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Desired privacy and the impact of crowding on customer emotions and approach-avoidance responses

Waiting in a virtual reality restaurant

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Abstract

Purpose – Recognizing that crowding in a restaurant waiting area forms a first impression of service and sets service expectations, the purpose of this study is to investigate the impact of crowding in the effective control of the waiting environment. The study seeks to examine the impact of crowding on customers' emotions and approach-avoidance responses and to examine the mediating role of emotion and the moderating role of desired privacy in the relationship between crowding and approach-avoidance responses.

Design/methodology/approach – Using real-scale, interactive virtual reality (VR) technology that allows high-fidelity representations of real environments, the authors created a navigable, photo-realistic three-dimensional model of a restaurant waiting area. Through an experimental study which manipulated crowding levels in the VR restaurant, they surveyed the subjects' responses toward crowding conditions.

Findings – The study found significant effects of crowding on emotions including arousal and dominance, but not pleasure, and on approach-avoidance responses. The impact of crowding on approach-avoidance responses was more direct than indirect, without having emotion as a mediator. It was also found that the desire for privacy as a psychological trait moderated the relationship between crowding and affiliation.

Practical implications – The findings of this study offer restaurant managers insights toward the effective management of the pre-process service environment during the waiting state that minimizes the negative consequences of waiting/crowding. This study provides three courses of management actions that can make unavoidable crowding in the restaurant waiting situation more enjoyable and comfortable.

Originality/value – By using VR simulation, this study adds a new approach for crowding studies. Theoretically, this study broadened the scope of crowding studies by adding a potential mediating variable, emotions, and a moderating variable, desired privacy, in examining the relationship between crowding and approach-avoidance responses. Also, by focusing on a restaurant waiting area, the authors were able to explore the pre-process service expectations.

Keywords Crowding, Emotions, Approach-avoidance, Wait management, Desired privacy, Service environment, Virtual reality simulation, Privacy, Virtual reality, Queuing time, Hospitality services

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1. Introduction

Would a crowded restaurant waiting area encourage or discourage customers entering a restaurant? A store with many shoppers creates images of an exciting store, feelings of restricted movement, or both. A crowded waiting area suggests an exciting, and popular place. But customers can sense difficulties about entering the restaurant's dining area, because of the presence of customers ahead of them, and may feel they lack control over their circumstances and renege on their booking. So, a restaurant's waiting area gives a key expectation of service that encourages or discourages customer patronage. Understanding how crowding in a waiting area influences customer expectations, opinions of service and willingness to receive service helps managers create a positive first experience of their restaurant. Environmental reasons have important effects on customers' feelings, thinking, and reactions about a service conditions (Zeithaml and Bitner, 2000), and social and environmental psychologists have theorized that crowding also influences mood and stress (Desor, 1972; Gormley and Aiello, 1982; Regoeczi, 2008).

Using a virtual reality setting, this study looks into how and to what extent crowding in a restaurant waiting area influences emotions and attitudes. Among the emotions influencing people's approaches or avoidance behaviors (Mehrabian and Russell, 1974), pleasure and arousal were explored in crowding studies (Choi *et al.*, 1976; Hui and Bateson, 1991; Wakefield and Blodgett, 1996). Dominance, as an emotional dimension influenced by crowding, however, remains unexplored. We examine crowding effects inclusively along the three emotional dimensions of pleasure, arousal, and dominance, testing if it influences restaurant patrons' attitudes directly or indirectly.

Crowding studies in noncommercial and residential settings have been conducted already (Eroglu and Machleit, 1990; Regoeczi, 2008), while service settings have received interest recently (Eroglu, Machleit and Barr, 2005; Machleit *et al.*, 2000). And research at service settings in bookstores, grocery stores and retail shops claim that crowding negatively influences emotions, consumption intentions, and behaviors. Machleit *et al.* (2000) showed that crowding's negative effect on satisfaction varied by store type. As is true of any marketing variable, the impact of crowding depends on the nature of the consumption setting. Thus, crowding in differing service settings like restaurants is worth examining. Previous research literature reports little interest about crowding in the restaurant industry, however, we focus on this crowding effect and its consistency with other service settings. Except for research (Hui and Bateson, 1991) on waiting for a bank teller no study reported on combining crowding and waiting within a service setting. Hence, this study examines if customers see crowding in a restaurant waiting situation differently from that at a bank or shop. Typical crowding studies have focused on the in-process stage in general retail environments but waiting in a restaurant occurs during the pre-process stage in the service delivery. Consequently, it remains unclear if pre-process crowding affects customer opinions differently than in-process crowding. For example, a crowded waiting area may inhibit the customers' attainment of their goals discouraging them from waiting for a table. Alternatively, if the place appears popular it could encourage customers to stay. Therefore, crowding influences customer stay or leave decisions.

Past research suggests that personal characteristics influence how people interpret environmental cues so individuals react differently to the number of people around them (Saegert, 1973). Among the characteristics influencing people's opinions about crowding is their desire for privacy (Belk, 1975) and satisfying this depends on the

service environment. Individuals wanting privacy might seek lower levels of social engagement. Hence, crowding may cause negative experiences by allowing unwanted social contact with other customers. Despite several decades of research on crowding, most studies have not involved personality variables. Thus, this study also examines privacy as a moderating variable that influences the association between crowding and customers' attitudes toward a service.

Restaurant managers can improve service experiences by understanding the effects of crowding on waiting customers' emotions and behavioral intentions. This would improve customer satisfaction, repatronage intentions, and profitability. The study explores these issues by asking three questions. First, what is the impact of crowding on emotions and approach-avoidance responses in a simulated restaurant waiting area? Second, does emotion play a mediating role between crowding and approach-avoidance responses? Third, does the desire for privacy moderate the crowding and approach-avoidance responses?

2. Literature review

2.1 Crowding as part of servicescape dimensions

Servicescapes have significant influences on individual behavior that sway customers' conviction about a place (Zeithaml and Bitner, 2000). In general, studies have found people enjoy spending more time and perhaps more money in places where they experience positive emotions such as pleasure. As any servicescape involves many components (color, sound, lighting, layouts, signs, etc) Bitner (1992) categorizes them into three dimensions: ambient conditions, space and function, and signs, symbols, and artifacts. Ambient conditions include lighting, sound, music, scent, and temperature that usually affect the five senses while determining the environmental background. Space and function considers the arrangement, shape, and size of equipment and furnishings and how these assist performance and goal attainment. Moreover, the signs, symbols, and artifacts include those items and cues enabling the organization to communicate with customers explicitly and/or implicitly. Studies have isolated specific servicescape factors to investigate their impact on customers' reactions including emotional responses and purchase intentions/behaviors with some studies showing that positive ambient conditions improved customers' store evaluation, approach behavior, and business results. Music is an example of the impact of an ambient condition on customer reactions that consumer research has examined frequently (Caldwell and Hibbert, 2002; Dube *et al.*, 1995; Dube and Morin, 2001; Herrington, 1996; Holbrook and Anand, 1990; Hui *et al.*, 1997; Morin *et al.*, 2007; North and Hargreaves, 1996; Yalch and Spangenberg, 1988; 2000).

While some field studies proved that music affects customers' reactions including store evaluations, length of stay and/or amount of money spent (Baker and Cameron, 1996; Dube and Morin, 2001; Hui *et al.*, 1997), other empirical studies have used objective parameters for categorizing music by different tempo, volume, and/or genre (Milliman, 1982; 1986; Sweeney and Wyber, 2002). Most prior studies focused on emotional responses including pleasure and/or arousal as a mediator in the relationships between music and customers' approach-avoidance behaviors (e.g. Holbrook and Anand, 1990; Sweeney and Wyber, 2002). Other ambient conditions such as scents, colors, and lighting have received attention in consumer research also (e.g. Kurtich and Eakin, 1993; Mattila and Wirtz, 2001; Spangenberg *et al.*, 1996; Valdez and Mehrabian, 1994). Overall, previous research

indicates ambient conditions change customers' opinions of the physical and emotional aspects of a place and influence their intentions and behaviors. Space and function have received less attention in service settings than ambient conditions with research focused on the influence of spatial layout and functionality in organizational behavior. Crowding as part of a spatial layout and functionality dimension began receiving attention in terms of its effect on human behavior in noncommercial or residential settings (Eroglu and Machleit, 1990; Regoeczi, 2008) and then service settings (Eroglu, Machleit and Barr, 2005; Machleit *et al.*, 2000). Crowding is receiving attention as an important servicescape factor because of its impact on consumer behavior (Dion, 2004; Eroglu, Machleit and Barr, 2005; Hui and Bateson, 1991; Machleit *et al.*, 1994; Machleit *et al.*, 2000).

Machleit *et al.* (1994) define crowding by distinguishing its human and spatial dimensions that affect satisfaction in different ways. The human dimension is a closed, confined feeling and the spatial dimension is a restricted movement feeling. For example, in a restaurant many customers could represent high human crowding and tables in close proximity could represent high spatial crowding. This study focuses on human crowding during the preprocess stage and controlled other servicescape factors because they can influence customer perceptions by interacting with the other dimensions (Bitner, 1992). While researchers have explored the impact on emotions and revisit intentions of servicescape atmospherics in restaurants (Jang *et al.*, 2011; Kim and Moon, 2009; Kincaid *et al.*, 2010; Liu and Jang, 2009; Ryu and Jang, 2007) less is known about the impact of crowding in the restaurant industry. Furthermore, studies of restaurants' physical environments are limited to the dining situation and the evaluations of it after consumption has occurred, however, this study concentrates on evaluations during the preprocess stage. At the point customers form their first impression of the restaurant experience so this study examines what impact crowding has on expectations of restaurant service.

2.2 Effects of crowding on customer attitudes and behavior

From an environmental psychology viewpoint, individuals react to places with either approach or avoidance behaviors (Mehrabian and Russell, 1974). Approach includes positive responses like desires to stay, explore, work, and affiliate while avoidance includes negative responses to the same things (Mehrabian and Russell, 1974). Typical research on the effects of crowding has focused on affective responses (Hui and Bateson, 1991), satisfaction (Eroglu and Machleit, 1990; Machleit *et al.*, 1994; Machleit *et al.*, 2000), and shopping value (Eroglu, Machleit and Barr, 2005). The exception being Hui and Bateson (1991) who adapted approach-avoidance responses developed by Mehrabian and Russell (1974) to study crowding in theoretical settings. Few studies of service settings included approach-avoidance measures for examining crowding even though they are used for assessing the impact of other environmental features. Mehrabian and Russell (1974) identify four aspects of approach-avoidance responses within environments: desires to stay, explore, and communicate, and degrees of satisfaction. Donovan and Rossiter (1982), however, considered approach-avoidance as the "attitude toward the act" when classifying these responses and identified four independent sub-dimensions of approach-avoidance responses within environments. These are affect, relevant to store patronage intention; affiliation, relevant to interaction with others in the environment; and time and spend, relevant to the reinforcement of time and financial expenditure in an environment.

For deciding which approach-avoidance responses crowding stimulates and the extent of its influence on these responses, we followed the Donovan and Rossiter (1982) classification by focusing on readiness of action and behavioral intention, and measuring them with attitude dimensions. Although attitude is not always a credible measure of behavior, the attitude characteristics and expected actions are considered accessible therefore we assumed a strong consistency between attitude and behavior.

Prior studies present contradictory views about crowding effects. Some studies confirmed Eroglu and Harrell's (1986) proposition of the negative influence high levels of crowding have on satisfaction with shopping experiences. Through a field study in which shoppers reported their shopping experience in various retail stores including malls and grocery stores, researchers found a negative relationship between crowding and shopper satisfaction (Machleit *et al.*, 2000). Similarly, a field study of supermarket shoppers revealed crowding negatively influenced confidence in shopping behavior and altered shoppers' behavioral patterns (Harrell *et al.*, 1980). Machleit and others (1994) conducted an experimental study using a video tape and a written scenario about bookstore and demonstrated a negative correlation between crowding and shopping satisfaction. These studies consistently report that negative influences include crowding limits and routine shopping speed, preventing exploratory and low priority shopping, and discouraging dealings with store employees, which result in low satisfaction and unfavorable evaluation of their shopping experience by customers. Another study also postulated that crowding is negatively correlated with number of purchases (Grossbart *et al.*, 1990). For the waiting issue, Grewal *et al.* (2003) showed customer density increases customers' expectations about waiting times in shopping areas, explaining that when there are higher expectations of long waiting periods the evaluations of a store's atmosphere and its repatronage rate are lower.

Some studies, however, suggested positive views on crowding. Eroglu, Machleit and Barr (2005) inferred more people in a store is desirable when people want better social contact as empty spaces are more isolating and less stimulating than busy spaces. Using theoretical settings, they found crowding is more desirable in discount book stores than in expensive book stores. In discount book store, customers may gauge value or a good bargain by the number of people shopping in the store while in expensive book stores, customers may not need to rely on the crowding cue to gauge value. Further, using slides and scenarios Hui and Bateson (1991) compared crowding perceptions of hypothetical bar and bank settings and speculated that busy bars are considered more enjoyable than busy banks. The study findings support the view that the crowding effect varies by consumption contexts. It appears that customers view crowding positively if it facilitates their attaining goals and negatively when it hinders them. For example, a busy bar could make possible an exciting social evening while a busy grocery store can obstruct the pleasure of exploratory shopping. Other studies indicate that crowding perception can be influenced by customers' expectations suggesting if customers found the place less crowded than anticipated they could accept crowded surroundings (Machleit *et al.*, 1994; Machleit *et al.*, 2000). Thus, these studies' mixed results indicate a complex relationship between crowding and consumer behavior. Therefore we question if a crowded waiting area affects diners' plans for exploring, interacting with others, and spending money and time in a restaurant because little is known about waiting at restaurants. This leads us to anticipate that crowding in a restaurant waiting area influences customer approach-avoidance responses.

2.3 Emotional impacts of crowding

The atmosphere in service settings influences people's mood. For example, apt music lifts customer moods, emotions and approach behavior, which then influences business results (Baker and Cameron, 1996; Hui *et al.*, 1997). Despite many studies on relationships between ambient conditions and emotional responses, little attention is given to crowding and emotional responses. Negative emotions can arise when people associate a crowded waiting area with a loss of control or feeling intruded on when more people smoking or talking loudly enter it (Hui and Bateson, 1991). Nevertheless, positive emotions can arise too when people associate a crowded waiting area as the entryway to an exciting space where opportunities for social contact beckon.

Emotions can fit into three dimensions: pleasure, feeling state usually by facial expressions; arousal, a feeling state ranging from sleep to frantic excitement; and dominance, the extent people believe unfamiliar circumstances are limiting their freedom of choice (Mehrabian and Russell, 1974). Of these, perceived crowding negatively influences the pleasure of shopping (Hui and Bateson, 1991) and attending football and baseball stadiums (Wakefield and Blodgett, 1996). Arousal, however, has not received much attention in relation to crowding. According to arousal theory, people experience differing levels of arousal in varying situations (Mehrabian and Russell, 1974). For example, a busy restaurant may convey an image of a more exciting place than a crowded bank. In crowding studies, however, there is less understanding of dominance. The main contribution coming from Hui and Bateson (1991) who combined it with helplessness as "perceived control," which they separated from the other emotional dimensions using it as a moderator in the link between crowding and emotions. But, questioning if crowding influences an individual's feelings about how restricted their freedom of choice is, we included dominance as an emotional dimension. Clearly environmental features can influence these emotional dimensions. Thus, we raise the question of which emotional dimensions a crowded waiting area would impact.

2.4 The mediating role of emotion

This study examined the mediating role of emotions between crowding and approach-avoidance responses because other researchers have reported conflicting results about the mediating roles of emotions between perceived crowding and consumer behavior. While some studies found that perceived crowding is associated with emotions, which then influences approach-avoidance behaviors (Hui and Bateson, 1991; Eroglu, Machleit and Chebat, 2005), the mediating role of emotions is not fully supported. Machleit *et al.* (2000) showed emotions did not mediate the effects of spatial crowding on satisfaction. Without a consensus on the mediating role of emotions in the link between crowding and customer behaviors, it is still questionable if the effect of crowding is direct or not. Crowding may directly influence customer perception, but without influencing their emotions. Alternatively, crowding may influence customer perceptions through an indirect affect transfer by first influencing their emotions and then influencing their perceptions. Specifically, Machleit *et al.* (2000) found that crowding and customer satisfaction varied by store type. Using this logic, we examined if emotions have a mediating role between crowding and approach-avoidance responses in a restaurant. Thus, we questioned whether emotions play a mediating role between crowding and service expectation.

2.5 Crowding and the desire for privacy

By supporting personal needs and influencing an individual's activities (Architecture-Research-Construction, 1976; Sommer and Gilliland, 1962) physical environments encourage or discourage social interactions. Thus, perceptions of crowding and preference for different environments may vary according to the desire for privacy. With some people enjoying privacy when dining out, others prefer crowded restaurants with more social interaction. As a personal psychological variable, the desire for privacy significantly moderates the link between crowding and individual behavior (Bitner, 1992). Privacy, defined as the "selective control of access to the self or to one's group" (Altman, 1975), involves optimizing contact with others (Pedersen, 1994). It is multidimensional (Marshall, 1974; Pedersen, 1979), and occurs in six types:

> Reserve indicates an unwillingness to be with and talk with others, especially strangers. Isolation reflects a desire to be alone and away from others. Solitude suggests being alone by oneself and free from observation by others. Intimacy with family connotes being alone with members of one's own family. Intimacy with friends suggests being alone with friends. And, anonymity is wanting to go unnoticed in a crowd and not wishing to be the center of group attention (Pederson, 1979, p. 1,293).

Comparisons between the Turkish and American contexts show that preferred types of privacy varied by culture (Demirbas and Demirkan, 2000; Kaya and Weber, 2003; Rustemli and Kokdemir, 1993). Hall (1966) differentiates contact culture, where individuals face one another more directly, from noncontact culture, where individuals are more distant from each other. According to the studies (Demirbas and Demirkan, 2000; Kaya and Weber, 2003; Rustemli and Kokdemir, 1993), people from a contact culture such as the Turks preferred solitude and intimacy with friends over the other dimensions. People from a noncontact culture such as in America wanted higher levels of privacy than the Turks. The studies found that people who preferred more privacy saw residential environment space as being more crowded and that culture moderated the link between the want for privacy and sensing crowding in residential environments. Because most studies dealing with crowding and privacy examined residential environments (Butler and Steuerwald, 1991; Demirbas and Demirkan, 2000; Kaya and Weber, 2003; Robinson, 1998; Rustemli and Kokdemir, 1993), their results might not apply to service settings, if strangers are present.

Within a service setting where social interaction is appreciated, privacy might not be preferred, or it might be critical. In investigating the link between privacy and crowding, our study focuses on a service setting, a restaurant, where hedonic value is emphasized, and where little research has been done around privacy and crowding. The current study examines whether a desire for privacy influences the link between crowding and attitude toward service. Therefore, we question what dimension of privacy is occurs with approach-avoidance behavior in a restaurant waiting situation and what privacy dimension plays an important role in moderating the link between crowding and attitude toward service.

Based on literature review, we have proposed the following hypotheses:

H1. Crowding in a restaurant waiting area influences customer approach-avoidance responses.

H2. Crowding in a restaurant waiting area will influence the customer emotions of pleasure, arousal, and dominance.

H3. Emotion will mediate the relationship between crowding and approach-avoidance response.

H4. Desire for privacy moderates the relationship between crowding and approach-avoidance responses.

2.6 The study of customers' psychology and behavior in virtual reality environments

As the study hypotheses were tested in a Virtual Reality environment, this section gives some background information about how valid it is for researching customers' psychology and behavior. The rapidly developing Virtual Reality (VR hereafter) technologies give users a convincing experience of being present in an artificial situation. Beyond the well-known applications with confirmed effectiveness in the training of pilots, soldiers, machinery operators, as well as in video entertainment games, social scientists have been using VR simulation since the late 1990s. For example, in psychology, researchers and practitioners use VR for treating types of phobias (Peñate *et al.*, 2008), psychological disorders (Rizzo *et al.*, 2006) and psychiatric disabilities (Marques *et al.*, 2008). Moreover, Rizzo *et al.* (2009) have used VR simulations for treating post-traumatic stress disorders, sometimes described as virtual exposure therapy or cyber-therapy.

VR is known for giving users a sense of "presence" and many users report an experience of total immersion in the simulation (Glantz *et al.*, 2003). Virtual simulations have been used as a method to study behavioral and psychological phenomena enabling the replication of real world experiments in controlled environments (Fox *et al.*, 2009). There has been growing interest in understanding what is occurring when participants perform a near real-world task (Wiederhold and Wiederhold, 2008). Given the ability to represent real environments and sensory experiences closely, researchers have explored social and psychological phenomena occurring in the physical world and novel experiences unique to VR representation (Fox *et al.*, 2009) from disciplines including psychology, marketing, and advertising. Researchers have found vivid experiences in virtual environments induce emotional reactions. These lead to increases in heart rate, blood pressure, galvanic skin response, respiration, and skin conductance (Macedonio *et al.*, 2007; Tarnanas *et al.*, 2009) as well as brain activity measures identified via functional magnetic resonance imaging (fMRI) (Baumann *et al.*, 2003). From a recent empirical study in Stanford's Virtual Human Interaction Lab, Fisher (2011) reports such engaging media experiences as VR can change how people behave in the real world.

For an environmental simulation to be considered valid, it should evoke responses comparable with direct experience of the replicated environment (Rohrmann and Bishop, 2002). Much research has established the psychological, physiological, and behavioral effects of VR simulations for successfully approaching real-world psychological and behavioral problems. Limited research efforts, however, have examined the validity and generalizability of virtual environments to real environments (de Kort *et al.*, 2003). Lombard (1995) and Loomis *et al.* (1999) claim that virtual environments are able to provoke responses and behavior similar to those portrayed in real environments. Furthermore, with the development of VR technology, the potential for providing viewers with an accurate representation of real experience has increased significantly (de Kort *et al.*, 2003). Against this background, the use of VR in servicescape research extends its growing usefulness in business settings as is shown in this study.

3. Method

Despite the recognized importance of crowding, the main restraint on conducting crowding studies in commercial settings is controlling variables such as the number of customers in real service environments. We overcame this challenge by creating a computer-simulated three-dimensional high-fidelity photo-realistic VR restaurant waiting area including waiting customers, which was navigable by joystick input. This featured photo-realistic virtual customers to maximize the natural emotional and attitudinal responses obtained from 61 subjects who acted as customers under two crowding conditions in the simulated setting.

3.1 Subjects and data collection

Students enrolled in a hotel and restaurant management program at a US Midwest university were invited to take part in a research study and 61 undergraduate students participated in the VR simulation study receiving a free pizza coupon for their help. They included 30 (49 percent) males and 31 (51 percent) females. The participants' averaged 2.5 times weekly restaurant dining, with averaged spending of $18.11 at dinner. The study was a between-subject design with subjects randomly assigned to either the low crowding or high crowding condition and no subject exposed to both conditions. When a subject arrived at the VR laboratory, a research assistant set low or high crowding conditions and rotated the condition each time. Thus, participants arriving in consecutive order explored differing conditions. On arrival participants received written instructions and verbal and visual guidance on the joystick device and interaction with the VR simulation. Because of the good design, they needed a one-minute practice for understanding the joystick and the VR simulation. Data were collected for examining their emotions and approach-avoidance responses about the differing crowding scenarios. In the VR lab subjects used a joystick for exploring inside the VR restaurant waiting area and then completed a series of survey questions based on imagining themselves in the following scenario.

> Assume it is a Friday night. You and three of your friends have decided to dine in a casual-themed restaurant located in your community. The restaurant you have just entered is known for having good-quality food with an average check of $20. This is your first time visiting the restaurant and you find the host, who greets you in a friendly way. While the host looks over the seating chart, you take a look at the waiting area shown on the screen in front of you.

Faculty members and graduate students at the hotel and restaurant management program validated the scenario, which describes a typical dining-out situation; however, except for the crowding conditions other influences were considered constant. Hence, factors like the time of the visit, dining partners, the average check, food quality, restaurant location, and their previous experience at the restaurant were not imputed. Using this scenario exposed all subjects to the VR restaurant in the same condition and allowed the subjects to focus on the crowding in this setting. Additionally, we used a hypothetical figure in the scenario intending to avoid problems involving individual differences in reactions to specific types of activities (Havlena and Holbrook, 1986).

3.2 Developing the Virtual Reality (VR) simulation

Environmental psychologists and marketers have shown that simulated environments lead to results similar to those found in actual environments (Bateson and Hui, 1992;

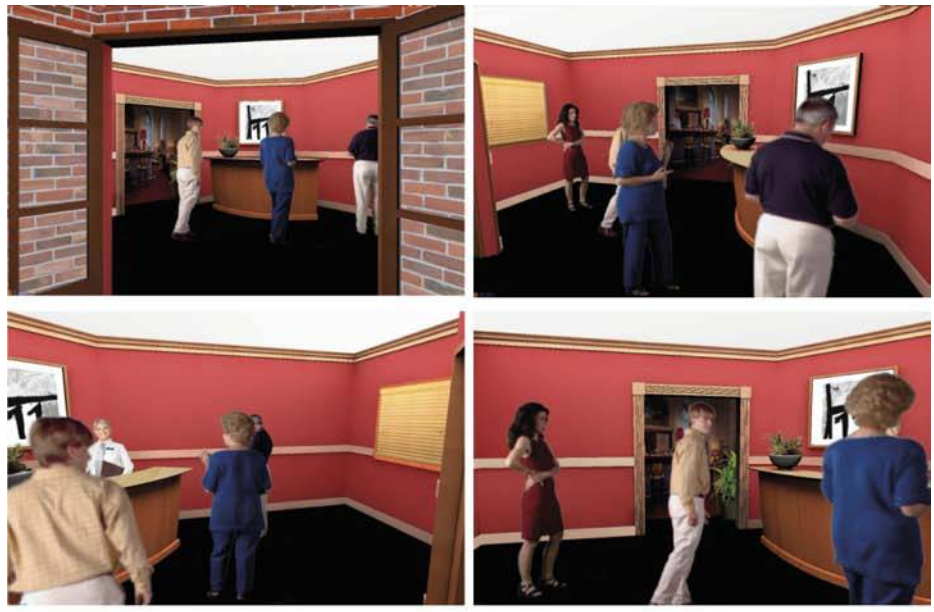
Nasar, 1989). For example, most personal space studies used simulation methods (Altman, 1975). This study used a high-fidelity real-time interactive VR-simulated restaurant to study customer responses toward the crowding conditions of waiting areas. Research on presence in virtual environments (VEs) established that real-time interactive 3D virtual environments promote a sense of being engaged. The VEs are known for engaging the user via the unique technology characteristic called "presence". This allows a sense of being there that is greater for immersive VEs with larger displays or HMDs. Interactive marketing studies show consumers feel an enhanced sense of being there when interacting with 3D products resulting in a stronger "virtual experience" (Biocca *et al.*, 2006; Li *et al.*, 2001). Consequently, consumers interacting with 3D products are more confident in their attitudes about the product information presented (Kim and Biocca, 1997). Li *et al.* (2001) noted that people interacting with VEs had virtual experiences consisting of vivid, involved active, and affective psychological states. VEs allow user responses to the computer-generated 3D environment that are similar to their responses in a real environment.

A licensed interior designer planned the VR restaurant waiting area by referring to the layouts of reception areas from 10 casual-dining restaurants in a US Midwestern city. The seating in the restaurants ranged from 140 to 250 (mean = 157) seats. Their space configurations were analyzed and based on an average size and layout, the interior of a 270 square-foot VR reception area was developed using a three-dimensional (3D) computer-aided design application.

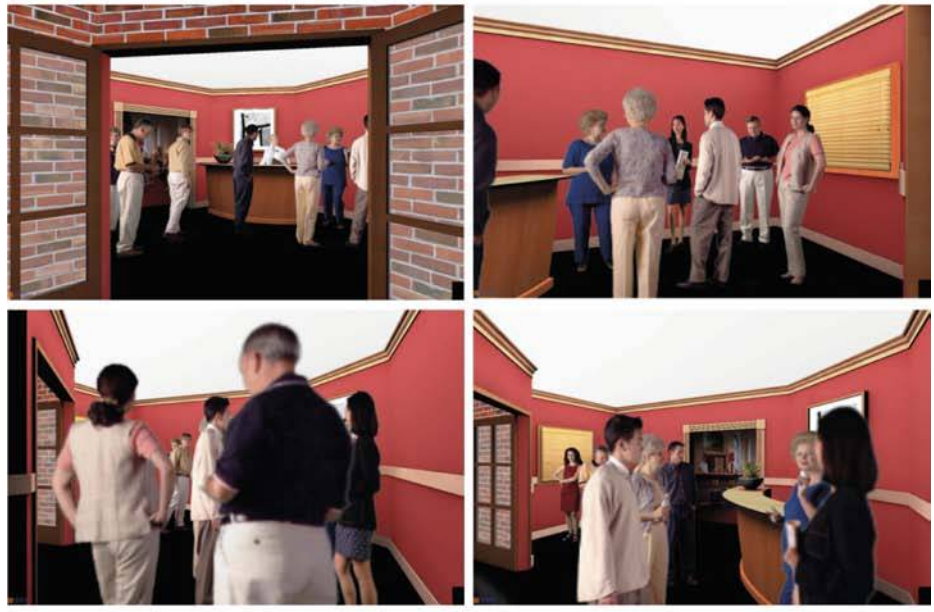
The computer-simulated interior, representing a typical restaurant waiting area, was created in Autodesk 3D Studio Max 9 and Vray, a photorealistic rendering engine. Then, using EON Reality VR software, the high-fidelity renderings of the 3D computer model were converted into a real-time interactive 3D environment, navigable by using a joystick. This computer simulation used three-dimensional, photographic models of people, which were added to the simulated environment using an ArchVision RPC plug-in. Finally, for a higher immersion levels and more spatial awareness the scene inside the VR restaurant waiting area was rendered with a wide-angle lens providing a 65° field of view (McCreary and Williges, 1998). A 1024 × 768 dpi rear-projection system (ANSI 2500) displayed the VR restaurant on an 8′ × 6′ screen. Subjects could browse this simulated space using a joystick that allowed navigation (walking) and panning (looking around). When the viewer navigated the virtual space, the human figures also respond to the changing views, appearing lifelike in three dimensions, as seen in Figure 1.

3.3 Proxemics and virtual crowding

Two levels of crowding were used in the VR setting based on Hall's (1966) delineation of "proxemics" the three measurable distances between people (see Figures 1-2). First, is the intimate distance that ranges from physical contact of about 6 inches (150 mm) in a close phase out to 18 inches (450 mm) in a far phase. People only allow strangers to enter this space under special conditions such as a crowded elevator. Second is the personal distance that ranges from 1.5 feet to 2.5 feet (450-750 mm) in a close phase and from 2.5 feet to 4 feet (750-1200 mm) in a far phase. If given a choice, people will keep at least this distance between themselves, friends, family members, and others. Third, is the social distance that ranges from about 4 feet to 7 feet (750-2,100 mm) in a close phase and from 7 feet to 12 feet (2100-3,600 mm) in a far phase. It is at this distance where most impersonal business, work, and other communication takes place between strangers or in formal situations. Within this space, speech and nonverbal



(a) Screenshots of low level of crowding with 4 strangers in the VR restaurant waiting area



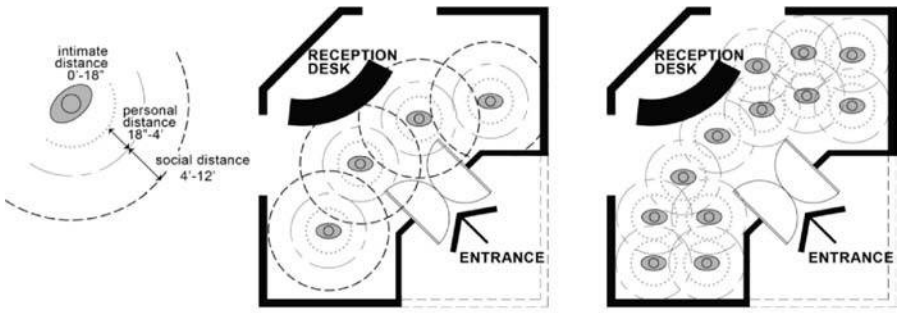
(b) Screenshots of high level of crowding with 12 strangers in the VR restaurant waiting area

Figure 1.
Screenshots of low and high crowding used in the virtual reality simulation of the restaurant waiting area

communication are understood clearly, but personal space is maintained. At about 10 feet (3,000 mm), ignoring other people nearby, such as in a reception room or library, is polite. After field observations in the ten reference restaurants, we concluded that strangers in their waiting areas did not transgress intimate distance. So, formulated on Hall's personal and social distances, two crowding levels were defined: high level crowding of 3-foot spacing among customers, and low level crowding with 5-foot spacing among customers. In the VR setting, this was 12 people or four people respectively, represented by human figures reflecting the typical age, gender, and racial groups noted at the ten restaurants. As Figure 2 shows, the customers in these simulated scenes were spaced apart consistent with Hall's theory. As we isolate human crowding for our investigation, we set other servicesacape factors constant across the two crowding conditions because each servicescape dimension can influence customer perceptions by interacting with other dimensions. Specifically, in the virtual waiting area low-saturated warm color walls and a deep-red color carpet were selected. Light birch wood was used for the receptionist's podium and moldings were neutral wood color. A licensed commercial interior designer designed the layout, color scheme, and accessories.

By gathering additional data from the subjects, several steps were taken to test the efficacy of the two crowding levels and the realism of the VR setting. First, by adapting Hui and Bateson's (1991) "perceived crowding" seven-point semantic differential scale of five perceived crowding items: stuffy or not stuffy, cramped or uncramped, crowded or uncrowded, free to move or restricted, and spacious or confined. The Cronbach's alpha of the five items was 0.75 and it was high enough to keep all the five items. The average of the four items was used to represent the value of "perceived crowding."

The result showed that the 31 subjects who were exposed to the 4-person environment rated 3.74 (with S.D. of 1.17) out of 7, while the 29 subjects who were exposed to the 12-person environment rated 5.10 (with S.D. of 0.70). Because of an independent *t*-test, we found that the two groups rated perceived crowding significantly differently ($p < 0.01$). Thus, supporting our manipulations of the VR setting that we varied by the two crowding levels. Second, to check the VR simulation's quality, subjects were asked to rate its degree of authenticity. The three questions used seven-point scales: how close is it to a real restaurant (not close at all – very close); how realistic it on the screen (not realistic at all – very realistic); how similar was it to a restaurant the subject had visited (not similar at all – very similar). We can state the VR simulations were experienced as significantly similar to an actual restaurant



(a) Low crowding: Social distance

(b) High crowding: Personal distance

Figure 2.
Plan view of crowding in the VR restaurant waiting area: low level (four strangers) and high level (12 strangers)

because the result showed the mean of the realism scale (mean = 4.70, S.D. = 1.19, $p < 0.01$), significantly higher than the scale midpoint, 4.

3.4 Measures

This study used a survey that included questions for measuring emotions and attitudes toward service that drew on Mehrabian and Russell's (1974) emotions and approach-avoidance scales. Faculty members and graduate students at the hotel and restaurant management program validated the questionnaire through a pilot study. The following sections describe the constructs and scales used in the current crowding study that is summarized in Table I, which includes information about reliability and validity analysis of the constructs.

Measure of emotions. The emotions scale included three dimensions: pleasure, arousal, and dominance. For this study, pleasure was defined as the degree to which a person feels pleased, happy, contented, satisfied, relaxed, and hopeful. Arousal as the degree to which a person feels aroused, jittery, frenzied, wide awake, excited. And dominance as the degree to which a person feels controlled, dominated, and influenced. Each dimension was operationalized by using seven-point semantic differential scale to collect subjects' responses. On the "pleasure" scale, the following adjectives were used: content or depressed, happy or sad, satisfied or dissatisfied, pleased or annoyed, relaxed or bored, and hopeful or despairing. Half of the items had positive adjectives on the "1" side of the scale, and the other half had negative adjectives on the "1" side of the scale. The items with positive adjectives on the "1" side of the scale were reverse-coded. On the "arousal" scale, the following adjectives were used: excited or calm, jittery or dull, aroused or unaroused, frenzied or sluggish, wide-awake or sleepy, and stimulated or relaxed. Similar to the pleasure scale, half of the items had positive adjectives on the "1" side of the scale, and the other half had negative adjectives on the "1" side of the scale. The items with positive adjectives on the "1" side of the scale were reverse-coded. On the "dominance" scale, the following adjectives were used: controlling or controlled, dominant or submissive, and influential or influenced.

Measure of approach-avoidance responses. The approach-avoidance scale was adapted to the VR waiting situation and classified responses as affect, relevant to restaurant patronage intention; affiliation, relevant to interaction with others in the environment; and willingness to spend more and to wait longer in the environment. Depending on the subject's agreement with each statement each item was rated on a seven-point Likert scale that ranged from 1, strongly disagree, to 7, strongly agree. The approach or avoidance scale was composed of five measures. The first measure is "affect," which includes statements such as "I like the environment," "I would enjoy dining in the restaurant," and "I would avoid ever having to return to this restaurant." The second measure is "affiliation," which includes the statements "I feel friendly and talkative to a stranger who happens to be near me" and "I would avoid other people and avoid having to talk to them." The third measure is "spend more money" and was measured using the statement, "I would spend more money than I set out to spend." The fourth measure is "willingness to wait," and was measured using the statement, "I would be willing to wait longer than the amount of time I was expecting to wait." The fifth measure is then included to measure the overall approach-avoidance response, and the statement is "I would avoid dining in the restaurant."

Validity and reliability analysis. Results obtained from a principal-component analysis using varimax rotation indicated the measure of emotions and approach-avoidance responses captured five distinctive constructs. The analysis

Construct	Factor 1	2	3	4	5	Cronbach's alpha
Emotion						
Pleasure						
Content-depressed[a]		0.61				
Happy-sad		0.83				
Satisfied-dissatisfied[a]	0.34	0.48	0.57			0.84
Pleased-annoyed			0.75			
Relaxed-bored[a]	0.43		0.71			
Hopeful-despairing		0.33	0.47		0.56	
Arousal						
Jittery-dull[a]	0.41	0.70				
Aroused-unaroused	0.33	0.51			0.42	0.79
Frenzied-sluggish[a]		0.70				
Wide-awake-sleepy[a]		0.81				
Dominance						
Dominant-submissive					0.88	NA
Approach-avoidance responses						
Affect						
I like the environment	0.82					
I would enjoy dining in the restaurant	0.82					
I would avoid ever having to return to this restaurant[b]	0.85					
Spend: I would spend more money than I set out to spend	0.60					0.91
Spend: I would be willing to wait longer than the amount of time I was expecting to wait	0.73					
Overall: I would avoid dining in the restaurant[b]	0.87					
I would be willing to recommend this restaurant to my friends	0.78					
Affiliation						
I feel friendly and talkative to a stranger who happens to be near me				0.93		
I would avoid other people and avoid having to talk to them[b]				0.88		0.86

Notes: Items with loadings of less than 0.30 not shown; NA: single-item measure; alpha not applicable; [a]items reverse worded; [b]items reverse scored

Table I.
Validity and reliability analysis: the crowding study constructs

produced a five-factor solution (with eigenvalues greater than 1.00) with explained 72.11 percent of the total variance in the items. The structure was investigated by assessing the four subgroups of items: pleasure, arousal, dominance, and approach-avoidance responses. Factors were extracted as expected with the exception that approach-avoidance items were split across two factors in which affiliation was separated from the rest of approach-avoidance responses. Thus, the two factors could be described as "general approach-avoidance responses" and "affiliation responses." Mehrabian and Russell's (1974) view supports this separation of affiliation from the remaining approach-avoidance as the indicated affiliation responses are independent of other approach-avoidance responses generally. The validity analysis finalized the items for further analysis, as shown in Table I. Reliability coefficients (Cronbach's alpha) were acceptably high for pleasure (0.84) and arousal (0.79). A single item was retained for dominance, reliability coefficients for general

approach-avoidance responses and affiliation were 0.91 and 0.86 in Cronbach's alpha and for later analysis the average scores of the items selected in each construct were computed.

Measure of desire for privacy. For this study "desire for privacy" was defined as the degree to which a person takes selective control of access to the self or to others including family, friends, and/or strangers. Pedersen's (1979) privacy questionnaire was used to measure the subjects' privacy preferences. It was comprised of 30 items, which measured all six dimensions of privacy: reserve, isolation, solitude, intimacy with family, intimacy with friends, and anonymity. Each dimension had five items. Each item was rated on a five-point semantic differential scale as to how often the subject did or felt as the statement indicated (1, never, 5, always). The sample questions included "I would be reluctant to engage in a prolonged conversation with someone I had just met," "I like to meet new people," and "I like other people to notice me when I am in public." Reverse-worded questions were reverse-coded. The mean of each dimension was calculated by averaging across the five responses. The overall mean was calculated by averaging across the 30 responses. In this study, we used the mean of the 30 item responses as a score for the desire for privacy and the reliability of all 30 items was 0.78.

4. Results

4.1 Crowding, customer emotions, and approach-avoidance responses

The study examined what impacts a crowding environment had on customer emotions and approach-avoidance responses, and whether crowding directly affected approach-avoidance responses, or did so indirectly through emotions. Additionally, the desire for privacy as a personality variable was included to investigate whether it influenced the relationship between crowding and approach-avoidance responses. The first hypothesis tested was "Crowding in a restaurant waiting area influences customer approach-avoidance responses." Among the approach-avoidance responses, the result of two sample independent *t*-tests showed that crowding significantly influenced affiliation (see Table II). We found that the high-crowding condition led to lower affiliation (mean affiliation value = 4.27, SD = 1.34) than did the low-crowding condition (mean affiliation value = 4.92, SD = 1.48) ($p < 0.10$). As defined earlier, affiliation is a tendency to interact with others in the environment. The result indicates that the high-crowding condition made people feel like avoiding other people and avoiding talking to other people in the waiting area. Thus, the first hypothesis was supported partially.

The second hypothesis tested was "Crowding in a restaurant waiting area will influence the customer emotions of pleasure, arousal, and dominance." The result of two sample independent *t*-tests showed that crowding influenced emotions (arousal and dominance). We found the high-crowding condition led to significantly higher arousal than did the low-crowding condition ($p < 0.05$, See Table II). The mean arousal score for the low-crowding condition was 3.41 (SD = 1.11) while the mean arousal score for high crowding was 4.00 (SD = 1.02). As for "dominance," the low-crowding condition led to higher dominance than that achieved by the high-crowding condition ($p < 0.10$). The mean dominance score for the low-crowding condition was 4.03 while the mean dominance score for the high-crowding condition was 3.43. When respondents perceived the environment as getting more crowded, they felt more

Dependent measures	Crowding: Low $n = 31$ M	SD	High $n = 30$ M	SD
Emotions				
Pleasure	4.16	1.34	4.54	0.86
Arousal	*3.41*	*1.11*	*4.00*	*1.02* **
Dominance	*4.03*	*1.30*	*3.43*	*1.13* *
Approach-avoidance responses				
Affect	4.53	1.59	4.61	0.88
Affiliation	*4.92*	*1.48*	*4.27*	*1.39* *
Spend more money	4.00	1.65	3.87	1.50
Willingness to wait	3.23	1.73	3.13	1.28
Overall attitude	5.52	1.71	5.07	1.05
Word of mouth	4.55	1.50	4.55	1.12

Notes: *Difference is significant at the 0.1 level ($p < 0.10$); **difference is significant at the 0.05 level ($p < 0.05$)

Table II.
Dependent measures: the impact of crowding in the VR restaurant waiting area

dominated. Unlike arousal and dominance, crowding did not affect pleasure. From the results, we decided the second hypothesis was supported partially.

The third hypothesis tested was "Emotion will mediate the relationship between crowding and approach-avoidance response." This hypothesis was assessed using the three-step procedure of testing mediation recommended by Baron and Kenny (1986). First, we tested the association of the independent variable (perceived crowding) with the dependent variable (approach-avoidance responses: affect, affiliation, spend money, willingness to wait, and overall). According to the regression analysis, only the relationship between perceived crowding and affiliation was significant (beta $= -0.291$, $p < 0.05$). Thus, we focused our further steps on affiliation measure. Second, we tested the association of the independent variable with the mediator (emotions) and discovered a significant relationship between crowding and arousal (beta $= 0.276$, $p < 0.05$). Third, we tested how the relationship between the independent and dependent variable (affiliation) changed when the mediator was added to the regression equation. When including the arousal variable to the regression equation, we found the regression coefficient for arousal became insignificant although the absolute magnitude of the regression coefficient for the crowding decreased from 0.291 to 0.258. Thus, the third hypothesis was not supported as our data did not support the third condition as one of the three conditions required for the mediation relationship. We found there was no mediating role of emotion in the relationship between crowding and approach-avoidance response.

4.2 Desire for privacy as a moderating variable in the relationship between crowding and attitude toward service

The final hypothesis tested was "Desire for privacy moderates the relationship between crowding and approach-avoidance responses." From testing the second hypothesis, we found that crowding influenced affiliation. Thus, we focused our analysis on affiliation among the approach-avoidance attitude measures. A regression analysis was conducted to test an interaction effect between the desire for privacy and crowding. The result indicated that crowding, the desire for privacy, and an interaction

between the two accounted for 39.5 percent of the variance in affiliation, $F(3, 44) = 3.394$, adjusted $R^2 = 0.11$. Importantly, the result showed that an interaction between crowding and the desire for privacy was significant (beta $= -2.963$, $t = -2.572$, $p < 0.05$) (see Table III and Table IV). This implies the impact of crowding on affiliation depends on the level of people's desire for privacy.

A further analysis investigated the interaction in more detail. We ran two separate regression analyses between a desired privacy variable and affiliation variable after we divided the whole sample into two groups: low crowding group and high crowding group (see Table III and Table IV). As a result of the analysis, we found that for the high-crowding condition, a significant negative association existed between the desire for privacy and affiliation (beta $= -0.445$, $t = 2.63$, $p < 0.05$). The result indicated the desire for privacy accounted for 44.5 percent of the variance in affiliation, $F(1, 28) = 6.904$, adjusted $R^2 = 0.169$. The result implies that on one hand, people who seek high privacy show lower affiliation when they were exposed to a high crowding condition than people who seek low privacy. On the other hand, people who seek low privacy show higher affiliation when exposed to the high-crowding condition than people who seek for high privacy. Unlike the high crowding condition, the low crowding condition showed no significant association between the desire for privacy and affiliation ($p > 0.05$). Therefore, we can conclude that our data supported the last hypothesis, *H4*.

5. Discussion

The findings show the psychological effects of other people being present in a service setting as influencing the customers' evaluation of that place. This happened in the VR restaurant setting where, according to Hall's definition of personal and social distances, we manipulated two levels of crowding in the waiting area. Here the results showed that in a waiting situation at a service setting, crowding within personal distances was more intimidating than crowding within social distances. Strangers in sufficient numbers causing intrusions into people's personal distance discouraged customers from associating with the service setting. This varied by the desire for privacy levels

Table III.
Descriptive statistics: desire for privacy and affiliation

	Desire for privacy		Affiliation	
Crowding	Mean	Standard deviation	Mean	Standard deviation
High ($n = 30$)	3.08	0.44	4.27	1.39
Low ($n = 29$)	2.99	0.34	4.78	1.41

Table IV.
Regression analysis: the impact of crowding and desire for privacy on the customers' affiliation response

Regression analysis	Predictors	β	t	R^2	Adjusted R^2	F
All	Crowding	2.44	2.39*	0.16	0.11	3.40
	Desire for privacy (DP)	0.95	2.13*			
	Crowding × DP	−2.96	−2.57*			
High-crowding condition	DP	−0.45	2.63*	0.20	0.17	6.91
Low-crowding condition	DP	−0.02	−0.16	0.06	0.02	1.64

Notes: Dependent variable = affiliation; *$p < 0.05$

among customers, as those wanting higher privacy were more sensitive to the crowded setting than those wanting lower privacy. Detecting these divergent preferences and serving them is critical for customer perceptions of quality during their dining experience, particularly as our study indicates that higher arousal induced by crowding did not have a positive influence on interactions among strangers in the wait area. As we found the desire for privacy matters in how customers perceive a crowded environment discerning their preferences and offering modulated waiting options accordingly is important. Understanding these preferences can reduce the variance between desired privacy and crowding levels.

Our findings showed that crowding induced both positive and negative emotions. Specifically, crowding had a positive association with arousal, a negative association with dominance, and a negative association with affiliation. Our study showed no mediating role of emotions in the relationship between crowding and approach-avoidance response, which indicates the direct impact of crowding on approach-avoidance response. We found the desire for privacy as a psychological trait moderated the relationship between crowding and approach-avoidance response, especially affiliation. While some of our findings were consistent with evidence in the general crowding literature, some of them are newly implying there are various optimums for the crowding levels associated with differing service settings.

Overall, we saw a significant impact of crowding on emotions and approach-avoidance responses. Crowding seems to influence customer decisions to enter the service environment. Crowding influenced emotions in both a positive and negative way. First, the positive effect of crowding has been shown in the result related to its influence on arousal. The high-crowding waiting area made customers feel more aroused than the low-crowding waiting area. It appears that subjects felt crowding to be an opportunity for social stimulation. Subjects viewed arousal in a positive way because, according to our extra analysis of correlation, higher levels of arousal held by respondents associated positively with their responses toward service (see Table V). Arousal correlated positively with willingness to wait ($r = 0.37$), affect ($r = 0.43$), spend ($r = 0.37$), overall attitude ($r = 0.28$), and word of mouth ($r = 0.28$). Second, the negative effect of crowding has been shown in the result related to its influence on dominance. The high-crowding waiting area made customers feel dominated due to a loss of control over their environment. Several theories explain this negative association between density and dominance. According to manning theory (Wicker, 1984), "every setting requires an optimal number of occupants to function effectively; then the setting is said to be adequately manned." A crowded waiting area is different from a crowded bar area where an adequately manned environment is

			Approach-avoidance responses			
Emotions	Affect	Affiliation	Spend money	Willingness to wait	Overall attitude	Word of mouth
Pleasure	0.52**	0.10	0.41**	0.58**	0.35**	0.42**
Arousal	0.43**	0.10	0.37**	0.37**	0.28**	0.28*
Dominance	0.08	0.06	0.06	0.05	0.06	0.10

Notes: *Correlation is significant at the 0.05 level (two-tailed); **correlation is significant at the 0.01 level (two-tailed)

Table V.
Pearson correlations: emotions and approach-avoidance responses

expected. Although a crowded bar might offer higher levels of perceived control, a crowded waiting area may offer lower levels of perceived control. Crowding in a waiting area may limit service speed, which can cause perceptions of difficulty in getting into the dining area to receive service because of customers waiting ahead. A theory of behavior-environment fit (Michelson, 1970) also provides a similar explanation to the manning theory. Customers in crowded waiting areas may feel their environment is incompatible with their goal of entering the restaurant to enjoy dinner. Unlike arousal and dominance, crowding did not influence pleasure significantly. This no significance of pleasure might result from the two levels of crowding used in the study being too low to trigger a significant change in the pleasure from low to high.

Also the negative effect of crowding appeared in affiliation, which included any verbally or nonverbally expressed approach behavior toward another person (Mehrabian and Russell, 1974). The high-crowding waiting area made customers feel like avoiding the service system as shown in the low value of affiliation measure. In this way, a crowded waiting area may deter people from even entering the system without making customers consider how long they can wait. In other words, a crowded environment influences balking, which is leaving the system without joining the queue, rather than reneging, which is leaving the system after joining the queue. We confirm that crowding in an environment affects the emotional evaluation of the service setting and approach-avoidance response toward the service organization (Bitner, 1990).

We state that crowding has a direct influence on approach-avoidance responses as emotion did not mediate the relationship between crowding and approach-avoidance responses. The subjects seeing the crowding situation as not created by them but from high demand by others can explain this. Our subjects wanted to avoid situations where high social density exists and other customers can interrupt the service process. Despite the different service settings, our findings of negative association between crowding and the evaluation service in a restaurant waiting area were consistent with propositions and findings from other service settings including grocery shops, banks, and bookstores (Eroglu and Harrell, 1986; Harrell *et al.*, 1980; Machleit *et al.*, 1994).

6. Implications

6.1 Crowding theory and research

Our study offers five contributions to crowding theory. First, it examined the impact of crowding by focusing on three dimensions of emotion. While prior studies (Hui and Bateson, 1991) examined the two emotional dimensions of pleasure and arousal, dominance has not been explored fully. Thus, by adding the dominance dimension, we captured the multi-dimensional nature of emotions affected by crowding. Also, we tested the mediating role of emotions in the relationship between crowding and the dependent variable. Previous studies have shown controversial results about the mediating roles of emotions in relationships between crowding and consumer behavior in retail stores. As it might be possible the mediating role varies by the service setting type, we add value to the body of knowledge because we tested if the mediating role of emotions holds for the restaurant case. Second, we examined the impact of crowding by focusing on the multi-dimensions of approach-avoidance responses. Prior studies mainly focused on affective responses (Hui and Bateson, 1991), satisfaction (Eroglu and Machleit, 1990; Machleit *et al.*, 1994; Machleit *et al.*, 2000), and shopping value (Eroglu, Machleit and Chebat, 2005). Even though approach-avoidance responses have been

used for measuring the impact of environmental factors intensively, few studies included approach-avoidance measures into their models for studying the impact of crowding. Thus, we add insight to the impact of crowding by incorporating approach-avoidance measures.

Third, we broadened the scope of crowding studies by including the moderating variable – desire for privacy that improves understanding the effects of crowding in a service setting. Also, the finding of the relationship between privacy preferences and crowding improves the understanding of customers' social behavior/interaction and its relation to the environment. Fourth, by focusing on a restaurant waiting area, our study explored the pre-process service expectations rather than the in-process or post-process service evaluations. Previously, crowding in service settings has received attention in studies focused on the in-process stage of service in retail shops, bookstores, and grocery stores. Finally, by using a VR simulation this study adds a new approach for crowding studies because video has been the standard method used in experimental studies previously. By adopting a real-scale, interactive virtual reality technology that allows high-fidelity representations of actual environments, we derived different emotional and attitudinal responses from customers exposed to differing crowding conditions. Conducting crowding studies in real service settings is challenging because of difficulties in controlling variables such as the number of customers, the expense, and the difficulty of collecting data, and the high costs in business settings.

6.2 Practical implications: first impressions count

Recognizing the limited research of crowding in the restaurant industry, excepting a study of seating density (Yildirim and Akalin-Baskaya, 2007), our findings provide useful industry implications. We consider crowding as important as odors in influencing a service's revenue. Hirsch (1991, 1995) showed pleasant smells increased the revenue of a bakery by up to 300 percent and increased the money spent on a slot machine in a Las Vegas casino. As such, our study implies that waiting area design can improve customer satisfaction and make profits. The physical environments where service begins, such as hotel lobbies, are critical in customers forming impressions of these places (Countryman and Jang, 2006). Specifically, the effective design of the service system starts with managing the waiting stage to minimize any potential negative outcomes during the pre-process service experience. For customers, their first impression forms at the waiting area immediately after they enter a restaurant. A crowded waiting area can easily turn a customer away. Our study indicated customers felt dominated and wanted to avoid talking to strangers in a crowded waiting area and this affects their emotional states during the wait. If crowding is perceived negatively, then manipulating customer perceptions is critical. Overall, actions that managers take should encourage positive emotions and approach behaviors while discouraging avoidance behaviors. From this study, there are three practical implications for combating negative crowding experiences at restaurant waiting areas that align with servicescape dimensions (Bitner, 1992). First, customer perceptions begin with the space and function of the waiting area so providing a positive physical environment through effective interior design mitigates a negative waiting experience. Although environmental conditions make a large difference to customer comfort in waiting areas (Baraban and Durocher, 2010) some managers make design decisions without considering customers' emotional responses. The common mistake appears that operators and designers have limited communication about and understanding of

customer psychology in these spaces. At the construction design stage the restaurant operators and interior designers can evaluate how large the waiting area should be as an integral ingredient in the customer experience and not as an improvised afterthought. If the business is running, evaluating and remodeling the waiting area can promote positive customer experiences. Managers need to consider that ideal crowding levels for one person may not be the same for others. Also, cultural differences in preferred privacy need operational strategies for manipulating customer opinions about crowding and waiting times. When customers want privacy operators can provide temporary movable divisions in the waiting area, and include privacy choices when designing the waiting area layout. Careful design can reduce customer perceptions of crowdedness by providing a layout that minimizes customers' perceptions of intrusions into their personal space. Second, ambient conditions can be distracters that reduce customer dissatisfaction with waiting. This includes the floor and wall finishes and colors; artworks, multimedia displays, greenery and mirrors; and providing pleasant music, scents and temperature. Managers can coordinate waiting area music, lighting, and displays with the restaurant theme creating a place of mood transition and positive anticipation. Careful improvements to the waiting area's ambient conditions are a useful choice if remodeling is not possible for an existing business. Third, signs, symbols and artifacts in the waiting area giving customers information about waiting times may reduce feelings of dominance caused by crowding, for example, customer beepers with video screens featuring entertainment and time remaining. To give customers correct information a restaurant needs effective tracking of table status and speedy communication among its employees. Access to information gives customers a sense of control over their environment (Dion, 2004) and if they receive comments about waiting times they may sense some power over their circumstances and feel better in a crowded place. When customers are pleased, the high arousal caused by crowding would not be perceived negatively.

7. Limitations and future studies

Our study contains some limits. It focused on social and personal distance based on Hall's definitions of proximity, however, by using two crowding levels it did not allow for an inflection point. Considering the continuous nature of crowding conditions, more crowding levels could provide useful information about ideal thresholds for adverse effects on moods and recommendations for the ideal environment scale. Due to the difficulty of carrying out crowding studies as pointed out in the previous studies, identification of an inflection point was a challenge despite manipulating the two levels above and below inflection point. Also, due to the difficulties of attracting people from the general population to the VR study room we used a relatively small convenience sample of college students who may not represent the adult population. Thus, future studies should access a larger sample representing mixed customer populations.

Another limit is the high-fidelity VR environment itself. Due to the high costs of building real environments, crowding studies have relied on simulated environments using photos or slides and videos. In VR, it is difficult to evoke emotional responses equivalent with a real environment and to simulate real dining behavior. Although studies have demonstrated the validity of VR environments in provoking emotional responses (Ferrer-García *et al.*, 2009; Gutiérrez-Maldonado *et al.*, 2006), this limitation derives from the mediated interaction implicit in the technology and the variable quality of spatial representations. So, how VR gives a sense of presence depends on the

characteristics of the technology (Ijsselsteijn *et al.*, 2001), individual differences among users (Sacau *et al.*, 2008) and degrees of graphic realism (de Kort and Ijsselsteijn, 2006; Ivory and Kalyanaraman, 2007). Therefore repeating this study in a field experiment would buttress its findings and by comparison test the VR environment reliability as a research instrument. On the other hand, the benefit of a VR restaurant simulation is the ability it provides for controlling the effects of physical and interpersonal environments without interfering with a real business setting. Thus, this study clarifies causal relationships that could have been unclear in a field study and shows the usefulness of a VR setting for exploring environment-behavior relationships.

The findings from the imaginary situation created in the VR scenario have limited generalizability because it focused on casual-dining experiences with friends. Thus, when applying these findings to other restaurants and situations caution is required. Future studies can include comparisons between hedonic and utilitarian service settings, the influence of situational factors and personal factors, or a holistic approach for understanding the interplay of multiple elements (e.g. color, layout, lighting, and temperature) on emotions, service evaluations, and time perceptions. If our results are replicable in various settings, the managerial implications for other restaurants can be significant. In varying VR settings future research should examine spatial layout and environmental elements, privacy options, and information provision as impacts on customer satisfaction in the pre-process service environments.

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