definition and Conceptions of Crowding

Crowding refers to the psychological state of discomfort and may be thought of as a subjective experience which may or may not be adequately reflected by population density measures such as the amount of physical space per person or number of people per unit of living space (Sears et al., 1988).

It is important to distinguish between the subjective, psychological experience of crowding and the objective, environmental source of the crowding experience: high population density. Density is a measure of the number of individuals per unit area. It is an important antecedent to the experience of crowding, but is not often sufficient to explain an individual's experience of crowding in different settings or at different times. Besides, people do not always feel crowded when density increases. High density at a sporting event, or a concert is necessary to generate desired levels of excitement. In such cases, although density is fairly high, most people do not feel crowded. Crowding, then, is a psychological variable that reflects the ways in which people expect or believe density will affect them in a negative way (Horn, 1994).

If crowding is conceptualized by only physical terms, lack of space is the only crucial element. However, crowding should also be conceptualized as an external state. The sensation of being crowded is related to, but distinct from the physical state of having little space. There are times when there is very little space but the individual does not feel crowded; there are other times when there is more space but the person feels crowded (Freedman, 1975). This may indicate the importance of activity patterns on the feeling of crowding.

Perceived density is a related but distinct concept. It refers to an individual's estimate of the density in a place, accurate or not, rather than the actual ratio of individuals per unit area (Rapoport, 1975). This distinction is based on the hypothesis that behavior is sometimes influenced more by one's perception of density than by density itself. Although density is the ratio of individuals to area, it may vary in two ways. When crowding is studied by varying the number of individuals in a fixed space, social density is being examined. When crowding is studied by varying the amount of space available to a fixed number of individuals, then, spatial density is being examined (Gifford, 1994).

Freedman (1975) has argued that crowding and density are equivalent and there is no need to propose a subjective state. However, data obtained in human field and laboratory studies are inconsistent with this belief, and Stokols (1972)

has established the necessity of viewing density and crowding as different phenomena. According to Stokols (1972):

> Density is a physical condition involving space limitations, whereas crowding is an experiential state determined by perceptions of restrictiveness when exposed to spatial limitations. The potential inconveniences of limited space such as the restriction of movement, the preclusion of privacy, and other disadvantages of space limitation must reach some degree of saliency and be viewed as aversive before people experience crowding (276).

Proshansky et al. (1970) propose that crowding is not simply a matter of the density of persons in a given space. For the crowded person at least, the experience of being crowded depends also to some degree on the people crowding him, the activity going on, and his previous experience involving number of people in similar situations. Furthermore, Choi et al. (1976) show that the perception and expression of crowding depend on social, personal, and physical dimensions of the situation.

Crowding is a multidimensional experience. It may refer to ourselves or to the setting. The internal focused variety of crowding refers to our own negative feelings, whereas external focused variety of crowding refers to our estimate of how crowded the setting is (Gifford, 1987). Internal focused variety of crowding has three aspects; situational, emotional, and behavioral modes, which are clarified by Montano and Adamopoulos (1984). Their study involves a selection of a variety of different crowding situations and

ratings by individuals as to how they would act and feel in each one. They (1984) are able to conclude that the situational aspects include experiences in which people feel their behavior is constrained, they are physically interfered with the presence of others causes their discomfort, or their expectations have not been met. Second, the emotional aspects include both negative reactions and positive feelings to the situation. Although Freedman (1975) has maintained that high density is sometimes positive, most believe that crowding is negative by definition. Montano and Adamopoulos (1984) claim that positive emotion is associated with crowding only when individuals feel they have successfully coped with it. Therefore, positive emotion seems to be a part of crowding only when we believe that we could overcome it. Finally, behavioral aspects include five primary behavior modes in response to crowding. These are expressing an opinion, activity completion, psychological withdrawal, immediate physical withdrawal, and making the physical setting more comfortable.

Crowding has an effect on health problems, physiological reactions related to high density, and task performance. D'Atri (1975) found that increases in density are associated with rising blood pressure and heart rate as well as a skin conductance and sweating. The physiological and health effects of increasing density are strongly influenced by the

individual and by social coping mechanisms that people have learned to use in dealing with these situations.

The effect of high density on individual performance depends largely on the kind of task. Performance decrements as a result of increases in either spatial or social density have been reported for tasks that are sufficiently complex or require a high rate of information processing and problem solving (Sinha and Sinha, 1991). In many high social density settings, performance depends on the physical interaction of individuals, either through direct communication or because they must move around the setting to acquire and process. Glassman et al. (1978) demonstrate that high social density adversely affects extended task performance and is experienced by those exposed to it as a social stressor. Those students who live in dormitory rooms with high density, reveal greater interpersonal and environmental dissatisfaction, request more room changes, and obtain lower grades than their counterparts who reside in low density rooms (Glassman et al., 1978). Expectations about the situation also effect performance. Individuals who are subjected to high density and believe they will not do well on the task, might perform poorly.

Finally, noise which is a stimulus expected to increase with crowding, has an effect on performance. However, it differs for simple and complex tasks. If the task is complex, the effect of noise on performance is more severe than simple

ones. When one of several tasks is more important, noise tends to increase the effort extended on important tasks. This may be an additional impact of crowding on performing individuals.

3.2. Factors Influencing Crowding

Crowding is influenced by some factors such as individual preferences, social interaction between participants, and perception of the environment.

3.2.1. Personal Factors

These factors include gender, personality, together with the socioeconomic class and education, expectation and sociability of the individual, past experience and familiarity with a setting.

Significant effects of sex on the perception of density have been observed. In general, males find crowded conditions to be more emotionally unpleasant than females. Women seem to handle the stress better than men. This may be because men are less able to share distress. Besides, men may handle high density less well because they prefer greater interpersonal distances (Sears et al., 1988). Male adults may feel more aggressive in short-term exposure to high density, but they are socialized not to express it directly (Stokols et al., 1973). According to Aiello et al. (1977) individuals with

preferences for larger interpersonal distances experience more physiological stress in high density situations than individuals who prefer smaller interpersonal distances. Another personality variable relevant to the crowding experience is sociability. Individuals who generally like to be with others seem to have a higher tolerance for dense situations than individuals who are not very affiliative.

Baum and Greenberg (1975) state that, the preferences and expectations of individuals about density influence their perceptions of crowding. Those who preferred high densities and expected higher densities than they found, felt less crowded. As well as that, past experience with high density can modify crowding experience in the present. This past experience may include a short-term experience such as a dormitory or sharing a house. Personal experience with high density situations or familiarity with a behavior setting where crowding occurs may affect the degree of distress that is experienced. Stokols (1976) suggests a distinction between primary and secondary environments. Primary environments are those in which one spends much time doing personally significant things. The home and office are two basic examples. Secondary environments are those involving interactions with strangers which are usually brief and relatively unimportant. In primary settings, people can not easily overcome the effects of high density. However, familiarity can help individuals to cope with high density in secondary settings.

3.2.2. Social Interaction

High density situation usually affects social interaction between individuals. An increase in the number of people or decrease in the amount of available space, leads to high density situations in which individuals may feel uncomfortable. What determines the level of comfort is the nature of social interaction between individuals.

Many studies (Gifford, 1987) support the idea that increasing social density increases the feeling of being crowded in residential settings. Privacy is lowered, the same amount of resources must be distributed to higher number of persons, more physical interference is encountered, and the sense of control is reduced. Particularly when social density is undesirable, social outcomes are generally negative such as more aggression, less cooperation, and more social withdrawal. According to Horn (1994), crowding affects a number of social behaviors. People tend to like people less when they are crowded than when they are not. Another experiment was done by Jain (1987) with two levels of density, high and low; and two levels of resources, sufficient and scarce. In both conditions, the feeling of crowding is related to high density and scarcity of resources. The results suggest that there is an increase in competition under conditions of social density and scarce resources.

As well as that, Desor (1972) demonstrates that the type of activity significantly affects the degree to which occupants perceive crowding. There are important differences between high density in different settings, like stadiums or supermarkets. For example, in a stadium the cheers and enthusiasm of a crowd can be stimulating and help the spectator to have a good time. In a supermarket, the presence of many people can interfere with or constrain a shopper's movement through the supermarket and his or her ability to do shopping. Lack of control over the environment can cause some people to feel psychologically distressed. Loo (1977) hypothesizes that negative effects of crowding are more likely to be observed when people's activities involve social interaction or when the territorial intrusions occur. McClelland and Auslander (1978) observed a variety of settings and activities. They found that smaller interpersonal distances are likely to be associated with larger groups and waiting lines, whereas larger interpersonal distances occur in standing postures, free seating, high tension situations (Long, 1984), and visually complex environments.

Lastly, high temperature and noise as a result of crowding cause social aggression (Hall, 1966) and have an effect on helping behavior. If noise is too loud, people try to escape it, rather than helping someone in need. Loud noise may prevent helping because in attempting to escape, attention is narrowed (Gifford, 1987).

3.2.3. Cultural Factors

Different societies approach crowding in a different manner due to their varying cultural background. Aiello and Thompson (1976) state that adaptation strategies, consisting of highly developed ways to manage time, space, and people exist within the Chinese culture. This permits individuals to cope with overcrowding at home. Some cultures may adapt to and even prefer higher densities than others. According to Gifford (1994), many Chinese and Japanese families appear to be relatively less affected by living in high density dwellings because they have developed methods for coping with the crowding. For example, in crowded Chinese households, it is common to eat at different times for family members to reduce the amount of crowding during meals (Gifford, 1987). Japanese homes often have movable walls and partitions than can be used to get the maximal function from the limited space and rooms in the homes. Additionally, Iwata (1974) examined the effects of density on the perceptions of crowding of male and female Caucasian and Japanese students. The results indicated that Japanese students report more discomfort in high density conditions than Caucasian students. While no sex differences were found for the Caucasian students, the Japanese males were more sensitive than the Japanese females. In another investigation, Iwata (1978) asked subjects to fill out two questionnaires of crowding to tell the maximum number of people with whom they thought they could share a room without

feeling uncomfortable. The findings indicate that culture, sex, age, and familiarity are significant determinants in the perception of crowding.

In a recent study, Rüstemli (1992) investigated the effects of spatial and social variables on perceived crowding on Turkish teenagers. He found that social aspects of crowding were more important than spatial ones. Turkish adolescents and young adults were very sensitive to gender and friendship. Male subjects showed equal amounts of discomfort when surrounded by male or by female others, but female subjects felt more crowded with male others than they did with female others. This characteristic of Turkish society is utilized in the field survey of this thesis.

3.2.4. Physical Factors

Physical factors are twofold: inside and outside factors. Inside physical factors include two dimensional area (length x width of floor) as well as three dimensional area (length x width x ceiling height), since ceiling height may alter the experience of crowd. Higher ceilings are associated with less crowding. It was also found that a square-shaped room was perceived to be more crowded than a rectangular shaped room (Desor, 1972). The presence or absence of windows or mirrors are examples of inside physical factors that may determine the degree of experienced crowding. Rooms receiving more

sunlight are perceived as less crowded by individuals (Mandel et al., 1980).

Another important concern about the effects of architectural design, partitioning, on the occupants' perception of crowding has been investigated (Baum et al., 1974; Loo, 1977). These findings support that feelings of crowding can be altered by certain kinds of changes in architectural design while density is held constant. Architectural structures that create territorial places for individuals are likely to reduce the probability that a state of crowding will be experienced or that negative effects of crowding will be demonstrated.

Secondly, outside physical factors of the environment include geographical factors, number of apartments in a hallway, number of apartments in a dwelling, height of the apartment in terms of floor, population size and density of the neighborhood, town, city, and country. The physical setting can increase or decrease crowding stress. Crowding is affected by the arrangement of space in rooms and buildings. Studies of high-rise dormitories clearly show that when the design involves long corridors, residents experience more crowding and stress (Baum et al., 1978; Baum et al., 1979). The longer corridor designs are accompanied by the lower feelings of personal control. Living in a high-rise building may lead to a greater feeling of crowding and other

negatively toned attitudes such as less perceived control, safety, privacy, building satisfaction, and lower quality of relationships with other residents (McCarthy and Saegert, 1979). However, Schiffenbauer (1979) found that residents of higher floors felt less crowded than did residents of lower floors. This may be because fewer strangers venture to the upper reaches of a building or because views out the windows of upper level apartments provide more visual expanse or visual escape.

3.3. Influences of Crowding on Personal Space

As mentioned before, Sommer (1969) defined personal space as an area surrounding the body with invisible boundaries into which others may not intrude. As such, it constitutes a potential control mechanism available to an individual. If a person feels uncomfortable in an interaction with another person, he or she can increase the physical distance from the other. It can be stated with a great deal of confidence that people will become uncomfortable if they are approached at a distance that is judged to be too close. The greater the immediacy of the invasion, the more discomfort or arousal is experienced by the person. This increase in arousal then generates a pattern of withdrawal or avoidance. Thus, the psychological experience of crowding may be due to more to invasions of personal space than to a response to the absolute number of people present.

3.3.1. Personal Space Intrusion

According to Sommer (1969):

> Inappropriately close interpersonal distance is often viewed as an invasion; in other words, the invasion of personal space is an intrusion into a person's self boundaries (29).

There have been numerous studies investigating reaction to the invasion of one's personal space (Aiello, 1987; Veitch and Arkkelin, 1995). Most of the research has indicated that invasions of personal space lead to arousal, dislike of the invader, and negative mood.

Studies which have been conducted within a library setting indicated a decrease in flight responses (Sommer, 1969), or for those who do not leave, an increase in withdrawal behavior (Patterson et al., 1971) as a function of the immediacy of the intruder. The subjects in Sommer's study (1969), mental patients, were observed to leave the setting when an intruder sat next to them. Other behaviors observed when subjects were invaded included shifting of postures and withdrawal behaviors. In the investigation by Patterson et al. (1971) college students were invaded while they sat at tables in a library. The students were observed to leave the area more quickly, if the invasion is closer. According to flight, behaviors such as blocking or turning away from the invader were observed. In Sommer's study (1969) the persons would typically face away from the intruder immediately, pulling in their shoulders, and placing their elbows at their

side. In Patterson et al. study (1971), subjects frequently turned away from the intruder and exposed shoulder and back; they often placed the elbow on the table and rested the head in the hand. Additionally, subjects who chose not to leave would use objects including books, notebooks, coats, and bags in building a barricade between themselves and the intruder.

Krail and Leventhal (1976) examined whether the sex of the subject or intruder had a significant effect on the reaction to personal space intrusion in a university library. It was found that intrusion by the same sex takes shorter time for response. It was also observed that there was a significant decrease in the response time as the proximity of the intruder increased. Similarly, Hortaçsu et al., (1990) investigated the reactions to personal space intrusion upon same and different sex groups in a university dining hall. Their results supported the previous studies in that responses take longer time for different sex groups than for either of the male-male and female-female subjects.

Furthermore, Rüstemli (1988) searched for the effects of personal space invasions on impressions and decisions. The results failed to support the hypothesis that intrusions into personal space have negative effects on people. The distance manipulation did not produce any variation in decisions and impressions; both male and female subjects were positive towards the others from the same or different sex, whether

the other intruded their personal space or not. According to Rüstemli (1988), this may be because the subjects might have experienced crowding rather than invasion.

Lastly, personal space intrusions have effects on helping behavior. DeBeer-Keston et al. (1986) supported that invaded subjects would be less likely to help, presumably because of the negative mood induced by the invasion.

3.3.2. Privacy Reduction

A major goal of human spatial behavior is to regulate the amount of contact with others. Privacy concerns the regulation of access to self. Too much privacy leads to feelings of social isolation, and too little privacy leads to subjective feelings of crowding. It can be defined as an individual's freedom to choose what he or she will communicate about himself or herself and to whom in a given circumstance. Proshansky et al. (1970), indicate two dimensions of privacy that are relevant to environmental design. These are freedom from unwanted intrusion and freedom to determine the time and place of communication.

3.3.3. Withdrawal Behaviors

Two basic forms of social response have been identified in high density conditions. Individuals subjected to high density, often respond by withdrawing from social interaction

and avoiding social contact. Social withdrawal is manifested in various ways such as moving away, choosing less personal topics to talk about, making remarks about leaving (Sundstrom, 1975), turning away, avoiding eye contact, or increasing interpersonal distance (Baum and Greenberg, 1975).

Although there are situations where the intrusion of personal space is tolerated, some behavioral mechanisms are involved to maintain privacy (Hall, 1966). Eye contact and conversation are avoided in behavior settings such as elevators, theater foyers, subways, and counters at fast food restaurants. Many people feel uncomfortable in such situations. Even well acquainted individuals speak less and more quietly when they enter a crowded elevator and they may wish to avoid being overheard. Furthermore, aggressive response has been observed in situations where crowding has more to do with spatial restriction or inappropriate proximity of others. Withdrawal has been viewed as an active coping response to residential settings characterized by frequent contact with a large number of people. According to Baum and Paulus (1987), students confronted with frequent unwanted interaction with their neighbors experience crowding and avoid contact with strangers in their residential environments.

Above mentioned behaviors that are utilized to protect personal space under crowded conditions give clues for the empirical survey of this thesis.

3.4. Crowding Theories in Relation to Personal Space

Among various others, the four theories which are proposed to account for crowding phenomena, ranging from relatively brief statements or hypotheses to more elaborated and involved models may link the concepts of personal space and crowding better. All of the four models focus both on spatial and social factors. The sensory overload and personal control theories emphasize the impacts of number of people, whereas the behavioral constraint theory emphasizes the space. Although the personal control theory focuses on a broad range of responses, the others have a more limited focus.

3.4.1. Sensory Overload Theory

This theory claims that a setting is evaluated as crowded when an individual is overwhelmed by the presence of others or when the physical conditions in the environment increase the effects of social density.

High levels of density is a potential source of excessive stimulation resulting in a possible state of stimulus overload. The stimulus load theory is based on the notion that humans have a limited capacity to process information.

When input exceeds that capacity, people tend to ignore some of the input and devote more attention to others. For humans, overload is often unpleasant, can diminish task performance, and could lead to health problems (Lepore, 1994).

In addition to this, personal space invasion might be considered as an upper level of information overload when the situation is crowded and privacy is inadequate.

However, familiarity with the situation and settings would help in coping with greater quantities and levels of stimulation. Unfamiliar environments require to make more decisions because one does not know what information is important. In a situation where the individual is familiar with his/her surroundings, he/she could be able to handle a greater amount of information. Therefore, it can be stated that higher densities could be handled better in such situations.

3.4.2. Personal Control Theory

Personal control theory hypothesizes that high density is undesirable and harmful because it renders the environment more unpredictable and exposes individuals to situations over which they have little or no control. A lack of control in high density settings increases the negative effects of

density, whereas the availability of control reduces it (Lepore, 1994).

Schmidt and Keating (1979) distinguish three forms of personal control: cognitive, behavioral, and decisional. If the person is able to attain one or more of these forms of control under high density conditions, stress caused by crowding will be reduced. However, if one's expectations for control in a high density situation do not match the actual availability of control, then the high density can be more disturbing (Lepore, 1994). First of all, accurate signs and information reduce the feeling of crowding and this may be successful because it imparts a sense of cognitive control to individuals in densely populated areas. Secondly, behavioral control refers to the ability or lack of control to act toward a goal. Lastly, decisional control refers to the amount of available choice in a setting.

Researchers (Rodin et al., 1978) tested the control hypothesis by examining the effects of control on people's moods in crowded elevators. Control in the elevator was manipulated by giving some people access to the elevator control panel. Those who had panel access, or more control, in the crowded elevators felt less crowded and had more positive moods than those without control.

3.4.3. Arousal Theory

This theory concerns that dense conditions increase arousal and in turn, affect task performance and social behavior. Generally, performance is maximized at intermediate levels of arousal, but falls off as arousal is either increased or decreased too much. The optimum level of arousal leads to performance enhancement, but as it increases further, overarousal occurs, causing performance decrements. If people in a high density situation can be induced to attribute their arousal to something other than the people present, they should feel less crowded. Some researchers contend that invasions of personal space experienced in crowded settings are a source of arousal (Hayduk, 1983; Gifford, 1987).

3.4.4. Behavioral Constraint Theory

Behavioral constraint theory focuses on limitations of freedom to choose among a number of behavioral options in dense environments. Limitations and restrictions of behavior are the source of crowding stress and related behavioral and psychological reactions. Proshansky et al. (1970) emphasized the importance of freedom of choice in settings and used this idea to explain the concepts of territoriality, personal space, and crowding. Feeling of crowding is induced by violations of expectations about the use of space and frustration of goals by the physical presence of others. These factors are seen as threats to one's freedom of choice.

What makes the high density undesirable is the diminished freedom. People in high density settings that do not prevent their goal directed behaviors, tend to be less negatively affected by this density than high density that prevents their goals. According to Stokols (1976), behavioral constraints do not only refer to restrictions in bodily movement. High density may sometimes create resource shortages and may have negative effects on performance and mood.

In the following chapter, the effects of short-term crowding on personal space are evaluated through a case study at an indoor Automatic Teller Machine (ATM) hall in Ankara in order to obtain clues for cultural patterns. The appropriate design solutions are proposed with the help of these clues.

4. THE EFFECTS OF SHORT-TERM CROWDING ON PERSONAL SPACE: A CASE STUDY ON AN AUTOMATIC TELLER MACHINE

4.1. Methodology of the Study

Most research related to the study of interpersonal distance preferences and the interrelationship of environment and behavior, have been conducted in public spaces such as libraries, airports, schools, offices, and restaurants (Hall, 1966; Sommer, 1969; Gifford, 1987).

As mentioned in the previous chapters, the feeling of crowding is induced by violations of expectations about the use of space and frustration of goals by the presence of others. When spatial needs are violated, an emotional distress may arise, followed by behavioral adjustments aimed at preserving one's personal space.

As a beginning point, public spaces where people can wait in a queue are evaluated in order to search the effects of short-term crowding on interpersonal distance. Automatic Teller Machines (ATMs) are found appropriate for the purpose of this study. The two levels of density; low and high, can be analyzed and activity allows to observe short-term

crowding. Since, any research related to the study at ATM spaces was not reported, it is also considered as an original site to be analyzed.

4.1.1. Site Selection

In Ankara, there are a lot of banks having ATMs. Yapı Kredi Bank has been chosen because it has the maximum number of indoor ATM branches, so the possibility of choosing an appropriate setting is higher. The second reason is that, this bank has the first indoor ATM design.

While deciding for choosing a branch, some criteria have been taken into consideration; having a single machine, located at indoor spaces, having enough area in order to be able to make observation, having opportunity to serve for many districts, having no other branches nearby, and being frequently used.

According to these criteria, Sıhhiye branch in Necatibey avenue was chosen (see Appendix A). It is an indoor space, having a single ATM. It does not have any other branches nearby, so it is frequently used. The ATM hall has an adequate area to be able to make observation (see Figure A.1).

4.1.2. Sampling

Subjects were chosen through non-probability (quota) sampling. That is, the number of subjects both in low and high density conditions were kept equal at the end of the research. The sampling was continued until the necessary quota was obtained for each level. The subjects waiting alone in the queue were selected.

The sex of the subject and the sex of the invader are important for the research, so there are four possible combinations as; male-female, male-male, female-male, female-female. All four combinations were observed under the conditions of both low and high density. Density conditions were determined by the number of people waiting in the queue at indoor ATM hall. The number of individuals from 2 to 4 was considered as low density, whereas 5 and more was considered as high density. These numbers were decided due to the space limitation of the indoor ATM hall.

To satisfy high density conditions, the observations were conducted on weekdays, from 12:00 p.m to 2:00 p.m. For low density conditions, observations were carried out at weekends, from 12:00 p.m to 2:00 p.m. Time sampling was decided after a pilot study including various observations over the site.

4.1.3. Research Methods and Procedure

This survey research consists of two parts; participant observation and questionnaire. First, the behavior of the individual who was in front of the machine, in other words, the first person in the queue, was observed. The interpersonal distance preferences between individuals in the line were also noted on observation form. Second part of this research was conducted through a questionnaire which was applied to the first person in the queue, when he/she completed his/her operation and left the ATM hall.

The observation form includes date, day, time begins and ends, sex of subject, sex of invader, and density (low or high) (see Appendix B). The types of behavior of the first individual such as looking around, looking at the person standing behind, hiding the ATM screen from others, making verbal response to the person standing behind, asking for help from the person standing behind are also indicated.

Along with these, the preferred interpersonal distances between subjects are recorded on this form. 1 indicates the distance interval between 15 and 45 cm, 2 indicates the distance interval between 46 and 75 cm, 3 indicates the distance interval between 76 and 120 cm. These distance categories are based on Hall's (1966) Proxemic Theory. They represent intimate distance-far phase, personal distance-near phase, and personal distance-far phase, respectively.

In order to differentiate the sex of the subjects waiting in the queue, different symbols are used for male and female. Δ indicates a male subject, Ω indicates a female subject.

The questionnaire was applied to the subjects when they completed their operation and left the ATM hall (see Appendix C for the questionnaire form). It is composed of questions about the opinions of subjects on the spatial aspects of the ATM hall, the opinions about the presence of others in ATM hall, the degree of importance the individual gives to the sex of the person standing behind, the security of the place, and personal characteristics of the respondents such as age, education, occupation, and district in which he or she inhabits.

4.1.4. Hypotheses

Hypotheses of this study are as follows;

1) It was expected that people should maintain smaller distances in high density situations compared to low density conditions and they might get more annoyed with the presence of others standing behind.

2) It was assumed that, males would find crowded conditions to be more emotionally unpleasant and they might get more annoyed with the presence of others in short-term exposure to

high density than females. Females were also expected to give more importance to the sex of the person standing behind than males.

3) It was hypothesized that a relation exists between the perception of space dimensions and the respondent's preference for an ATM space designed for a single person. This was investigated for both density conditions and sexes. In high density conditions, people would perceive the space dimensions as narrower than in low density conditions; therefore they would prefer an ATM space designed for a single person more than the ones in low density conditions. Furthermore, sex differences would affect the preference of an ATM space designed for a single person and females would perceive the space dimensions as narrower than males.

4) In high density conditions, subjects having smaller interpersonal distance between the person just standing behind, would make some behavioral adjustments such as hiding the ATM screen, looking at the person standing behind and warning the person standing behind verbally.

5) The subjects looking at the person standing behind, would get annoyed with the presence of others at the ATM space in both density conditions.

6) The subjects hiding the ATM screen from others, would prefer an ATM space designed for a single person in both density conditions.

In order to test the hypotheses, the chi-square test was applied.

4.2. Analysis and Results of the Study

The size of the sample group is 200; 100 subjects for each density conditions. Table 1 presents the demographic features of the respondents derived from the questionnaire. The group consists of 49.5% female and 50.5% male.

Most (54%) of the subjects are between 35-49 years old; 22% of the sample is between 20-35, and 24% is older than 50. The overall mean age is 43 years. 50% of the group graduated from high school, 37.5% from university, and the remaining group either from primary (1%) or secondary schools (11.5%). 82.5% of the respondents have an occupation, whereas the others (17.5%) have not.

As mentioned earlier, the sex of the subject and the sex of the invader are important; so there are 4 basic combinations as male-male, male-female, female-female, female-male. In high density condition, there are 26 male-male, 25 male-female, 25 female-female, and 24 female-male situations;

whereas in low density condition, there are 24 male-male, 26 male-female, 23 female-female, and 27 female-male situations, which is a result of a further quota applied to obtain these situations.

Table 1. Characteristics of Sample Group

	Value Label	Value	Frequency	Valid Percent
Sex distribution				
	Male	1	101	50.5
	Female	2	99	49.5
	Total		200	100
Age distribution				
	20-34 years	1	44	22
	35-49 years	2	108	54
	50+ years	3	48	24
	Total		200	100
Education				
	Primary	1	2	1
	Secondary	2	23	11.5
	High-school	3	100	50
	University	4	75	37.5
	Total		200	100
Occupation				
	Yes	1	165	82.5
	No	2	35	17.5
	Total		200	100
***District**				
		1	58	29
		2	109	54.5
		3	33	16.5
	Total		200	100

* Districts are divided into three main groups according to their proximity with others. The first group includes Çankaya, Gazi Osman Paşa, Kavaklıdere, Ayrancı, Dikmen, Oran, Yıldız, Gölbaşı, second group includes Ulus, Sıhhiye, Kızılay, Bakanlıklar, Cebeci, Mamak, Yenimahalle, Kocatepe, Esat, and third group includes Bahçelievler, Emek, Beşevler, Tandoğan, Maltepe. This information is used only for exhibiting the heterogeneity of respondent group.

The total mean value for time period doing an operation at ATM is 1.54 minutes in both densities. However, this value is approximately 1.4 minutes for males; whereas 1.7 minutes for females.

After having a general information about the sample group, the results of the analysis emerged from the hypotheses tested are given below (see Appendix D for the statistical analysis).

1) For the first hypothesis, the relation between density conditions and distance preferences were examined. It was not found independent (see Table D.1). ($\chi^2 = 62.48813$, $p<0.05$) Thus, hypothesis 1 was not rejected by the analysis. In high density situations 80.2% of the subjects maintain the distance interval between 15-45 cm; whereas in low density situations, 19.8% of the subjects maintain this distance interval. Also, the degree of annoyance with the presence of others standing behind (Question 5) and density conditions was not found independent (see Table D.2). ($\chi^2 = 11.7489$, $p<0.05$) In high density situations 59.3% of the individuals get very annoyed with the presence of others standing behind at ATM; whereas 40.7% of the individuals in low density situations get very annoyed with the presence of others.

2) In order to test the second hypothesis, sex differences were investigated in relation to the degree of annoyance with the presence of others (Question 5). It was found independent. Thus, hypothesis 2 was not verified by the analysis (see Table D.3). (χ^2 = 2.75685, $p>0.05$)

The test was repeated with the degree of importance the individual gives to the sex of the person standing behind (Question 6). This relationship was not found independent (see Table D.4). (χ^2 = 6.83493, $p<0.05$) Females (63.2%) give more importance to the sex of the person standing behind than males (36.8%).

3) For the third hypothesis, initially, the relation between the perception of space dimensions (Question 2) and the respondent's preference for an ATM space designed for a single person (Question 3) was investigated for both density conditions. Hypothesis 3 is verified by the analysis (see Table D.5 and D.6). (for high density conditions, χ^2 = 15.77567, $p<0.05$; for low density conditions, χ^2 = 3.67834, $p<0.05$). In high density situations, the ones both preferring an ATM space designed for a single person and finding the space narrow was 29%; 10% of the respondents both wanted an ATM space designed for a single person and found the space wide, and 35% of the respondents both wanted an ATM space designed for a single person and found the space normal.

Therefore, in high density conditions, 74% of the subjects required an ATM space designed for a single person. On the other hand, in low density conditions, the ones both wanting an ATM space designed for a single person and finding the space narrow was 4%, 31% of the respondents both required an ATM space designed for a single person and found the space wide, and 30% of the respondents were both wanted an ATM space designed for a single person and found the space normal. Consequently, in low density conditions 65% of the subjects required an ATM space designed for a single person.

Furthermore, Hypothesis 3 is also tested by the analysis for both sexes (see Table D.7 and D.8). (for male subjects, $\chi^2 = 12.34641$, $p<0.05$; for female subjects, $\chi^2 = 7.01307$, $p<0.05$) It was found as not independent. Both sexes wanted an ATM space designed for a single person.

72.3% of male respondents wanted an ATM space designed for a single person; whereas 27.7% of them did not. 66.7% of female respondents preferred an ATM space designed for a single person; whereas 33.3% of them did not. Among these, 22.2% of females perceive the ATM space as narrow, whereas 13.9% of males perceive the space as narrow.

4) By the fourth hypothesis, the relation between density conditions and interpersonal distances between subjects were analyzed through behavior types such as looking at the person standing behind, hiding the ATM screen, and warning the person standing behind verbally. Density conditions and interpersonal distances between subjects observed through behavior types such as looking at the person standing behind and hiding the ATM screen were found as not independent (see Table D.9 and D.10). ($\chi^2 = 36.29463$, $p<0.05$; $\chi^2 = 41.84821$, $p<0.05$) However, the occurrence of warning the person standing behind verbally can not be statistically tested against density conditions due to the limited observation for that case (Sümbüloğlu and Sümbüloğlu, 1993). Thus, hypothesis 4 was verified by the analysis only for certain behavior types. For occurrence of looking at the person standing behind, most of the subjects who have been observed in high density conditions had a smaller interpersonal distance between the others (81.8%); whereas in low density conditions, this ratio is only 18.2%. Secondly, for the occurrence of hiding the ATM screen, most of the subjects who have been observed in high density conditions, had a smaller interpersonal distance (15-45cm) between others (78.6%); whereas in low density conditions, only 21.4% of the subjects had the same distance.

5) Hypothesis 5 was tested against the density conditions and the degree of annoyance (Question 5) in case of the subjects looking at the person standing behind. This hypothesis was also verified by the analysis (see Table D.11) (χ^2 = 12.56613, $p<0.05$). In both density conditions, 61.3% of the subjects got very annoyed with the presence of others, 22.5% of the subjects got annoyed, 16.2% of the subjects did not get annoyed at all with the presence of others in case of the subjects looking at the person standing behind.

6) Hypothesis 6 was tested against the density conditions and the subject's preference of an ATM space designed for a single person (Question 3) in case of the subjects hiding the ATM screen from others. It was found not independent by the analysis (see Table D.12). (χ^2 = 4.86117, $p<0.05$) 81.3% of the respondents in both density conditions, prefer an ATM space designed for a single person; whereas 18.7% do not prefer in case of hiding the ATM screen.

Furthermore, the relationship between same sex and different sex pairings to interpersonal distance preferences in both density conditions was investigated (see Table 2). It was found that same sex pairings in both density conditions, have a smaller interpersonal distance interval between themselves. For different sex pairings, a female's approach to a male is more distant than a male's approach to a female in both density conditions.

Table 2. The Relation between Sex Pairings and Distance.

		15-45cm		46-75cm		76-120cm	
		Frequency	%	Frequency	%	Frequency	%
High Density	Male-Male	22	84.6	4	15.4		
	Male-Female	6	24	19	76		
	Female-Female	24	96	1	4		
	Female-Male	13	54.2	11	45.8		
Low Density	Male-Male	5	20.8	15	62.5	4	16.7
	Male-Female	3	11.5	11	42.3	12	46.2
	Female-Female	5	21.7	15	65.2	3	13
	Female-Male	3	11.1	15	55.6	9	33.3
	Total	81		91		28	

Besides, the relationship between the education level of the respondent (Question 10) to the degree of importance he or she gives to the sex of the person standing behind (Question 6) was investigated. The chi-square test can not be applied for this case since the observation is limited (see Table D.13 for male subjects and D.14 for female subjects).

Similarly, the chi-square test can not be applied to test for the relationship between the education level (Question 10) and the degree of annoyance with the presence of others (Question 5) due to the same limitation (see Table D.15 for male respondents and D.16 for female respondents).

As well as, the relationship between the security of the ATM space (Question 7) was tested for male and female respondents. It was found independent (see table D.17). (χ^2 = 3.85984, $p>0.05$) However, the results indicate that half of the respondent group, 50.5% of the individuals, found this ATM space as very secure, 41.0% found the space as moderately secure and 8.5% of the respondents did not find the ATM space as secure at all.

Lastly, relationship between the age of the respondent (Question 11) and the degree of importance he or she gives to the sex of the person standing behind (Question 6) was not tested by chi-square test due to the limitation mentioned above (see Table D.18 for male subjects and D.19 for female subjects).

In section 4.4, the results of the survey research are discussed in relation to the hypotheses. Afterwards, design recommendations on the indoor ATM spaces are suggested based on the findings of this research, as well as the literature utilized in the previous chapters.

4.4. Discussion and Design Recommendations

People manipulate the physical environment and prefer to use various distances for social interaction depending on the

people around and the activity takes place. Personal space is an important aspect of physical space as a part of the human-environment interface. It serves to describe and communicate the requirements for individual privacy and the need for freedom of the person from unwanted intrusion by others. In case of the activity analyzed in this study, withdrawing money from an ATM, people would like to attain certain levels of privacy. It can be stated that people feel uncomfortable if they are approached at a distance that they judge as too close. This may increase in arousal, then generates a pattern of withdrawal behaviors.

As mentioned earlier, environmental psychologists who consider personal space as a spacing mechanism, tend to refer to personal space as interpersonal distance. Interpersonal distance informs both participants and observers about the nature of the participant's relationship to others. However, there are some influences on the determination of the distance and orientation preferred by the individuals. Personal characteristics of the individual such as age, sex, and education have an important role on interpersonal distance, but the personal characteristics of the other person have also an effect in a social interaction.

In addition, the situational variables have an influence on interpersonal distance. Increasing the number of people may cause reductions in the amount of space available for each person.

Consequently, the situation is associated with privacy reduction and spatial invasion. The results of this research support that in high density conditions people are more overwhelmed by the presence of others than in low density situations. First of all, this is because of the invasions on their personal space such that they can not be able to attain desired levels of privacy in order to complete their activities. Secondly, when social density increases, the feeling of being crowded increases and interpersonal distance between subjects decreases. Therefore, people get more annoyed with the presence of others.

According to the literature, intrusion into personal space usually leads to withdrawal behaviors (Sommer, 1969). Thus, the findings of this research clearly support that when individuals subject to high density conditions, they often respond by increasing withdrawal behaviors. In our case, these behaviors include hiding the ATM screen from others and looking at the person standing behind. This kind of responses are a function of the proximity of the intruder, because the subjects in high density conditions have a smaller interpersonal distance between the others. Furthermore, aggressive response has been observed in situations where crowding has to do more with inappropriate proximity of others. Some subjects make verbal response to the nearest person.

As well as that, people perceived the space dimensions as narrower in high density conditions than in low density conditions. This is because of the increasing the number of people leading to social density. In this study, the number of people at the ATM hall had an important role on the interpersonal distance between subjects. Therefore, people in high density preferred an ATM space designed for a single person more than the ones in low density conditions in order to achieve desired levels of privacy.

Moreover, the results of the research supported that sex differences have an effect on the perception of space dimensions. Females perceive the space dimensions as narrower than males, although both male and female subjects prefer an ATM space designed for a single person in order to provide their personal space and privacy. In addition to this, the preference for an ATM space designed for a single person is reflected by some withdrawal behaviors such as hiding the ATM screen from others and looking at the person standing behind. When the subjects exhibit these behavior types, it indicates that they prefer an ATM space designed for a single person.

As discussed before, personal characteristics of the individuals have an important role on interpersonal distancing. Sex of the individual and sex of the invader have an effect in a social interaction. Similar to Rüstemli's study (1986), it has been found that same sex pairings; male-

male and female-female, have smaller interpersonal distance than different sex pairings in both density conditions. Also, for same sex pairings males have larger distances than females. For different sex pairings, a female's approach to a male is more distant than a male's approach to a female in both density conditions.

In general, it has been observed through the case study that, both female and male subjects prefer smaller interpersonal distances while waiting in the queue at the ATM hall in high density conditions. This may be because of the nature of this activity. People would like to do their operations in a short period of time. If the operation of the person who is in front of the machine takes a longer time than expected, the ones waiting in the queue respond by leaving the ATM hall or by using smaller interpersonal distances in order to invade the personal space of the individual and make him/her uncomfortable to force the user finish the operation immediately.

Besides, the results of the study supported that females find the gender of the person standing behind more important than males do. This indicates that Turkish female adults are more sensitive to the gender of the person in a social interaction.

Lastly, most of the respondents found this ATM space very secure. This may be because of the presence of a camera controlling device and an electronic card control system at the entrance door.

Based on the results of the conducted research, as well as the literature review, some design principles can be proposed that would lead to improvements in the design of indoor ATM spaces.

According to the responses of the subjects, the preference for an ATM space designed for a single person is mostly shared. Therefore, the space can be designed for a single person in order to maintain both functional properties and individual needs for privacy. However, when the space is designed for a single person, nature of the activity should be taken into consideration. This activity requires the users to complete their operations in a short period of time. Some individuals may need help from the person standing behind, which makes the activity difficult for the person in a booth. As well as that, some branches have more than one ATM. In that case, there may be space restrictions which may lead to loss of space. Still, it is possible to combine both; a single person, booth-like space and an existing open queue.

When the ATM space is not designed for a single person, some recommendations can be proposed for waiting in a queue to avoid personal space intrusion and privacy reduction of the user. One alternative can be a remark on the floor such as a line or a different floor pattern to define the personal distance of the user. Second alternative can be installing a turnstile to separate the interpersonal distance between the user and the one just standing behind. In that case, circulation path can be manipulated in such a way that when the person completes the operation, he/she can directly go to the outside of the ATM space.

Furthermore, the orientation of ATM can be arranged so that the ones waiting in the queue will not be able to see the ATM screen and the operation of the user. Shields at the side of ATM screen may help for this. Finally, the individual needs for privacy can be separated from the others by a partition behind the user which may prevent the probability of personal space invasion and attain desired levels of privacy.

5. CONCLUSION

The studies on human-environment relationship include a broad spectrum of variables and situations. A number of studies focus on intrusion into personal space, whereas others deal with people in intimate relationships or examine the relationship between unacquainted individuals. Some focus on people with different personality characteristics, and some others deal with people from different cultural groups.

In this study, the effects of short-term crowding were investigated in relation to personal space. The research was conducted at an indoor ATM hall. Two levels of density, low and high, were manipulated to examine people's distance preferences and behaviors in both density conditions. The reason for focusing on people's interpersonal distance preferences at an ATM space is that, certain variables associated with an individual can be studied only in social interactions. Individual's need for privacy can best be observed in situations involving contact with others. This activity requires a certain level of privacy which may vary with personal characteristics of the individual. Sex differences were considered as an important factor on the determination of interpersonal distance preferences. Also,

situational variables such as density conditions had an effect on interpersonal distance. Another important factor is the effect of the activity on the behavior of people and interpersonal distance between individuals. This activity, withdrawing money, requires certain privacy needs due to the nature of the activity itself.

The results were found to be consistent with the previous studies in the literature. When social density increased, the feeling of being crowded increased and interpersonal distance between subjects decreased. Therefore, people were more overwhelmed by the presence of others at the ATM space in high density conditions. This increase in arousal generated a pattern of withdrawal behaviors. These behaviors included hiding the ATM screen from others and looking at the person standing behind. This kind of responses were a function of the proximity of the intruder in the queue at ATM hall.

Furthermore, it was found that the number of the persons at the ATM hall has an important role on the perception of space dimensions. As the number of the persons increased, people perceived the space narrower. This effects the preference for an ATM space designed for a single person in order to achieve desired levels of privacy for this activity, preventing the personal space invasion, and decreasing the feelings of being crowded.

Findings were obtained also about the importance of sex differences on the interpersonal distance preference. It has been found that same sex pairings had smaller interpersonal distance than different sex pairings at ATM hall. For the same sex pairings, males preferred larger distances than females. For different sex pairings, a female's approach to a male was more distant than a male's approach to a female. Also, females gave more importance to the gender of the person standing behind. It can be concluded that, Turkish female adults are more sensitive to the gender of the person in the social interaction defined by this activity.

Design recommendations were suggested for indoor ATM spaces based on the findings of this research as well as the literature review. Finally, it should be noted that the spaces occupied by these machines are not designed well to satisfy users' privacy needs probably because of the short-term character of utilization.

Lastly, future researches to bridge the gap between proxemic research and design can be proposed. In this study, the analysis was carried out by an empirical survey at an indoor ATM space of Yapı Kredi Bank, Sıhhiye branch. A further research may be conducted at two indoor ATM branches, with different dimensions in order to be able to make comparison about user's opinions and preferences on the use of space.

Another research could be conducted at the ATMs of two different banks, with similar dimensions in order to find the impact of physical properties of the space such as color, shape, height, etc. on user's evaluations and behavior.

Additionally, research on interpersonal distance preferences and personal space may be conducted in different public spaces such as restaurants, offices, schools, libraries, and so on to examine cultural patterns in different social encounters.

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APPENDICES

APPENDIX A

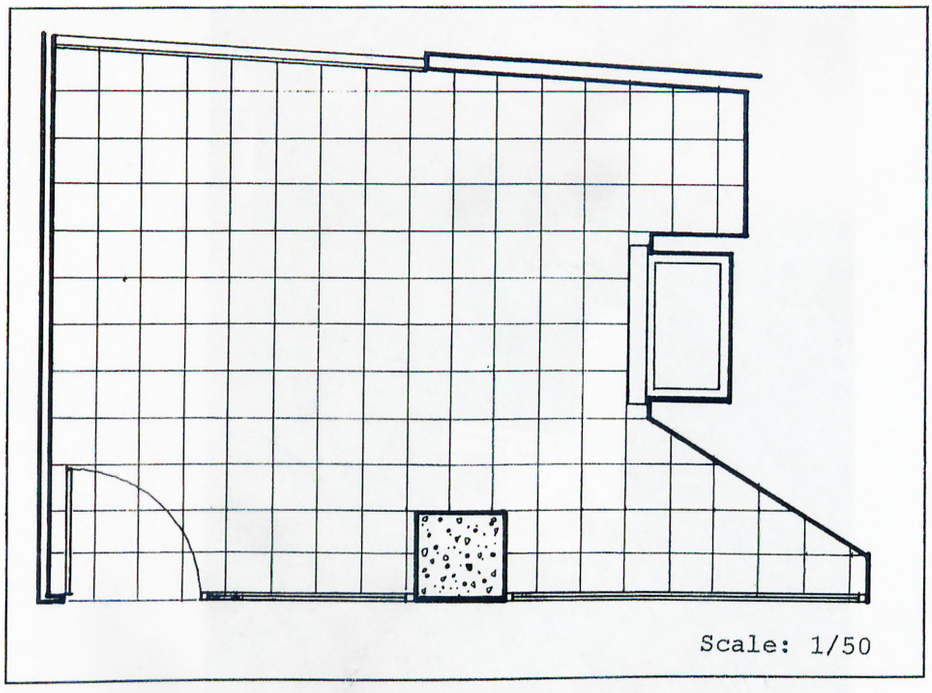


Figure A.1. Floor Plan of the ATM Hall.

Figure A.2. View of the ATM Hall from Entrance.

Figure A.3. View of the ATM Hall from Inside.

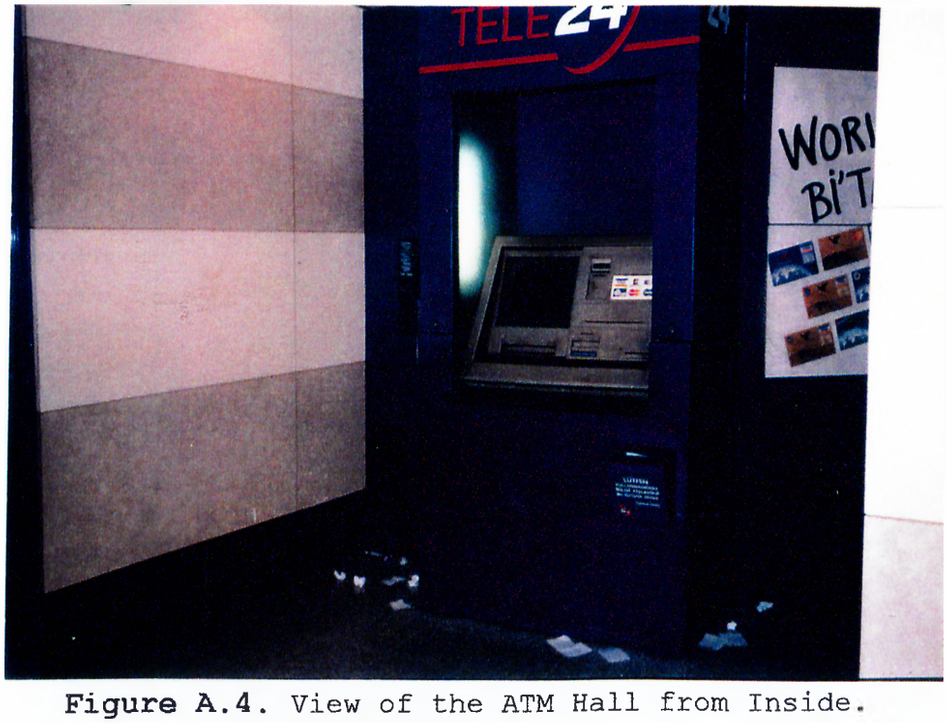


Figure A.4. View of the ATM Hall from Inside.

APPENDIX B

Date: _____ **Observation No. :** ☐☐☐

Day: _____ **Density:** ☐ Low
☐ High

Time Begins: _____
Time Ends: _____

Sex of Subject:
☐ Male
☐ Female

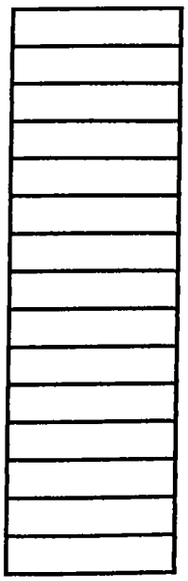
Sex of Invader:
☐ Male
☐ Female

Behavior Types:

☐ **1.** Looking around.
☐ **2.** Looking at the person standing behind.
☐ **3.** Hiding the ATM screen from others.
☐ **4.** Warning the person standing behind verbally.
☐ **5.** Asking for help from the person standing behind.
☐ **6.** Other(s) _____.

Distances:

1. 15-45 cm.
2. 46-75 cm.
3. 76-120 cm.



APPENDIX C

Questionnaire No. : ☐☐☐

1. How long have you been using an Automatic Teller Machine?
   - ☐ 1. Less than one year.
   - ☐ 2. About two-three years.
   - ☐ 3. More than three years.

2. What do you think about the space dimensions of this ATM hall?
   - ☐ 1. Narrow.
   - ☐ 2. Normal.
   - ☐ 3. Wide.

3. Would you like an ATM space designed for a single person?
   - ☐ 1. Yes
   - ☐ 2. No

4. Why?_____

5. Did you get annoyed with the presence of others standing behind?
   - ☐ 1. Not at all.
   - ☐ 2. Annoyed.
   - ☐ 3. Very annoyed.

6. Do you think the gender of the person just behind you is important?
   - ☐ 1. Not at all.
   - ☐ 2. Moderately important.
   - ☐ 3. Important.

7. Do you think this place is secure enough for withdrawing money from the ATM?
   - ☐ 1. Not at all.
   - ☐ 2. Moderately secure.
   - ☐ 3. Very secure.

8. Do you have an occupation?
   - ☐ 1. Yes
   - ☐ 2. No

9. In which district do you live? _____

10. Your education level?
   - ☐ 1. Primary
   - ☐ 2. Secondary
   - ☐ 3. High-school
   - ☐ 4. University

11. Your age _____

APPENDIX D

Table D.1. Density by Distance

Density	Count / Row Pct / Col Pct / Tot Pct	15-45cm	46-75cm	76-120cm	Row Total
High Density		65	35		100
		65.0	35.0		50.0
		80.2	38.5		
		32.5	17.5		
Low Density		16	56	28	100
		16.0	56.0	28.0	50.0
		19.8	61.5	100.0	
		8.0	28.0	14.0	
Column Total		81	91	28	200
		40.5	45.5	14.0	100.0

Chi-Square	Value	DF	Significance
Pearson	62.48813	2	.00000

Minimum Expected Frequency - 14.000

Table D.2. Density by Question 5
(Degree of annoyance with the presence of others standing behind)

Density	Count / Row Pct / Col Pct / Tot Pct	Not at all	Annoyed	Very Annoyed	Row Total
High Density		19	17	64	100
		19.0	17.0	64.0	50.0
		51.4	30.9	59.3	
		9.5	8.5	32.0	
Low Density		18	38	44	100
		18.0	38.0	44.0	50.0
		48.6	69.1	40.7	
		9.0	19.0	22.0	
Column Total		37	55	108	200
		18.5	27.5	54.0	100.0

Chi-Square	Value	DF	Significance
Pearson	11.74891	2	.00281

Minimum Expected Frequency - 18.500

Table D.3. Sex of Subject by Question 5
(Degree of annoyance with the presence of others standing behind)

Sex of Subject	Question 5: Not at all	Annoyed	Very Annoyed	Row Total
Male	17	33	51	101
	16.8	32.7	50.5	50.5
	45.9	60.0	47.2	
	8.5	16.5	25.5	
Female	20	22	57	99
	20.2	22.2	57.6	49.5
	54.1	40.0	52.8	
	10.0	11.0	28.5	
Column Total	37 18.5	55 27.5	108 54.0	200 100.0

Chi-Square	Value	DF	Significance
Pearson	2.75685	2	.25197

Minimum Expected Frequency - 18.315

Table D.4. Sex of Subject by Question 6
(Degree of importance of the gender of the person standing behind)

Sex of Subject	Question 6: Not at all	Moderately important	Important	Row Total
Male	58	22	21	101
	57.4	21.8	20.8	50.5
	53.7	62.9	36.8	
	29.0	11.0	10.5	
Female	50	13	36	99
	50.5	13.1	36.4	49.5
	46.3	37.1	63.2	
	25.0	6.5	18.0	
Column Total	108 54.0	35 17.5	57 28.5	200 100.0

Chi-Square	Value	DF	Significance
Pearson	6.83493	2	.03280

Minimum Expected Frequency - 17.325

Table D.5. HIGH DENSITY

Question 2 by Question 3
(perception of space dimensions)by(preference of an ATM space designed for a single person)

Question 2	Count / Row Pct / Col Pct / Tot Pct	Question 3: Yes	Question 3: No	Row Total
Narrow		29	1	30
		96.7	3.3	30.0
		39.2	3.8	
		29.0	1.0	
Normal		35	14	49
		71.4	28.6	49.0
		47.3	53.8	
		35.0	14.0	
Wide		10	11	21
		47.6	52.4	21.0
		13.5	42.3	
		10.0	11.0	
Column Total		74	26	100
		74.0	26.0	100.0

Chi-Square	Value	DF	Significance
Pearson	15.77567	2	.00038

Minimum Expected Frequency - 5.460

Table D.6. LOW DENSITY

Question 2 by Question 3
(perception of space dimensions)by(preference of an ATM space designed for a single person)

Question 2	Count / Row Pct / Col Pct / Tot Pct	Question 3: Yes	Question 3: No	Row Total
Narrow		4	2	6
		66.7	33.3	6.0
		6.2	5.7	
		4.0	2.0	
Normal		31	10	41
		75.6	24.4	41.0
		47.7	28.6	
		31.0	10.0	
Wide		30	23	53
		56.6	43.4	53.0
		46.2	65.7	
		30.0	23.0	
Column Total		65 / 65.0	35 / 35.0	100 / 100.0

Chi-Square	Value	DF	Significance
Pearson	3.67834	2	.03030

Minimum Expected Frequency - 2.100

Table D.7. MALE SUBJECTS

Question 2 by Question 3
(perception of space dimensions)by(preference of an ATM space designed for a single person)

Question 2	Count / Row Pct / Col Pct / Tot Pct	Question 3: Yes	Question 3: No	Row Total
Narrow		14		14
		100.0		13.9
		19.2		
		13.9		
Normal		35	9	44
		79.5	20.5	43.6
		47.9	32.1	
		34.7	8.9	
Wide		24	19	43
		55.8	44.2	42.6
		32.9	67.9	
		23.8	18.8	
Column Total		73 / 72.3	28 / 27.7	101 / 100.0

Chi-Square	Value	DF	Significance
Pearson	12.34641	2	.00208

Minimum Expected Frequency - 3.881
Cells with Expected Frequency < 5 - 1 OF 6 (16.7%)

Table D.8. FEMALE SUBJECTS

Question 2 by Question 3
(perception of space dimensions)by(preference of an ATM space designed for a single person)

		Question 3		
	Count / Row Pct / Col Pct / Tot Pct	Yes	No	Row Total
Question 2	Narrow	19 86.4 28.8 19.2	3 13.6 9.1 3.0	22 22.2
	Normal	31 67.4 47.0 31.3	15 32.6 45.5 15.2	46 46.5
	Wide	16 51.6 24.2 16.2	15 48.4 45.5 15.2	31 31.3
	Column Total	66 66.7	33 33.3	99 100.0

Chi-Square	Value	DF	Significance
Pearson	7.01307	2	.03000

Minimum Expected Frequency - 7.333

Table D.9. BEHAVIOR TYPE 2 (Looking at the person standing behind)

Density by Distance

Density	Distance: 15-45cm	46-75cm	76-120cm	Row Total
High Density	45	16		61
	73.8	26.2		55.0
	81.8	35.6		
	40.5	14.4		
Low Density	10	29	11	50
	20.0	58.0	22.0	45.0
	18.2	64.4	100.0	
	9.0	26.1	9.9	
Column Total	55	45	11	111
	49.5	40.5	9.9	100.0

Chi-Square	Value	DF	Significance
Pearson	36.29463	2	.00000

Minimum Expected Frequency - 4.955
Cells with Expected Frequency < 5 - 1 OF 6 (16.7%)

Table D.10. BEHAVIOR TYPE 3 (Hiding the ATM screen)

Density by Distance

Density	Distance: 15-45cm	46-75cm	76-120cm	Row Total
High Density	44	27		71
	62.0	38.0		47.3
	78.6	35.1		
	29.3	18.0		
Low Density	12	50	17	79
	15.2	63.3	21.5	52.7
	21.4	64.9	100.0	
	8.0	33.3	11.3	
Column Total	56	77	17	150
	37.3	51.3	11.3	100.0

Chi-Square	Value	DF	Significance
Pearson	41.84821	2	.00000

Minimum Expected Frequency - 8.047

Table D.11. BEHAVIOR TYPE 2 (Looking at the person standing behind)

Density by Question 5

Density	Count / Row Pct / Col Pct / Tot Pct	Question 5: Not at all	Annoyed	Very Annoyed	Row Total
High Density		8	7	46	61
		13.1	11.5	75.4	55.0
		44.4	28.0	67.6	
		7.2	6.3	41.4	
Low Density		10	18	22	50
		20.0	36.0	44.0	45.0
		55.6	72.0	32.4	
		9.0	16.2	19.8	
Column Total		18	25	68	111
		16.2	22.5	61.3	100.0

Chi-Square	Value	DF	Significance
Pearson	12.56613	2	.00187
Minimum Expected Frequency -	8.108		

Table D.12. BEHAVIOR TYPE 3 (Hiding the ATM screen)

Density by Question 3
(preference of an ATM space designed for a single person)

Density	Count / Row Pct / Col Pct / Tot Pct	Question 3: Yes	Question 3: No	Row Total
High Density		63	8	71
		88.7	11.3	47.3
		51.6	28.6	
		42.0	5.3	
Low Density		59	20	79
		74.7	25.3	52.7
		48.4	71.4	
		39.3	13.3	
Column Total		122	28	150
		81.3	18.7	100.0

Chi-Square	Value	DF	Significance
Pearson	4.86117	1	.02747

Minimum Expected Frequency - 13.253

Table D.13. MALE SUBJECTS

Question 10 by Question 6
(Education level)by(Degree of importance of the gender of the person standing behind)

		Question 6			
	Count / Row Pct / Col Pct / Tot Pct	Not at all	Moderately important	Important	Row Total
Question 10	Primary	1			1
		100.0			1.0
		1.7			
		1.0			
	Secondary	7		1	8
		87.5		12.5	7.9
		12.1		4.8	
		6.9		1.0	
	High	28	15	14	57
		49.1	26.3	24.6	56.4
		48.3	68.2	66.7	
		27.7	14.9	13.9	
	University	22	7	6	35
		62.9	20.0	17.1	34.7
		37.9	31.8	28.6	
		21.8	6.9	5.9	
	Column Total	58	22	21	101
		57.4	21.8	20.8	100.0

Chi-Square	Value	DF	Significance
Pearson	6.07514	6	.41483

Minimum Expected Frequency - .208
Cells with Expected Frequency < 5 - 6 OF 12 (50.0%)

Table D.14. FEMALE SUBJECTS

Question 10 by Question 6
(Education level)by(Degree of importance of the gender of the person standing behind)

Question 10	Count / Row Pct / Col Pct / Tot Pct	Question 6: Not at all	Moderately important	Important	Row Total
Primary		1			1
		100.0			1.0
		2.0			
		1.0			
Secondary		13	2		15
		86.7	13.3		15.2
		26.0	15.4		
		13.1	2.0		
High		22	5	16	43
		51.2	11.6	37.2	43.4
		44.0	38.5	44.4	
		22.2	5.1	16.2	
University		14	6	20	40
		35.0	15.0	50.0	40.4
		28.0	46.2	55.6	
		14.1	6.1	20.2	
Column Total		50	13	36	99
		50.5	13.1	36.4	100.0

Chi-Square	Value	DF	Significance
Pearson	14.46077	6	.02489

Minimum Expected Frequency - .131
Cells with Expected Frequency < 5 - 4 OF 12 (33.3%)

Table D.15. MALE SUBJECTS

Question 10 by Question 5
(Education level)by(Degree of annoyance with the presence of others standing behind)

Question 10	Count / Row Pct / Col Pct / Tot Pct	Question 5: Not at all	Annoyed	Very annoyed	Row Total
Primary		1			1
		100.0			1.0
		5.9			
		1.0			
Secondary		3	3	2	8
		37.5	37.5	25.0	7.9
		17.6	9.1	3.9	
		3.0	3.0	2.0	
High		12	18	27	57
		21.1	31.6	47.4	56.4
		70.6	54.5	52.9	
		11.9	17.8	26.7	
University		1	12	22	35
		2.9	34.3	62.9	34.7
		5.9	36.4	43.1	
		1.0	11.9	21.8	
Column Total		17 16.8	33 32.7	51 50.5	101 100.0

Chi-Square	Value	DF	Significance
Pearson	13.94092	6	.03030

Minimum Expected Frequency - .168
Cells with Expected Frequency < 5 - 6 OF 12 (50.0%)

Table D.16. FEMALE SUBJECTS

Question 10 by Question 5
(Education level)by(Degree of annoyance with the presence of others standing behind)

		Question 5			
	Count / Row Pct / Col Pct / Tot Pct	Not at all	Annoyed	Very Annoyed	Row Total
Question 10	Primary	1			1
		100.0			1.0
		5.0			
		1.0			
	Secondary	7	3	5	15
		46.7	20.6	33.3	15.2
		35.0	13.6	8.8	
		7.1	3.0	5.1	
	High	11	13	19	43
		25.6	30.2	44.2	43.4
		55.0	59.1	33.3	
		11.1	13.1	19.2	
	University	1	6	33	40
		2.5	15.0	82.5	40.4
		5.0	27.3	57.9	
		1.0	6.1	33.3	
	Column Total	20 20.2	22 22.2	57 57.6	99 100.0

Chi-Square	Value	DF	Significance
Pearson	25.37052	6	.00029

Minimum Expected Frequency - .202
Cells with Expected Frequency < 5 - 5 OF 12 (41.7%)

Table D.17. Sex of Subject by Question 7 (The security of the place)

Sex of Subject	Count / Row Pct / Col Pct / Tot Pct	Question 7: Not at all	Moderately Secure	Very Secure	Row Total
Male	Count	12	43	46	101
	Row Pct	11.9	42.6	45.5	50.5
	Col Pct	70.6	52.4	45.5	
	Tot Pct	6.0	21.5	23.0	
Female	Count	5	39	55	99
	Row Pct	5.1	39.4	55.6	49.5
	Col Pct	29.4	47.6	54.5	
	Tot Pct	2.5	19.5	27.5	
Column Total		17	82	101	200
		8.5	41.0	50.5	100.0

Chi-Square	Value	DF	Significance
Pearson	3.85984	2	.14516

Minimum Expected Frequency - 8.415

Table D.18. MALE SUBJECTS

Question 11 by Question 6
(Age of subject)by(Degree of importance of the gender of the person standing behind)

		Question 6			
	Count / Row Pct / Col Pct / Tot Pct	Not at all	Moderately important	Important	Row Total
Question 11	(20-34)	12	5	4	21
		57.1	23.8	19.0	20.8
		20.7	22.7	19.0	
		11.9	5.0	4.0	
	(35-49)	32	13	11	56
		57.1	23.2	19.6	55.4
		55.2	59.1	52.4	
		31.7	12.9	10.9	
	(50 +)	14	4	6	24
		58.3	16.7	25.0	23.8
		24.1	18.2	28.6	
		13.9	4.0	5.9	
	Column Total	58 57.4	22 21.8	21 20.8	101 100.0

Chi-Square	Value	DF	Significance
Pearson	.65589	4	.95666

Minimum Expected Frequency - 4.366
Cells with Expected Frequency < 5 - 3 OF 9 (33.3%)

Table D.19. FEMALE SUBJECTS

Question 11 by Question 6
(Age of subject)by(Degree of importance of the gender of the person standing behind)

		Question 6			
	Count / Row Pct / Col Pct / Tot Pct	Not at all	Moderately important	Important	Row Total
Question 11	(20-34)	12	3	8	23
		52.2	13.0	34.8	23.2
		24.0	23.1	22.2	
		12.1	3.0	8.1	
	(35-49)	26	6	20	52
		50.0	11.5	38.5	52.5
		52.0	46.2	55.6	
		26.3	6.1	20.2	
	(50 +)	12	4	8	24
		50.0	16.7	33.3	24.2
		24.0	30.8	22.2	
		12.1	4.0	8.1	
	Column Total	50	13	36	99
		50.5	13.1	36.4	100.0

Chi-Square	Value	DF	Significance
Pearson	.48492	4	.97495

Minimum Expected Frequency - 3.020
Cells with Expected Frequency < 5 - 2 OF 9 (22.2%)