An Experimental Study:
Ambient Scent, Competition, and Human Crowding in the Retail Environment

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ABSTRACT

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Trang Trinh

This thesis investigates the topic of human crowding in the retail environment and the affective and behavioural consequences it has on consumers. We are particularly interested in whether the arousal component of two different scents (lavender and grapefruit) and the presence or absence of competition, reduces the dissatisfaction and avoidance behaviour that consumers display when they experience human crowding.

Results support our hypothesis and show that a relaxing scent could be used to control for human crowding. The negative effects of human crowding are mitigated in the condition where the pleasing properties of the environmental manipulation (i.e. relaxing scent and no presence of competition) lower the displeasure generated by human crowding.

The thesis contributes to the research on the effects of ambient scent by considering the application of scent in conjunction with the human crowding component of the retail environment. Furthermore, this is—to our knowledge—the first study to use the presence of real people to simulate human crowding. Previous studies on the topic had participants look at pictures of a crowded settings, instead of immersing them in one.

Future research should replicate this study and expand on the scent selection, to ensure that the pleasing effect still holds for multidimensional scents.

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1. INTRODUCTION

According to the United Nations, the world's population will reach 10 billion people by the year 2056, which is six years earlier than what was previously estimated (United Nations, 2016). With population increase, comes an increase in demand for space. For urban areas, in addition to the population growth, there is the added influx of rural residents and immigrants from other countries. The United Nations forecast that the world's urban population is expected to rise from 53 percent to 67 percent by 2050.

This increase in urban population can be seen by the increase in the number of megacities. Megacity is a terminology to refer to metropolitan areas with total population exceeding 10 million. In 1990, there were only 10 megacities. At the present, there are 35 megacities globally and it has been projected that by 2030, there will be 41 megacities (United Nations, 2014). Given the projected increase in urban population, urban density and land scarcity are expected to become more extreme as time passes. Due to this projection, there is potential that this high urban density will spread to the retailing setting, and retailers will be faced with the problem of over crowding in their stores. The perception of retail crowding arises when the "number of object, people, or both in a limited space restricts or interferes with the individuals' activities and goal achievement" (Machleit, Eroglu, & Mantel, 2000, p. 30).Retail crowding has been found to influence consumers 'satisfaction (Eroglu & Machleit, 1990; Machleit, Eroglu, & Mantel, 2000), attitude towards the store (Mehta et al, 2012; Pan & Siemens, 2011), and behavioural responses (Byun & Mann, 2011; Hui & Bateson, 1991; Pan & Siemens, 2011).

Retail crowding has two dimensions: spatial (i.e., the nature of the physical environment) and human (i.e., the number of people in the environment). In the context of retailing stores, spatial crowding refers to nonhuman elements in the environment, such as the layout, fixtures, or merchandise, whereas human crowding arises from the number of individuals and the rate of social interactions among consumers in the store (Byun & Mann, 2011, p. 284).

There are three reasons why it is important to focus on human, instead of spatial crowding. Firstly, there is already a consensus within the spatial crowding literature that spatial crowding generates negative affective and behavioural reactions from consumers (Eroglu, Machleit, & Chebat, 2005; Hui & Bateson, 1991; Machleit et al., 2000; Rompay, Galetzka, Pruyn, & Garcia, 2008). However, there are mixed results regarding the impact of human crowding. Although the majority of the studies on human crowding point to the negative impact of human crowding on consumers, there are several studies that reported that human crowding has a positive impact, while others reported no impact at all on consumers (Byun& Mann, 2011; Hui& Bateson, 1991; Machleit et al.,2000). As such, it is important to examine these opposing findings and consolidate mediators and moderators within the literature. Secondly, spatial crowding is easier to control for than human crowding. A retailer can lower the perception of spatial crowding by reducing merchandise and décor fixtures in the store. On the other hand, while high end stores may have the luxury to limit consumer traffic in the store, small and medium size businesses would not be able to do so without it impacting potential sales and customer relations. Lastly, as was previously mentioned, the rate of urban density is increasing, particularly in areas of emerging economies (Dave, 2010). Globally, retailers are expanding their businesses to developing countries, whose middle class populations are expanding and with increasing disposal incomes to spend (Mehta, 2013). Consequently, more retail stores are opening up, and more and more people are populating these stores.

It is of interest of retailing researchers to further investigate this construct of crowding, and to explore cost-effective solutions for retailers to handle this problem. Over the past decades, researchers have investigated various store atmospheric elements, such as music (Mattila & Wirtz, 2001; Dube & Morin, 2001; Morin, Dube, & Chebat, 2007; Morrison, Gan, Dublaar & Oppewal, 2011; Spangenberg, Grohmann & Sprott, 2005), lighting (Areni & Kim, 1994; Baker, Grewal & Parasuraman, 1994; Baker, Levy, & Grewal, 1992), color (Bellizzi & Hite 1992; Crowley 1993), and store layout (Baker et al., 2002)in hope of finding a method to attract and extend consumers' shopping behaviour in the retail setting.

Possibly due to the inability to control for the manipulation of ambient scent, scent was traditionally only “acknowledged but not developed” (Ward et al., 2007, p. 297). However, in recent years, there has been a rise in the number of empirical studies examining the effect of ambient scent within the retail environment. Bradford and Desrochers (2009) reasoned that this growing interest in scent is due to the strong link between scent and emotional reaction. This link because of the fact that the olfactory bulb is directly connected to the limbic system of the brain, which houses the emotion center in humans (Wilkie, 1995).

Given the current state of the literature, the present study aims at achieving the following objectives: (1) propose the use of ambient scent to control for the negative affective and behavioural responses that consumers display as a result of retail crowding, and (2) conduct an empirical study to test this new model using live human density manipulation.

The remainder of the paper is structured as follows. Firstly, the paper set a theoretical foundation by reviewing past research in the crowding literature, and draws a conceptual model synthesizing past findings. Following the literature review is the development of a new model, using ambient scent and competition as potential moderators. Finally, the methodology and statistical analysis of the current empirical study are discussed, and future research directions explored.

2. THEORETICAL FOUNDATION

2.1. Retail Crowding

The introduction of perceived crowding in the retail literature came as a result of the increase in popularity of super stores and shopping centers in the 1970s. During this period, there was a growing number of recreational shoppers, particularly, working women with limited shopping hours. These limited shopping hours led to crowded retail stores during specific operating hours like lunch breaks and after work (Harrell & Hutt 1976). Harrell and Hutt (1976) were among the first researchers to introduce the concept of perceived crowding in the retail literature. The researchers reported that retail crowding negatively affects satisfaction, particularly for time-constraint shoppers.

2.1.1. Operationalization of Perceived Retail Crowding

Across empirical studies on retail crowding, there are two terms that researchers use interchangeably: density and perceived crowding. Although these terms are interrelated, there is a subtle but important distinction between the two.

Density is an objective measure of the physical environment; it is the physical condition of limited space. On the other hand, crowding is a subjective experience, and it has traditionally been defined as a state of psychological stress when the need for space exceeds the supply (Stokol, 1972). For the present study, we would like to delve deeper into the psychological processes related to the number of people present in a shopping environment. According to Worcherl and Teddlie (1976), the perception of a crowding is a two steps process. First, the individual becomes aroused when the individual perceives that the personal space has been violated. This violation arises when "the level of density interferes with an individual's activities and achievement of goal" (Mehta, 2013, p. 643). Then, the individual attributes the cause of this arousal to other people in the environment.

This operationalization of crowding reflects the classic Stimulus-Organism-Response Model (Woodsworth, 1929) and Pleasure-Arousal-Dominance Model (Mehrabian & Russell,1974), whereby environmental stimuli affect the individual's internal affective state, and consequently, their approach/avoidance behaviour. High human density (stimulus) increases arousal level (organism) and induces the perception of crowding and prompts avoidance behaviour (response) (Byun& Mann, 2011). Due to the "organism" component of the S-O-R model, the perception of crowding is subjective, and is dependent on personal (Machleit et al.,

2000) and situational factors (Eroglu&Machleit, 1990; Machleit et al., 2000). As such, high density is a necessary but not sufficient condition to induce the perception of crowding.

Following Harrell and Hutt (1976), it was not until Machleit et al. (1994) that researchers began to further make the distinction between spatial and human crowding. This distinction was made because the researchers found that the two dimensions of crowding affected shopping satisfaction differently. Whereas there was a direct negative effect of high spatial density on shopping satisfaction, the negative effect of high human density could be controlled for through managing expectations of human density. Shopping satisfaction only decreased under conditions of high human density when the number of individuals in the store exceeded the expectation of the consumers.

2.1.2. Human Crowding and Customer Response

The literature suggests that once human crowding has elicited a certain level of arousal, it is the perception of pleasure that directs behaviour (Hui & Bateson, 1991; Rompay et al., 2008; Machleit et al., 2000). Human crowding is often perceived as an unpleasant experience and negatively influences shopping satisfaction and shopping behaviour, leading consumers to adjust to crowdedness by engaging in avoidance behaviour. Even if consumers decide to enter a crowded store, they refrain from exhibiting a high degree of exploratory behaviours in the store (Hui & Bateson, 1991; Rompay et al., 2008; Machleit et al., 2000).

However, the effects of crowding on shopping satisfaction and approach behaviour is moderated by consumers' perception of control (Hui & Bateson, 1991; Rompay et al., 2008), expectation-tolerance of crowding (Machleit et al., 2000; Pans & Siemens, 2011), and shopping goals (Eroglu et al., 2005; Pons et al., 2006).

Retail crowding has the potential to influence the perception of control through obstruction and restriction of goal attainment (Ward & Barnes, 2001). Defined as the need "to be master over one's environment," the perception of control has been studied under the context of retail crowding (Rompay et al., 2008, p. 332). Across density levels, perceived crowding was reported to be significantly lower in response to scenarios where consumers chose to engaged with the retail (Hui & Bateson, 1991) or service (Rompay et al., 2008) setting than in response to no choice scenarios. Rompay et al. (2008) explained that this reaction happened because of a shift in the locus of control. When there was high human density, it caused individuals to lose their sense of control over their environment, and it resulted in a shift of locus of control to other shoppers. As a result, individuals reacted with negative affect and disengage from the environment. However, when individuals were given the opportunity to exercise their power to control (i.e. choosing to engage with the retail or service), they would feel less helpless and respond positively.

Machleit et al. (2000) found that the relationship between the decrease in shopping satisfaction and crowding could also be explained by expectation and tolerance for crowding. For those who reported low tolerance for crowded environment, their shopping satisfaction was negatively correlated with spatial and human crowding. However, for those who reported a high tolerance level, their shopping satisfaction was negatively correlated with only spatial crowding. As such, so while the negative effect of spatial crowding on satisfaction was consistently negative, the effect of human crowding could be moderated by personal characteristics.

Alternatively, perceived human crowding could positively impact shoppers' affect and behaviour if consumers have hedonic shopping goals (Eroglu et al., 2005; Pons et al., 2006) and when human density is of medium volume (Pan & Siemens, 2011). According to Babin and colleagues (1994), there are two types of shopping goals: utilitarian goal (i.e., the purchase goal of the shopping trip) and hedonic goal (i.e., the entertainment and experiential value of the shopping trip). Human crowding can have a direct negative impact on both of these shopping goals: high human density has the potential to prevent a consumer from achieving their utilitarian shopping goal of product acquisition by way of obstructing the consumer's path towards the product. In addition, human crowding increases arousal levels and elicits frustration in individuals (Byun & Mann, 2011), consequently decreasing the hedonic value of shopping.

However, for those with hedonic shopping values, human crowding can also elicit the emotion of surprise and contribute positively to their shopping value, leading to an increase in shopping satisfaction (Eroglu et al., 2005). Furthermore, within service settings, high human density can increase hedonic value through social facilitation. In social retail settings, such as bars, high human density increases the level of social interaction, adding to the hedonic value of the service (Pons et al., 2006). Only in such an instance, has human crowding been shown to elicit a positive response in consumers.

Furthermore, Pan and Siemens (2011) reported that there is an inverted U-shaped crowding effect. Such that, store attitude, intention to enter, and intention to browse were highest at a medium level of crowding in comparison to both low and high crowding conditions.

Although, Pan and Siemens' (2011) study expanded the literature on human crowding by comparing three levels of crowding, as opposed to only two levels (Machleit et al., 2000; Eroglu et al., 2005; Rompay et al., 2008) or one level (Pons et al, 2006), they did not specify the exact magnitude for the different levels of crowding manipulation. On their published report, there weren't any photographs or description of the manipulation to demonstrate the differences in the degree of crowding. Given the fact that one of the contributions of their study is the finding that different levels of crowding impact consumers differently, the lack of detail given to crowding manipulation is not constructive for the implementation and replication of the study's results.

Nonetheless, with the inclusion of moderators into the theoretical framework for crowding (Figure 1), it is clear that while there are specific personal and situational factors that could lead consumers to respond positively to a highly dense setting, these are unique cases. Keeping all factors constant, the relationship between high human density and behaviour would be negative.

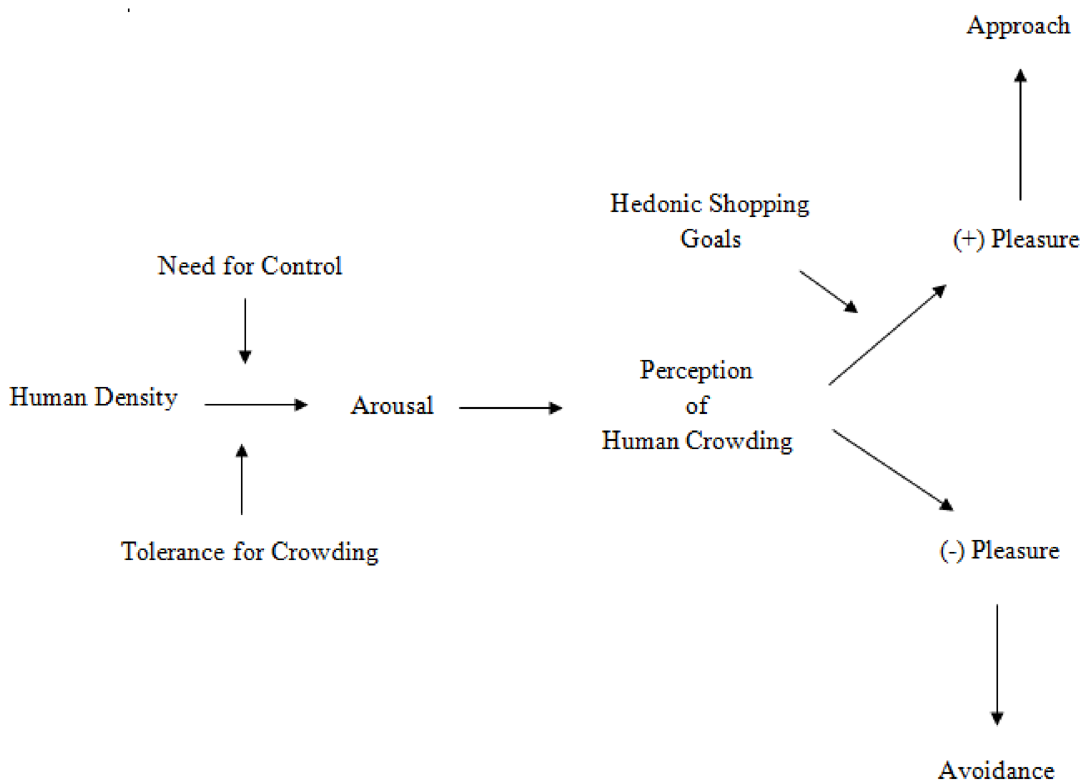


Figure 1. Current Retail Crowding Literature Conceptual Map

A weakness of the current crowding literature lies in the methodology employed. All experimental studies relied on scenarios and photographs (Hui& Bateson. 1991; Pan & Siemens, 2011; Pons et al, 2006; Rompay et al., 2008) or videotapes (Machleit et al., 2000) to manipulate the level of crowding. Although researchers were able to find significant differences using these stimuli to manipulate crowding perceptions, the use of a manipulation using real people seems to be worthwhile in the further exploration of crowding effects. The present study thus induced human crowding by means of a live human density manipulation.

2.2. Retail Atmospheric Factors

Kotler (1973) was the first to coin the term "atmospherics" as the intentional manipulation of environmental factors. Since then, the literature within this stream of research found that consumers are hypersensitive to environmental factors within the retail setting. Even those changes in atmospheric stimuli that are not consciously perceived by the consumers can still influence shoppers' behaviour (Gulas & Schewe, 1994; Turley & Milliman, 2000).

Numerous atmospheric stimuli were investigated by researchers including music (Mattila & Wirtz, 2001; Dube & Morin, 2001; Morin, Dube, & Chebat, 2007; Morrison, Gan, Dublaar & Oppewal, 2011; Spangenberg, Grohmann & Sprott,2005), lighting (Areni & Kim, 1994; Baker, Grewal & Parasuraman, 1994; Baker, Levy, & Grewal, 1992), color (Bellizzi & Hite 1992; Crowley 1993), and store layout (Baker et al., 2002). All of these atmospheric factors was found to affect evaluation (i.e. shopping satisfaction and store image) and a wide range of behavioural responses such as time spent in the store, approach behaviour, sales, and impulse buying.

2.2.1. Research on Ambient Scent

Ambient scent is among one of many atmospheric factor that retailers use to influence consumers' affective and behavioural reactions to a retail setting. As opposed to product-specific scents, ambient scent is defined as "scent that is not emanating from a particular object but is present in the environment" (Spangenberg et al., 1996, p. 67).

Scent marketing is considered to be one of the top ten trends to watch for (Thomaselli, 2006). In addition to retailers, hotels and restaurants are investing in this research area in hope that "distinctive, carefully considered smells will help amply consumer spending, attract customers, and create memorable brands" (Dowdey, 2008, para. 2). As a result, the scent marketing industry was estimated at $200 million in revenue in 2013, and was predicted to grow 10% annually (Elejalde-Ruiz, 2013).

Pleasing ambient scents indeed have been empirically demonstrated to have a positive influence on consumers' affective reaction, store evaluations, and approach behaviour (Bone & Ellen, 1999; Douce & Janssens, 2011; Fiore, Yah, & Yoh, 2000; Mattila & Wirtz, 2001;

Mitchell, Kahn & Knasko, 1995; Morrison et al., 2011; Orth& Bourrain, 2005; Parsons, 2009; Spangenberg et al., 1996; Ward et al., 2007). Ambient scent operates on two levels: presence and pleasantness.

On the first level, simply scenting the environment can lead to affective and behavioural changes in individuals (Morrin & Ratneshwar, 2000; Morrison et al., 2011; Spangenberg et al., 1997). Spangenberg et al. (1996) were among the firsts to examine ambient scent in the context of retailing and consumer behaviour. The study used a 2 (presence: no scent vs. scented) × 3 (scent intensity: low, medium, and high) between-participants design. Ambient scents were diffused at intervals of 15 (low intensity), 30 (medium), and 90 (high) seconds into a 16 × 20 feet room. A simulated store environment was created in a room, with the theme of "one-stop shopping" for students. The simulated store environment included product categories such as kitchen items, room decor items, clothing, school supplies, and outdoor athletic gear. Participants were told that the aim of the study was to gather input on a concept retail store for students. The participants were instructed to examine the "store" at their leisure and to provide feedback on the store and the product range, as well as the estimated duration of their visit. In addition to the participant's assessments, a laboratory assistant observed the participants behind a one-way mirror and recorded the actual duration of the time spent in the simulated store, the number of items the participants examined, and any scent-related comments made during the experiment.

Firstly, compared to the unscented store, participants perceived the scented store as more favourable, good, positive, liked, and modern. Furthermore, product evaluations in general were more positive (i.e., more modern, better selection of, and higher quality products) in the scented than in the unscented condition. Secondly, intent to visit the store was found to be higher among participants from the scented condition than from the unscented condition. The researchers measured intent to visit the store with the item "Assuming you were going to purchase this type of merchandise and had the money, how likely would you to visit this store?", suggesting that the participants were aware of the store and its merchandise. Given this operationalization of intent, this finding should be understood as intention to re-visit the store, as opposed to an explorative intention to visit the store for the first time. Lastly, with regard to time spent in the store, the actual duration between conditions did not differ. However, there was a significant difference in time perception across conditions. Those in the scented condition reported spending less time than the actual time. Given that actual time did no vary across conditions, it is not clear whether ambient spent can extend shopping time. However, Spangenberg et al., (1996) reasoned that ambient scent may be useful in minimizing the perception of waiting time.

On the second level, in addition to presence, the scent needs to also be pleasant. Positive affective and behavioural responses would only be elicited by the presence of a pleasant ambient scent. An unpleasing scent would result in negative responses (Mitchell, Kahn & Knasko 1995; Bone & Ellen, 1999; Fiore et al., 2000; Morrin & Ratneshwar, 2000). Pleasantness of ambient scent also promotes risk taking and variety seeking behaviour in consumers at a wine store (Orth & Bourrain, 2005).

2.2.2. Stimulus-Organism- Response Paradigm

The S-O-R model is the known theoretical basis for explaining the relationship between atmospheric stimuli and approach-avoidance behaviour (Mehrabian & Russell, 1974). Three emotional states nest in-between environmental stimuli and approach or approach: pleasure, arousal and dominance (PAD). The combination of these three emotional states determines how the individual behaves within a particular environment. In the context of retailing, approach and avoidance behaviours encompass levels of examination, time spend in the store, intent to visit the store, social interaction with personnel, and money spent.

In addition to subjective reports of arousal, the effect of scent on arousal has been observed objectively through electroencephalographs (EGG) (Lorig & Schwarts, 1988). On top of the unique arousing properties of each scent, there is a relationship between intensity and arousal, and subsequently on pleasure. The relationship between arousal and pleasure is not linear: as a scent become more intense, the reaction become more negative (Richardson & Zucco, 1989).

Based on the current literature on ambient scent and the S-O-R model, it is apparent that the use of ambient scent influences consumers' affective and behavioural responses. As such, the present study aimed to investigate the extent to which ambient scents could counteract the negative effects of human crowding.

3. DEVELOPMENT OF HYPOTHESES

3.1. Relaxing Scent (Arousal and Movement Restriction)

Past research argues that crowding is a driver of negative emotions which can lead consumers to have unpleasant shopping experience in a crowded retail environment (Hui & Bateson, 1991; Machleit et al., 2000; Rompay et al., 2008). Crowding leads to higher level of arousal and subsequently to a need for activity (Byun & Mann, 2011). However, a crowded environment limits consumers' ability to put their high arousal into action, leading them to feel restricted. Thus, the perception of crowding is elicited when an individual perceives that their personal space is violated (Worchel, 1978) and their movements are restricted, preventing them from distancing themselves from people in the crowd and/or accomplish their shopping task (Byun & Mann, 2011; Eroglu & Harrell, 1986; Machleit et al., 2000).

Based on the literature regarding the negative effects of perceived crowding as well as the effects of ambient scent on consumers' arousal level, it can be reasoned that a relaxing ambient scent has the potential to lower consumers' arousal level under conditions of high human density. Once the heightened arousal state that is reduced, consumers may feel less displeasure in a crowded retail environment.

H1A: In the context of high human crowding, a relaxing ambient scent (versus no scent) will decrease arousal level.

H1B: In the context of high human crowding, a relaxing ambient scent (versus no scent) will increase pleasure level.

H1C: In the context of high human crowding, a relaxing ambient scent (versus no scent) will reduce avoidance behaviour.

3.2. Stimulating Scent (Congruency of Environmental Stimuli)

It is important to acknowledge that the literature on environmental congruency suggests a different mechanism for the use ambient scent to control for crowding. The effect of congruency of environmental stimuli and its positive effects on consumers 'emotional and cognitive responses has been well documented in the ambient scent literature (Bosman, 2006; Douce, Poels, Janssens, & De Backer, 2013; Fiore et al., 2000; Gulas & Bloch, 1995; Mattila & Wirtz, 2001; Mitchell et al., 1995; Morrison et al., 2011; Parsons, 2009; Spangenberg, Grohmann, & Sprott, 2005; Spangenberg, Sprott, Grohmann, & Tracy, 2006).

Mattila and Wirtz (2001) manipulated music tempo (low vs. high vs. no music) and scent (low arousal scent vs. high arousal scent vs. no scent) to induce different levels of arousal. The researchers found that when ambient scent and music are congruent in terms of their arousing properties, consumers rate the environment significantly more positively, engaged in more approach and impulse buying behaviour, and report higher shopping experience satisfaction than when environmental stimuli were incongruent. Spangenberg, Grohmann and Sprott (2005) also reported similar results for scent and music congruency. Spangenberg et al. (2005) conducted an experimental 2 (scent vs. Christmas scent) × 2 (non-Christmas music vs. Christmas music) between-subjects design. They found that consistency in theme positively influenced behavioural intentions to visit the store.

Morrison et al. (2011) reported a similar effect of congruency in their experimental field study. The researchers tested the congruency effect of music (high vs. low volume) and scent (presence vs. absence of a vanilla scent) on young fashion shoppers in a real retail setting. The researchers found that high music volume and the presence of an ambient scent had a significant impact on shoppers' emotions and satisfaction level. The increase in arousal level induced by music and aroma increased pleasure levels, which in turn positively influenced shopper behaviours, including more time and money spent, approach behaviour, and shopping satisfaction.

From these studies, there is evidence to support the efficacy of environmental congruency, or more specifically, arousal congruency. Based on these findings, we hypothesize that in order to produce favourable affective and behavioural responses among consumers who are experiencing high levels of human crowding, ambient scent should be congruent (i.e., have a similar arousing characteristic). In other words, a stimulating ambient scent will increase arousal, and this high arousal will match with the high arousal that is produced by human crowding in the retail environment. This congruency is expected to lead to favourable consumer responses.

H2A: In the context of high human crowding, a stimulating ambient scent (versus no scent) will increase arousal level.

H2B: In the context of high human crowding, a stimulating ambient scent (versus no scent) will increase pleasure level.

H2C: In the context of high human crowding, a stimulating ambient scent (versus no scent) will reduce avoidance behaviour.

3.3. Competition

The competing hypotheses proposed in this research are based on findings documented in the literature. The observation that both stimulating and relaxing ambient scent might have positive effects on consumers suggests that this relationship may be subject to the influence of moderators. A review of the literature suggests that perceived competition might play a role in moderating scent effects.

In a doctoral dissertation, Nichols (2010) argues that a retail situation that creates a sense of competition (i.e., Boxing Day), can impact consumers' emotional and behavioural reactions by playing as a main driver of consumption decisions (as cited in Byun& Mann, 2011, p. 285). Byun and Mann (2011) found empirical evidence to support such an effect of competition. Participants were recruited by way of mall intercept and mail survey methods. Questionnaires were distributed to shoppers of different stores of fashion brands: ZARA and H&M. Perceived human crowding had a significant impact on both negative (anger, irritation, frustration, and annoyance) and positive (happiness, excitement, and thrill) emotions. More specifically, human density generally has a negative impact on consumers affect, however, human density can create positive emotions and induces hedonic shopping values if the human density is perceived in the context of shopping competition.

Similar to competition, product scarcity also plays a moderating role in the relation between retail crowding and consumers' affective reactions. The concept of scarcity within economics refers to "disparity between our wants and production capacities"(Leiss, 1976). Pons, Mourali, and Giroux (2014) reported that product scarcity can reduce negative affect that results from a high degree of human crowding within a retail setting. Ina 2 (scarcity: exclusive sales vs. no sales) x 2 (human density: high vs. low) experimental design, participants answered a questionnaire after reviewing a written scenario and a videotape about a retail setting. Within a utilitarian setting, high density usually results in lower shopping satisfaction, and yet, scarcity reversed this pattern. In a situation of scarcity, high density does not reduce consumers' positive affect as much as in a non-scarcity situation. Participants' affective rating for the high-scarce/high-density condition was above the midpoint of the satisfaction scale. Furthermore, scarcity also influenced perception of crowding: in highly dense situation, participants perceived significantly lower human crowding in the scarce situation than in the non-scarce situation. Pons et al. (2014) reasoned that the knowledge of scarcity serves as a rationale and as a signal for consumers to expect a high level of human density. This explanation fits with the findings of Machleit et al. (2000) that expectation of crowding moderates the impact of crowding on consumers' affective reaction.

Based on the competition study conducted by Byun and Mann (2011) and Pons et al. (2014) study on scarcity, it was hypothesized that the perception of competition will (a) increase arousal, and (b) moderate the positive effect of stimulating ambient scent under the condition of human density. Perception of competition is expected to generate positive high arousing affects, like feelings of excitement, and the use of a stimulating and arousing scent will further enhance these positive emotions. On the other hand, if the consumers do not associate human crowding with competition, they will display the expected negative affective and behavioural responses; in which case, a relaxing scent will be effective at decreasing negative responses.

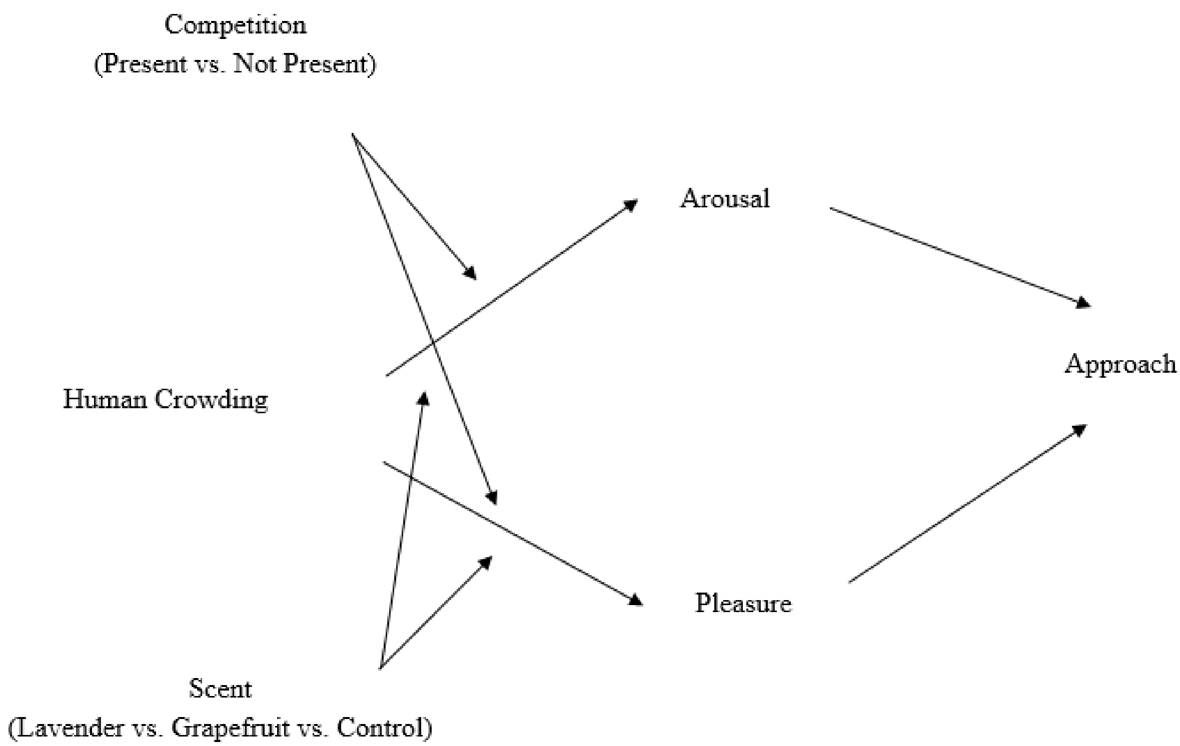
H3: Competition (vs. no competition) will increase arousal level.

H4A: In the context of high human crowding and no competition, a relaxing scent will decrease arousal and increase pleasure and approach behaviour.

H4B: In the context of high human crowding and competition, a stimulating scent will increase arousal, pleasure and approach behaviour.

The conceptual model of the present study can be found on Figure 2.

Figure 2. Present Study Conceptual Model (Moderated Mediation Effect)



4. PRE-TESTS

4.1. Objective

Scent Check. The purpose of this pre-test was to determine the intensity of the scent manipulation.

Across the ambient scent literature, researchers mostly used electric scent diffusers and essential oils for their scent manipulation. However, there are inconsistency in regards to the intensity of the ambient scent that should be used for testing. Morrin and Ratneshwar (2000) did not specify the exact quantity of the essential oils they used, however in their scented condition, detection rate was one-third. In Ward, Davis, and Kooijman (2007) study, detection rate was only 10%. And, Chebat and Michon (2003) simply stated that their scent manipulation reached the perceptual threshold without being perceived as bothersome.

Given that olfactory stimuli follow an inverted U-shape function: if they are too light, they do not elicit arousal, but if they are too strong they are perceived as unpleasant (Richardson &Zucco, 1989; Spangenberg et al., 1996). For the present study, the aim was for the ambient scent to reach the perceptual threshold, while remaining pleasant, and for detection rate to be at least 50%.

Crowding Check. This pre-test was to check that the experimental set up induces high levels of perceived human crowding but not spatial crowding. Past research reported that human and spatial crowding affect individuals differently, and that they may interact to further intensify affective responses (Machleit et al., 2000; Rompay et al., 2008). In order to avoid this confounding effect, it was thus important to ensure that the testing setting does not induce high levels of spatial crowding.

Participants' human and spatial crowding scores were calculated by averaging the responses on four human crowding items (Machleit et al., 1994), on a seven-point Likert scale (7 indicated high crowding). For the main study, expected human crowding score should be significantly above 5, and spatial crowding should be significantly below scale's midpoint (4).

4.1.1. Pre-Test: Series 1

Methodology. Twelve participants (7 women and 5 men, M_{age}= 22.83) were recruited from online ads posted on Kijiji (a classified ad website). Compensation for the participation was a 5 dollars' gift card from Starbucks. Three sessions were conducted: human density of 3 at 12 drops of lavender, human density of 4 at 12 drops of lavender, and human density of 5 at 12 drops of grapefruit. Human density refers to the number of individuals in the testing environment. Essential oils were diffused from an electrical diffuser 30 minutes before each testing session. Spatial density was set up by having four clothing racks standing against the wall, creating a wide open area in the middle. There was a total of 15 clothing items in the room.

Participants were given a "shopping list" with pictures and descriptions of three clothing items to retrieve from a scented, simulated retail environment set up at a lab. They were told that they could take as long as they want to do the retrieval task. Once they were done with the task, they answered a computer-based questionnaire about their experience in the simulation room.

Analysis. Participants' human and spatial crowding scores were calculated by averaging the responses on four human crowding items and four spatial crowding items (Machleit et al., 1994), on a seven-point Likert scale (7 indicated high crowding).

In this initial setup, human crowding perceptions were very low. Even at the highest level of human density, 5 participants per session, the mean human crowding score was only 3.80 (SD= .93) (Table 1). This score was lower than the scale's midpoint. Spatial crowding, on the other hand, was sufficiently low at 3.92 (SD = 1.07). At $t(11) = -.27$ and p-value of .79, mean score of perceived spatial crowding was not significantly different from scale's midpoint.

Rate of scent detection was 25%, which was lower than the initial goal of 50%.

Due to the low perception of human crowding, for the next pre-test, human density was increased. Furthermore, the participants finished the retrieval task within a minute, which may be too short of a duration for the ambient scent to influence arousal level. Changes to the setup and the procedure were thus implemented in a second series of pretests.

Table 1: Pre-Test 1 Result Summary

Human Density	$M_{Human\ Crowding}$	$SD_{Human\ Crowding}$	$M_{Spatial\ Crowding}$	$SD_{Spatial\ Crowding}$
3	3.42	1.04	3.92	1.61
4	2.31	1.25	3.25	.89
5	3.80	.93	4.45	.67

4.1.2. Pre-Test: Series 2

Methodology. Seventeen participants (14 women and 3 men, M_{age}= 25.29) were recruited from Kijiji and various Concordia Facebook groups. Compensation for the participation was a 5 dollars' gift card from Starbucks. There were two sessions: human density of 9 at 12 drops of grapefruit, and human density of 10 12 drops of lavender. One confederate posing as a participant, was hired to increase human density, as well as to verify whether the participants correctly performed the retrieval task.

To make the task more difficult and increase participants' time spent in the simulated lab environment, the following changes were implemented:(1) a new layout for the clothing display (i.e., the clothing racks were put in a zig-zag manner to create a path); (2) an increase in the number of clothing items from 15 to 30, and (3) removal of pictures of the items on the shopping list.

Analysis. Mean perception of human crowding at density of 9 was 4.88 (SD = 1.42) and density of 10 was 5.22 (SD = .80). While the perception of human crowding at density of 9 was below 5, at density of 10, the perception of human crowding was significantly higher than score of 5 ($t(8) = 7.65$, $p = .00$). Mean spatial crowding across the sample was 5.06 (SD =1.11), and it was significantly above scale's midpoint ($t(16) = 3.92$, $p = .00$).

Scent detection rate was 77% for the lavender condition and 38% for the grapefruit condition.

The human crowding manipulation was considered as successful at human density of 10 because it was significantly higher than score of 5. However, spatial crowding was higher than what was planned. In order to lower the perception of spatial crowding, the zig-zag layout was removed and the open middle layout was used in the main study. However due to the low rate of detection, another pre-test was needed to calibrate the scent intensity

4.1.3. Pre-Test: Series 3

Methodology. Twenty-nine undergraduate students (12 women and 17 men, M_{age}= 22.76) participated in this study. The students were recruited through Concordia University MRP System, which is a participant pool resource. Participants received course credits as compensation. There were three sessions: human density of 9 at 16 drops of grapefruit, human density of 9 at 16 drops of grapefruit, and human density of 11 at 10 drops of lavender.

Analysis. Mean perception of human crowding at density of 9 was 5.76 (*SD* = 1.26) and it was significantly higher than 5 ($t(17) = 2.57$, $p = .02$). Density of 11 was 5.59 (*SD* = .80), and it was also significantly higher than 5 ($t(10) = 2.24$, $p = .05$).The mean human crowding scores of the two density conditions were not significantly different ($F(1,29) = .16$, $p = .69$).

Mean spatial crowding across the sample was 5.44 (*SD* = 1.01) and it is significantly higher than scale's mid point ($t(28) = 7.62$, $p = .00$). The result indicated that even with the open middle layout, there was still high perception of spatial crowding. As such, in the main study, in addition to using the open middle layout, perception of spatial crowding would be statically controlled for and treated as a covariate.

The rate of detection was 44% for the grapefruit condition and 46% for the lavender condition. Both of the detection rates were lower than the goal of 50%. As such, another pre-test was set out to further examine the intensity manipulation.

4.1.4. Pre-Test: Series 4

Methodology. Twelve undergraduate students (7 women and 5 men, M_{age}= 22.08) participated in this study. The students were recruited through Concordia University MRP System, which is a participant pool resource. Participants received course credits as compensation. There were three sessions: human density of 2 at 20 drops of grapefruit, human density of 2 at 20 drops of grapefruit, and human density of 8 at 14 drops of lavender.

In order to ensure that the two scents are at the same level of perceived intensity, in addition to the question about detection, two more questions were included: (1) "Do you have a medical condition (i.e. a cold or allergies) that may affect your scent detection?" (YES/NO) and (2) "Please rate the intensity of the ambient scent" (seven-point Likert scale, 1 = too light,4 = Moderate,7= too strong).

Analysis. Two participants were excluded from analysis due to medical conditions. The rate of detection was 100% for grapefruit and 85% for lavender. Among participants who detected the scents, the reported intensity of grapefruit ($M = 4.33$, $SD = 2.08$) and lavender ($M = 4.33$, $SD = 1.36$) were not significantly different ($t(7)= .00$, $p= 1.00$). The scents were not significantly different from scale's midpoint ($t(8) = .67$, $p = .52$).

The results were satisfactory; there were no significantly difference in perceived intensity across the two scents and the perceived scent intensity was rated as moderate.

5. MAIN STUDY

5.1. Participants

A total of 277undergraduate students (139 women and 138 men, M_{age}= 21.32) participated. The students were recruited through Concordia University MRP System, which is a participant pool resource. Participants received course credits as compensation.

5.2. Research Design & Procedure

The study had a 3 (ambient scent: stimulating vs. relaxing vs. control) x 2 (competition: present vs. not-present) between-participants experimental design with random assignment to conditions. Basing on the literature of essential oils and the arousing property scents, lavender was used as a relaxing scent and grapefruit was used as stimulating scent (Butcher, 1998; Gill, 1996; Matilla & Wirtz, 2001).

At the beginning of the sessions, the participants were gathered inside a computer lab and were given a list of three clothing items to retrieve from a simulated retail environment. Once the retrieval task was completed, the participants returned to the computer lab and completed a questionnaire. The measures in the questionnaire are discussed below and could be found on Appendix B. The participants were debriefed by email after all of the study sessions had taken place.

5.2.1. Stimuli

Scent. Grapefruit and lavender essential oils were administered by using an electronic scent diffuser. Basing on the results of the pre-tests, the concentration of the oils were 20 drops of grapefruit and 14 drops of lavender for a 3 by 5-meter room. The diffuser was set to the highest level, and started diffusing 30 minutes before every session, and continued to be on throughout the sessions.

Spatial and Human Density. The testing room was set up with four clothing racks standing against the three walls of the room, creating a wide open area in the middle. In order to close up the open space, a small stand was placed in the middle of it. In total, there were 80 clothing items distributed across the racks. Human density manipulation was between 5 and 12 participants per session. The variation in density was due to differential rates of sign-ups across sessions. Number of participants was recorded and controlled for in the analysis.

Competition. To induce the perception of competition, participants were either told that they could take as long as they wanted to complete the task [Not-Present], or to imagine that there was promotional sale and they needed to compete for the items [Present].

5.2.2. Measures

Due to limited number of computers available during the testing period, two forms of the questionnaire were administered: an online version and a paper-pen version. The online version was administered through Qualtrics, an online platform for survey management. Both versions of the questionnaire were identical and consisted of six parts.

The first section included demographic questions regarding gender and age.

The second section included items on perceived human (e.g., "The room seemed very crowded to me.") and spatial crowding (e.g., "I felt cramped moving around the room."). These items were adapted from Machleit et al.'s Human Spatial Crowding Scale (1994). There were eight items in total, and they were on a seven-point Likert-scale (1 = strongly disagree, 7 = strongly agree).

The third section consisted of six items from Byun and Munn's Perceived Competition Scale (2011) (e.g., "I felt like running a race") and six items from Donovan and Rossiter's Approach- Avoidance Scale (1982). These items were also rated on seven-point Likert scales.

The fourth section is an adapted 16 items version of the Mehrabian and Russell's Pleasure-Arousal- Dominance Scale (1974).

The fifth section was a manipulation check for scent intensity. The participants were asked if they detected the presence of ambient scent during the retrieval task, and whether they had any medical condition that affected their scent detection ability (e.g., a cold). If participants responded that they had detected an ambient scent, they answered an additional question regarding scent intensity (seven-point scale, 1 = too light, 7= too strong).

The final section of the questionnaire had the participant smell the content of two plastic vials and rate their arousal level related to the scents on an eight-item, seven-point Likert scale (e.g., exciting). Each vial contained a cotton ball infused with either grapefruit or lavender essential oils. The aim of this section was to serve as a manipulation check for the arousal properties of the scents that were chosen for the study. An adapted version of Mehrabian and Russell's Pleasure-Arousal- Dominance Scale (1974) was used.

5.3. Data Preparation

5.3.1. Exclusion Criteria

A total of 37 participants were excluded from analysis for incompletion of questionnaire and/or a medical condition that could affect their scent detection sensitivity (*n*= 240).

5.3.2. Perceived Human Crowding

Item 3 ("There wasn't much traffic in the room") was reverse coded to align with the direction of the rest of the items on the scale. A reliability analysis was then conducted on all four items and the resulting Cronbach's alpha was .63. Reliability increased to .77 after the removal of the reversed coded Item 3.

SPSS Base module is limited to only performing exploratory factor analysis (EFA), however a confirmatory factor analysis could be done through SPSS by pre-setting the number of factor loading of the EFA (International Business Machines Corporation [IBM] Support, 2012). As such, a principal component analysis, with Varimax rotation and factor number set at 1 was performed to confirm item loading. Initial Eigenvalues indicate that this factor accounted for 70.39% of total variance. All items had primary factor loadings between .76 and .89. Overall, this analysis confirmed that three of the four items of the initial scale load on one factor (i.e., human crowding).

An averaged human crowding score was thus calculated with Item 1 ("The room seemed very crowded to me"), Item 2 ("The room was busy"), and Item 4 ("There were a lot of people in the room"), for every participant.

5.3.3. Perceived Spatial Crowding

Item 2 ("The room seemed very spacious") and Item 4 ("The room has an open, airy feeling to it") were reverse coded to align them with the direction of the scale. A reliability analysis was then conducted on all items and the resulting Cronbach's alpha was .72. Reliability did not increase with further reduction.

Principal component analysis, with Varimax rotation and factor number set at 1 was performed to confirm items loading. Initial Eigenvalues indicate that this factor accounted for 54.50% of total variance. All items had primary loadings between .67 and .81. Overall, this analysis confirmed that all four items of the initial scale load on one factor (i.e., spatial crowding).

An averaged spatial crowding score was thus calculated with all four items of the scale for every participant.

5.3.4. Perceived Competition

Cronbach's alpha for the scale was .79, and increased to .89with Item 2 ("I felt conscious about other individual's behaviour") removed.

Principal component analysis, with Varimax rotation and factor number set at 1 was performed to confirm the loading of three of the four items. Initial Eigenvalues indicate that this factor accounted for 81.71% of total variance. All items primary factor loadings between .86 and .93. Overall, this analysis confirmed that three of the four items of the initial scale load on one factor (i.e., competition).

An averaged competition score was thus calculated with Item 1 ("I felt competition with other individuals", Item 3 ("I felt like I was competing with other individuals for products"), and Item 4 ("I felt like running a race"), for every participant.

5.3.5. Approach-Avoidance

The scale had a total of six items, three for each factor. A reliability analysis was conducted but the Cronbach's alphas for each factors were too low ($\alpha_{Approach}$= -.03; $\alpha_{Avoidance}$ =.41). Avoidance items were reversed coded to align in the same direction with the Approach items. A second reliability analysis was conducted; the Cronbach's alpha increased but was still too low ($\alpha_{Approach}$ = .33).

Principal component analysis, with Varimax rotation and factor number set at 2 was performed to confirm the loading of the items. Initial Eigenvalues indicate that the first factor accounted for 29.20%, and the second factor for18.76%. Not only were the variances low, the item loadings were not as predicted. Overall, this factor analysis was in accordance with the reliability analysis. Thus, we decided to treat the items individually, and use the reverse code of an avoidance item ("I would avoid returning to the room") as the main item to measure participants' behavioural intent.

5.3.6. Pleasure-Arousal

Initial EFA of the scale separated the items into three factors, as opposed to the intended arousal and pleasure constructs (EFA results could be found on Table 15). As such, the 16 items of the adapted PAD scale (Mehrabian & Russell, 1996) were manually divided into two factors

(Pleasure- Arousal) based on the literature of PAD model (Bradley & Lang, 1994) and the Valence-Arousal model (Russell, 1980).

Two reliability analyses were then conducted to confirm the items loading. The final two components were as follow:

Pleasure: (R) Annoyed, Pleased, Relaxed, Pleasant, (R) Unpleasant, (R) Agitated (Cronbach's alpha = .76)

Arousal: Stimulated, Excited, High Energy, Tensed, Anxious (Cronbach's alpha = .70)

Two principal component analyses, with Varimax rotation and factor number set at 1 was performed to confirm the loading of the items. For the Pleasure items, initial Eigenvalues indicate that this factor accounted for 45.95% of total variance. All items had primary factor loadings between .59 and .80. For the Arousal items, initial Eigenvalues indicate that this factor accounted for 46.59% of total variance, with factor loadings between .60 and .79. The factor analyses correspond to the reliability analysis. For each participant, a calculated average scores for pleasure and arousal was calculated.

The results of all the reliability analyses could be found on Table 2.

Table 2. Questionnaire Reliability Analysis

Construct	Items	Cronbach's Alpha
Human Crowding	The room seemed very crowded to me.	.77
	The room was busy.	
	There were a lot of people in the room.	
Spatial Crowding	The room seemed very spacious.	.72
	I felt cramped moving around the room.	
	The room felt confining (i.e. restricted- trapped).	
	The room had an open, airy feeling to it.	
Perceived Competition	I felt competition with other individuals	.89
	I felt like I was competing with other individuals for products	
	I felt like running a race	
Approach-Avoidance	I like the environment.	.33
	I spent more time than I set out to.	
	I felt friendly with the other individuals in the room.	
	I would avoid returning to the room. ®	
	I avoided the other individuals in the room. ®	
	I avoided exploring the room. ®	
Arousal	Stimulated	.70
	Excited	
	High Energy	
	Tensed	
	Anxious	
Pleasure	Annoyed ®	.76
	Pleased	
	Relaxed	
	Pleasant	
	Unpleasant ®	
	Agitated ®	

6. ANALYSIS AND RESULTS

6.1. Manipulation Check

6.1.1. Scent Intensity

Lavender (*n*= 73) had a detection rate of 60% and grapefruit (*n*= 91) had a detection rate at 53%. An independent-samples t-test was conducted to compare the perceived intensity between the two scent conditions. Among participants who detected the scents, there was a significant difference ($t(90) = 3.49$, $p= .00$) in the perceived intensity between the lavender (M= 5.45, SD= 1.13) and the grapefruit groups (M= 4.58. SD= 1.25).

Given the significant difference in detection intensity, it was important to determine if intensity should be treated as a covariate, in order to control for any confounding effect. An SPSS add-on called PROCESS (Hayes, 2013) was imported. PROCES Model 1 was selected as the testing model because this model allows for the analysis of a basic moderation effect. The independent variable (X) was scent, the dependent variables (Y) were arousal and pleasure, and the moderator (M) was intensity. The analysis was split between the two scent manipulation: lavender/ no-scent and grapefruit/no-scent. This split was done because basing on the literature, the arousing properties of these two scent are in opposite direction (Butcher, 1998; Gill, 1996; Matilla & Wirtz, 2001). As such, in order to clearly examine how scent intensity affects arousal, it was necessary to analyze the two scents separately.

To control for potential confounding effect of competition on arousal level, the analyses were done on participants who were not exposed to the competition manipulation. Perceived human crowding and spatial crowding were treated as covariates.

The regression ran by PROCESS reported significant direct effect of intensity on arousal for the grapefruit/no-scent comparison (b= .11, t= 2.05, p= .04) and a marginal significant interaction effect of scent and intensity for the lavender/no-scent comparison (b= -.10, t= -1.79, p= .08). Intensity did not have a significant direct effect on pleasure for lavender (b= -.03, t= -.59, p= .56) nor for grapefruit (b= -.04, t= -.78, p= .44).

Figure 3 illustrates the effect that intensity has on arousal for lavender and grapefruit. As per the literature on scent and arousal, the two scents were behaving as expected: the lavender scent was less arousing compared to no scent, while the grapefruit scent was more arousing than no scent.

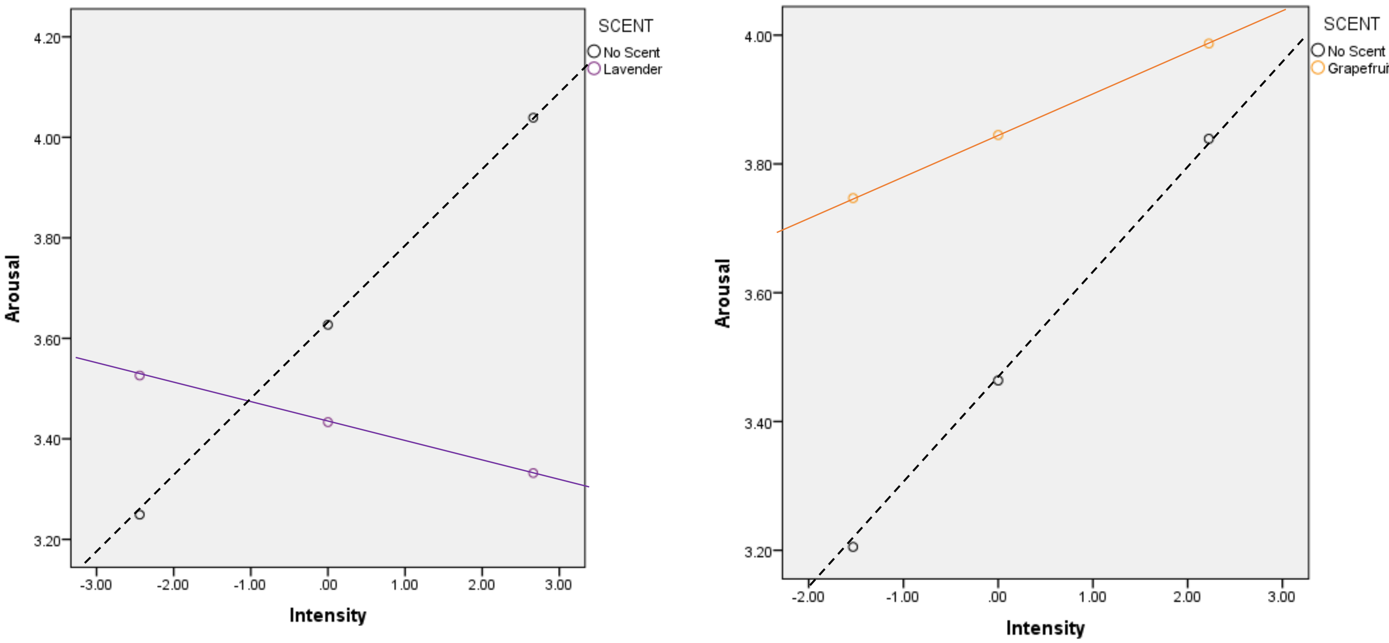


Figure 3. Interaction Effect of Intensity and Scent on Arousal

When intensity was taken into consideration, it appeared that the arousing property of the scents became more prominent. As perceived intensity increases, arousal decreased for those in the lavender condition and arousal increased for those in the grapefruit condition. Basing from the result of PROCESS, intensity had an effect on arousal, and as such, intensity was treated as a covariate in the main analysis.

6.1.2. Human Crowding Check

Two participants, one in the density of 11 and one in the density of 12 condition, were removed from analysis because of they were outliers (*n*= 238). Mean scores for perceived human crowding in the density of 11 group was 6.42 (*SD*=.78) and density of 12 group was 6.36 (*SD*=.69), but these two participants had scores beyond two standards deviation from the mean, at 2.67 and 1.67, respectively. Their reported behaviour was not representative of the bigger sample, as such, they were removed from the main analysis.

The purpose of this check was to ensure that human crowding scores across all the density groups were above 5, and that there are no significant between-group differences. The density manipulation ranged from 5 to 12 participants per session. As per the results of Pre-test 1, it was already reported that density of 5 is not dense enough to elicit the high level of human crowding that is required in this study. As such, all participants in density of 5 group were removed from further analysis (*n*= 233).

An ANOVA analysis was conducted for densities from 7 to 12. The Levene's test was non-significant ($p = .06$), meeting the homogeneity of variance assumption that was required to proceed with an ANOVA analysis. The analysis reported significant between-groups difference($F(5,232) = 2.95$, $p = .01$).

Tukey's post-hoc analysis identified the difference to have originated from the density of 8 group. Participants in the density of 8 group reported significantly lower scores of human crowding compared to those in the density of 11 group (*MD*= 1.17, *SE*= .31, *p*= .00) and density of 12 group (*MD*= -1.07, *SE*=.31, *p*= .00). Given that density of 7 was not significantly different from other groups, the significant differences found for density of 8 may not have been a reflection of manipulation failure. Instead, the difference may have stemmed from small cell size (Table 3). Density of 8 group only has 8 participants, as such, this small cell size may have exaggerated the difference. Furthermore, the removal of these 8 participants would affect cell size for other testing conditions. Therefore, the 8 participants were included in the main analysis.

Table 3. Human Density- Crowding Means Table

Density	Cell Size	*M*	*SD*
7	14	5.79	1.07
8	8	5.29	.86
9	23	5.96	.80
10	60	6.09	.99
11	56	6.46	.72
12	69	6.36	.69

6.1.3. Spatial Crowding

To ensure that the manipulation did not induced high levels of spatial crowding, a one-sample t-test comparing perception of spatial crowding to midpoint of 4 was conducted. The test reported a significant difference ($t(229) = 26.44$, $p = .00$) between the sample's average ($M = 4.95$, $SD = .54$) and the scale's midpoint.

Past research has reported that human and spatial crowding affect individuals differently, such that they could interact to further intensify affective response (Rompay et al., 2008). Given this high level of spatial crowding, in order to control of its confounding effect, spatial crowding was treated as a covariate in the main analysis.

6.1.4. Competition

An independent sample t-test was conducted comparing perception of competition across competition conditions. There was a significant between-group difference ($t(228)= 6.14$, $p= .00$) between the competition present condition ($M= 4.83$, $SD= 1.47$) and the competition no-present condition ($M= 3.56$, $SD= 1.64$). Furthermore, the average score for those in the competition present condition was significantly higher than scale mid-point (4) ($t(116)= 6.09$, $p= .00$).

The competition manipulation was successful.

6.2. Hypothesis Testing

Two hundred and thirty-three participants (120 women and 133 men, $M_{age}= 21.32$) were included in the final analysis.

Given that the hypotheses were formulated to compare specific scents to control, the analysis was between scents (lavender/ no-scent and grapefruit/no-scent) instead of a three-way comparison.

6.2.1. Hypotheses 1A, 1B, 1C

Three ANCOVA models examined the effect of a relaxing scent ($n_{lavender} = 73$; $n_{control}= 69$) on arousal, pleasure, and return intent. Spatial crowding and intensity were treated as covariates. The sample passed the Leven's test of equability of error variances ($F(3, 138) = 1.52$, $p = .21$) and was considered fit for ANCOVA testing. Results of the ANCOVA analysis reported that lavender scent did not have a significant main effect on any of the dependent variables. However, there was a significant interaction effect of scent and competition for intention to return ($F(1, 136)= 4.93$, $p= .03$). Due to the insignificant main effects, hypotheses 1A, 1B, and 1C were not supported.

6.2.2. Hypotheses 2A, 2B, 2C

Three ANCOVA models examined the effects of stimulating scent ($n_{grapefruit} = 91$; $n_{control} = 69$) on arousal, pleasure, and return intent. Spatial crowding and intensity were treated as covariates.

The sample passed the Leven's test of equability of error variances ($F(3, 156)= 1.34$, $p = .26$) and was considered fit for ANCOVA testing. There was a marginally significant main effect of grapefruit scent on arousal level ($F(1,154)= 2.86$, $p= .09$) and a significant interaction effect of scent and competition on intention to return ($F(1, 154)= 5.72$, $p= .02$). The marginally significant main effect on arousal partially supported hypothesis 2A. A summary of the ANCOVA results could be found on Table 4.

Table 4. Scent Main Effect and Interaction Effect ANCOVA Results

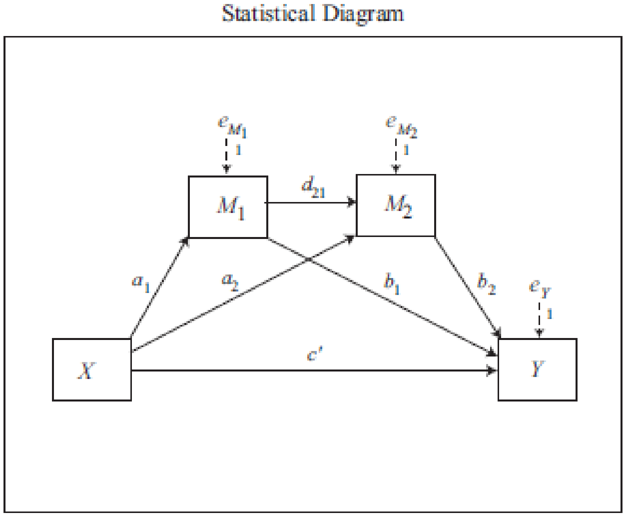
Source	$F_{Arousal}$	$p_{Arousal}$	$F_{Pleasure}$	$p_{Pleasure}$	F_{Return}	p_{Return}
Lavender/No-Scent						
Scent	.36	.55	.04	.84	.11	.74
Competition	10.25	.00**	.31	.58	.01	.91
Interaction	.13	.72	.21	.65	4.93	.03**
Grapefruit/No-Scent						
Scent	2.86	.09*	.47	.49	.47	.49
Competition	4.45	.04**	4.72	.03*	.07	.79
Interaction	.94	.34	1.36	.25	5.72	.02**

*Marginally Significant at α = .10
** Significant at α = .05

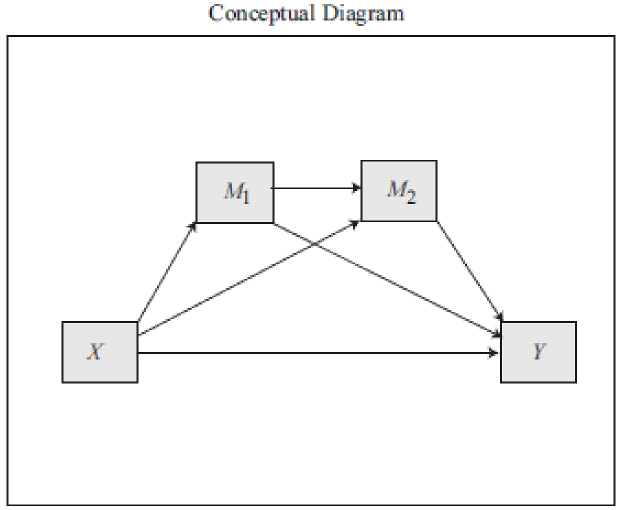
6.2.3. Hypothesis 3

An ANCOVA analysis comparing present (*n* = 120) and not-present (*n* = 113) manipulation of competition, for their effect on arousal was performed. Spatial crowding and intensity were treated as covariates. The sample passed the Leven's test of equability of error variances ($F(1, 231) = .00$, $p = .98$) and was considered fit for ANCOVA testing. At $F(1,233)=$ 9.18 and p-value of .00, the participants in the present group (*M*= 3.97, *SD*= .11) reported significantly higher levels of arousal than those in the not-present group (*M*=3.51, *SD*=.10). The analysis supported hypothesis 3.

Statistical Diagram



Conceptual Diagram



PROCESS Model 6 was ran to further examine the relationship among competition, arousal, pleasure, and intent to return. The independent variable (X) was perception of competition, the dependent variable (Y) was intent to return, and the mediators were (M1) arousal and (M2) pleasure. Intensity and spatial crowding were treated as covariates.

The overall regression mediation model was fitted correctly (R^2= .10, $F(3, 229) = 8.01$, p= .00). The perception of competition significantly increased arousal (b= .31, t= 7.97, p= .00) while decreasing pleasure (b= -.15, t= -3.69, p= .00). And in turn, there was a marginally significant direct effect of competition on intent to return (b= -.15, t= -1.69, p= .09). The indirect effect of competition on intent to return, mediated by arousal and pleasure, showed a trend towards significance (b = -.001, SE = .002, *BootLLCI* = -.01, *BootULCI* = .001).

With this combination of affective response, it can be expected that the heighten arousal and feeling of displeasure interacted to decrease approach behaviour in individuals who perceived high level of competition. The complete result of PROCESS Model 6 could be found on Table 10.

6.2.4. Hypotheses 4A and 4B

Planned comparisons using General Linear Model (GLM) was performed to examine the interaction effect of scent and competition on arousal, pleasure, and intent to return. As an additional analysis to compare the effectiveness of the two testing scents, for this section, a three-way comparison was performed. The results of the pair-wise comparison are presented in the tables below. Spatial crowding and intensity were treated as covariates.

GLM Syntax could be found in Appendix F and a means table for the three-way comparison could be found on Table 11.

(I) Arousal as Dependent Variable

In the not-present competition condition, lavender increased arousal compared to no-scent, however the difference was not significant (MD= .02, SE= .28, p= .94). Grapefruit showed the expected increase in arousal compared to no-scent under the competition present condition, however the increase was also not significant (MD = .21, SE = .26, p = .65). Hypotheses 4A and 4B were not supported with regards to arousal.

An interesting point to note is that although grapefruit did not have a significant main effect on arousal (Section 7.2.1.), pair-wise comparison showed that grapefruit was significantly more arousing than control under the no competition condition (MD = .51, SE = .25, p =.04).

Furthermore, lavender was marginally more relaxing that grapefruit under the no competition condition (*MD* = -.49, *SE* = .26, *p* = .06). Basing on this pattern of arousal, while lavender may not be sufficient to reduce the heighten arousal caused by high human density, it is nonetheless, more relaxing than grapefruit. A summary of the ANCOVA results for arousal could be found on Table 5.

Table 5. Arousal Pair-Wise Comparison ANCOVA Results

Competition manipulation	**(I) Scent manipulation**	**(J) Scent manipulation**	***MD* *(I-J)***	***SE***	***p***
Not Present	Grapefruit	None	.51	.25	.04**
	Lavender	None	.02	.28	.94
	Lavender	Grapefruit	-.49	.26	.06*
Present	Grapefruit	None	.21	.26	.41
	Lavender	None	.12	.27	.65
	Lavender	Grapefruit	-.09	.24	.70

*Marginally Significant at $\alpha = .10$
** Significant at $\alpha = .05$

(II) Pleasure as Dependent Variable

Under the not-present condition, there was no significant difference (*MD*= -.04, *SE*= .27, *p*= .88) between lavender and no-scent on pleasure. There was also no significant difference (*MD*= -.35, *SE*=.25, *p*= .17) in pleasure between the grapefruit and no-scent groups under the present condition. As such, hypotheses 4A and 4B were not supported with regards to pleasure.

However, under the competition present condition, lavender was rated as being significantly more pleasing than grapefruit (*MD* = .51, *SE* = .24, *p* = .03). It is unclear as to why this pleasing effect of lavender was not present in the no competition condition as well, but given the high mean difference and low p-value, it could not be overlooked. The only conclusion that could be stated about this analysis is that when there was high human density and competition, lavender made individuals felt more pleasure than the grapefruit scent did. A summary of the ANCOVA results for pleasure could be found on Table 6.

Table 6. Pleasure Pair-Wise Comparison ANCOVA Results

Competition manipulation	(I) Scent manipulation	(J) Scent manipulation	*MD (I-J)*	*SE*	*p*
Not Present	Grapefruit	None	.07	.25	.77
	Lavender	None	-.04	.27	.88
	Lavender	Grapefruit	-.11	.25	.66
Present	Grapefruit	None	-.35	.25	.17
	Lavender	None	.16	.26	.55
	Lavender	Grapefruit	.51	.24	.03**

*Marginally Significant at α = .10

** Significant at α = .05

(III) Re-Patronage Intention as Dependent Variable

Under the not-present condition, those in the lavender group were more willing than no-scent to return to the testing environment at marginal significance (*MD*=.87, *SE*= .48, *p*=.07). This finding partially supported hypothesis 4A.

On the other hand, when competition was present, those in the grapefruit group were significantly less willing to return than the control condition (*MD*= -.98, *SE*= .45, *p*= .03). Although this interaction was significant, it was in the opposite direction from what was predicted in hypothesis 4B. Although this relationship was in the opposite direction from what was hypothesized, it could be explained upon inspection of the affective responses. It is possible that a stimulating scent did not increase approach behaviour in a competitive setting due to the compounded effect of high arousal and low pleasure. Individuals did not regard competition as pleasurable, and the arousing properties of a stimulating scent and competitive setting may have further increased the feeling of displeasure, resulting in avoidance behaviour. A summary of the ANCOVA results for pleasure could be found on Table 7.

Table 7. Intent to Return Pair-Wise Comparison ANCOVA Results

Competition manipulation	(I) Scent manipulation	(J) Scent manipulation	*MD (I-J)*	*SE*	*p*
Not Present	Grapefruit	None	.49	.44	.26
	Lavender	None	.87	.48	.07*
	Lavender	Grapefruit	.38	.45	.40
Present	Grapefruit	None	-.98	.45	.03**
	Lavender	None	-.63	.46	.18
	Lavender	Grapefruit	.35	.42	.41

*Marginally Significant at $\alpha = .10$
** Significant at $\alpha = .05$

6.3. Summary of Hypothesis Testing

Aside from the marginally significant direct effect of grapefruit on arousal, grapefruit and lavender did not have a significant effect on pleasure and intent to return. However, significant interaction effects of scent and competition on affect and behaviour were found when examining specific pair-wise comparison with ANCOVA.

When there was no competition, participants who were exposed to the lavender scent was marginally more relaxed than those in the grapefruit condition. Those in the lavender group also reported higher intention to return to the testing environment, compared to those in the no-scent group. On the other hand, when there was competition, those in the lavender group reported higher pleasure than those in the grapefruit group. Compared to no-scent, those in the grapefruit group reported significantly lower intention to return when competition was present.

Focusing on competition alone, there was a significant direct effect of competition on both affective and behavioural responses. Across all the scent manipulations, participants who were in the present competition manipulation consistently reported higher arousal and lower pleasure than their no competition counterparts. And in turn, as reported by the PROCESS mediation Model 6, arousal and pleasure interacted to decrease approach behaviour. A summary of the hypothesis testing could be found on Table 8.

Table 8. Summary of Hypothesis Testing

Hypothesis	Supported	Partially Supported	Not Supported
H_{1A}: In the context of high human crowding, a relaxing ambient scent (versus no scent) will decrease arousal.			√
H_{1B}: In the context of high human crowding, a relaxing ambient scent (versus no scent) will increase pleasure.			√
H_{1C}: In the context of high human crowding, a relaxing ambient scent (versus no scent) will reduce avoidance behaviour.			√
H_{2A}: In the context of high human crowding, a stimulating ambient scent (versus no scent) will increase arousal.		√	
H_{2B}: In the context of high human crowding, a stimulating ambient scent (versus no scent) will increase pleasure.			√
H_{2C}: In the context of high human crowding, a stimulating ambient scent (versus no scent) will reduce avoidance behaviour.			√
H_3: Competition (vs. no competition) will increase arousal level.	√		
H_{4A}: In the context of high human crowding and no competition, a relaxing scent will decrease arousal and increase pleasure and approach behaviour.		√	
H_{4B}: In the context of high human crowding and competition, a stimulating scent will increase arousal, pleasure and approach behaviour.			√

6.4. Additional Analysis: Conceptual Model Testing

6.4.1. Mediation Model of Human Density and Human Crowding

In the literature, arousal has been used as the mediator to explain the relationship between high human density and the perception of human crowding (Stokols, 1972; Worcherl & Teddlie, 1976). Such that the perception of human crowding would only be elicit when the individual experienced high arousal. This additional analysis was set out to test for this mediation model, as well as to explore the possibility of pleasure being a potential mediator.

PROCESS Model 4 was selected for this analysis, because it can be used for basic mediation testing. Two PROCESS models were ran: one with arousal as the mediator, and one with pleasure as the mediator. Intensity and spatial crowding were treated as covariates.

The first model with arousal as mediator was insignificant. Density did not have a significant direct effect on arousal (b = .02, SE = .05, t = .47, p= .63), and in turn, arousal also did not have a significant direct effect on human crowding (b = .05, SE = .05, t = .99, p = .32). As such, although there was a significant direct effect of human density on human crowding (b = .14, SE = .04, t = 3.52, p = .00), the mediation effect of arousal was insignificant (b = .001, *BootSE* = .004, *BootLLCI* = -.004, *BootULCI* = .015). The Sobel's Normal Theory test affirmed this non-significant mediation effect (SE = .00, Z = .32, p = .75). The results of the present study did not support the mediation model with arousal that was proposed by the literature.

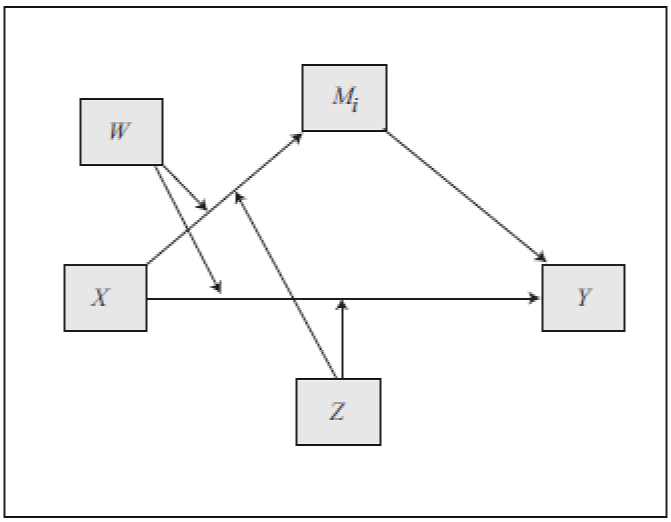
The second model with pleasure as mediator was also insignificant. Human density did not have a significant effect on pleasure (b = .00, SE = .05, t = .15, p = .88), however, pleasure did have a significant effect on the perception of human crowding (b = -.12, SE = .05, t = -2.37, p = .02). There was significant direct effect of human density on human crowding (b = .14, SE = .04, t = 3.62, p = .00), but the mediation effect of pleasure was insignificant (b = -.001, *BootSE* = .006, *BootLLCI* = -.016, *BootULCI* = .010). The Sobel's Normal Theory test affirmed this non-significant mediation effect (SE = .01, Z = -.14, p = .89).

While the mediation model with pleasure was also insignificant, the direct effect of pleasure on human crowding was worth noting. The results suggested that an increase in pleasure could lessen the perception of human crowding, and this is a theoretical implication worth exploring in future studies.

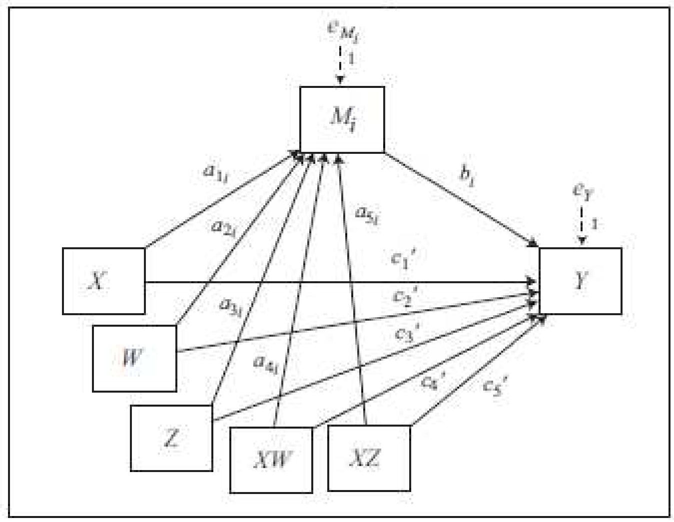
6.4.2. Testing of Moderated Mediation Model (DV: Intention to Return)

As an additional analysis, we wanted to test the moderated mediation relationship that was proposed in the conceptual model. PROCESS Model 10 was selected, and the independent variable (X) was human crowding, the dependent variable (Y) was intent to return, the mediators (M) were arousal and pleasure, and the moderators were(W) scent and (Z) competition. Intensity and social crowding were treated as covariates. Three PROCESS Model 10 analyses were ran: (1) lavender/no-scent, (2) grapefruit/no-scent , and (3) all three scents conditions.

Conceptual Diagram



Statistical Diagram



Scent Manipulation: Lavender/No-scent

The overall moderated mediation model was fitted correctly (R^2= .13, F(9, 132)= 2.26, p= .02).As expected, human crowing had a significant negative direct effect on intention to return (b = -.57, SE = .24, t = -2.34, p = .02). The conditional direct effect of human crowding on intention to return was of marginal significance under the no-scent and no competition condition (b = -.63, SE = .38, t = -1.66, p = .09). This pattern is in accordance with the literature on human crowding (Hui & Bateson, 1991; Rompay et al., 2008; Machleit et al., 2000). However, an interesting finding was that under the no competition condition, lavender had a significant negative moderating effect (b = -.94, SE = .45, t = -2.07, p = .04). This result was contradictory to the pair-wise comparison result (section 7.2.4), where it was reported that compared to no-scent, the lavender group reported significantly higher intention to return. None of the mediation effects were significant. A table for the PROCESS results could be found on Table 12.

Scent Manipulation: Grapefruit/No-Scent

The overall moderated mediation model was fitted correctly (R^2= .14, F(9, 150)= 2.61, p= .01). Human crowding did not have a significant direct on intention to return (b = .02, SE = .18, t = -.11, p = .91). The only significant direct effect on intention to return was from spatial crowding (b = -.92, SE = .29, t = -3.14, p = .00). A table for the PROCESS results could be found on Table 13.

Scent Manipulation: Lavender/Grapefruit/ No-Scent

Due to the previously mentioned contradiction, a third analysis with all three scents was conducted, in hope of attaining a clearer understanding. The overall moderated mediation model was fitted correctly (R^2= .14, F(9, 223)= 4.19, p= .00). Human crowding did not have a significant direct on intention to return (b = -1.01, SE = 1.29, t = -.79, p = .43). The only significant direct effect on intention to return was from spatial crowding (b = -.72, SE = .24, t = -2.96, p = .00). A table for the PROCESS results could be found on Table 14.

Overall, the three PROCESS analyses did not support the moderated mediation conceptual model. Although there were moderation effect of scent and competition for lavender, there was no effect for grapefruit. Furthermore, there was also no mediation effects. The non-significant result for the mediation effects may have stemmed from low detection intensity. As was raised in the Manipulation Check (section 6.1), the detection rate of the two scents were around 50%. Due to cell size limitation, all participants were included in the main analysis, regardless of whether they detected the scent or not. As a consequent, when intensity was treated as a covariate in the main analysis, the level of intensity that was used was only at 1.82. The floodlight analysis in the Manipulation Check identified an effect of intensity on arousal; as intensity increases, the arousing properties of the scents become more prominent.

Pair-wise analysis all identified the effect of scent on arousal to be directionally consistent with the hypotheses. Due to the low perceived intensity level, the arousing and potentially pleasing properties of the scents may not have been strong enough to induce detectable pleasure and arousal variations for model testing.

6.4.3. Testing of Moderated Mediation Model (DV: Friendliness)

Thus far in the study, the only behavioural response that was examined was with intention to return. As such, another behavioural item, friendliness, was explored. The additional analysis included a three-way ANCOVA and a PROCESS Model 10 analyses were performed to test for the effect of scent and competition on perceived friendliness.

Friendliness was measured on a 7-point Likert scale with the item: "I felt friendly with the other individuals in the room". This item was taken from Donovan and Rossiter's Approach and Avoidance scale (1982).

Three-way comparison was done through a GLM syntax (Appendix F). Spatial crowding and intensity were treated as covariates. The Levene's test was non-significant ($F(5, 227)= .45$, $p = .82$), meeting the homogeneity of variance assumption that was required to proceed with an ANCOVA analysis. Scent ($F(2,225)= 3.58$, $p = .03$) and competition ($F(1, 225)$- 8.37, $p = .00$) both had significant main effects on friendliness. Parameter estimates indicated that lavender ($b = .71$, $SE = .33$, $t = 2.8$, $p = .03$) and no competition ($b = .90$, $SE = .32$, $t = 2.82$, $p = .00$) have positive significant effects on friendliness.

Specifically, pair-wise comparison showed that under the no competition condition, those in the lavender group were significant more friendly than those in the no-scent group ($MD = .78$, $SE = .38$, $p = .04$). And in the competition present condition, those in the lavender condition were significantly more friendly than those in the grapefruit group ($MD = .71$, $SE = .33$, $p = .03$).

Means table could be found on Table 17 and pair-wise comparison for friendliness could be found on Table 9.

Table 9. Friendliness Pair-Wise Comparison ANCOVA Results

Competition manipulation	**(I) Scent manipulation**	**(J) Scent manipulation**	***MD* *(I-J)***	***SE***	***p***
Not Present	Grapefruit	None	.44	.34	.20
	Lavender	None	.78	.38	.04**
	Lavender	Grapefruit	.35	.35	.32
Present	Grapefruit	None	-.17	.35	.62
	Lavender	None	.54	.36	.14
	Lavender	Grapefruit	.71	.33	.03**

*Marginally Significant at $\alpha = .10$
** Significant at $\alpha = .05$

PROCESS Model 10 was then ran in order to further examine the internal processing that led to this pattern of behaviour. The independent variable (X) was human crowding, the dependent variable (Y) was friendliness, the mediators (M) were arousal and pleasure, and the moderators were (W) scent and (Z) competition. Intensity and social crowding were treated as covariates.

The overall model was fitted correctly (R^2= 29, *F*(9, 223)= 9.99, *p*= .00). As expected, human crowding (*b* = .32, *SE* = .13, *t* = 2.46, *p* = .01), scent (*b* = .94, *SE* = .45, *t* = 2.07, *p* = .04), and competition (*b* = 1.43, *SE* = .67, *t* = 2.14, *p* = .03) had a significant direct effect on friendliness. Furthermore, there were significant interaction effects between human crowding and scent (*b* = -.15, *SE* = .07, *t* = -1.96, *p* = .05), and between human crowding and competition (*b* = -.28, *SE* = .11, *t* = -2.65, *p* = .01). Pleasure also had a significant direct effect on friendliness (*b* = .60, *SE* = .09, *t* = 6.98, *p* = .00).

The conditional direct effects of human crowding on friendliness were present under conditions of no scent-no competition (*b* = .68, *SE* = .20, *t* = 3.43, *p* = .00), and lavender- no competition (*b* = .50, *SE* = .18, *t* = 2.76, *p* = .00). These moderation effects were mediated through pleasure. Friendliness decrease as a result of pleasure, under conditions of no-scent with competition (*b* = -.21, *BootSE* = .09, *BootLLCI* = -.39, *BootULCI* = -.06), and lavender with competition (*b* = -.16, *BootSE* = .09, *BootLLCI* = -.34, *BootULCI* = -.02).

The results of PROCESS analysis proposed that scent and competition moderate the relationship between human crowding and friendliness, through the pleasure mediator. The presence of competition and a stimulating scent decrease pleasure, and consequently, decrease the perception of friendliness among the participants.

The results of the PROCESS model could be found on Table 17.

7. DISCUSSION

7.1. General Discussion

The literature on retail crowding has pointed to the negative effects that both spatial and human crowding can have on consumers' affective and behavioural responses. Based on the S-O-R model, high spatial and human density leads to an increase in arousal level, resulting in the perception of crowding. Once crowding occurs, this perception elicits feelings of frustration and anger (Byun & Mann, 2011), decrease consumers' shopping satisfaction and prompt avoidance behaviour (Harrell & Hutt, 1976; Hui & Bateson, 1991; Machleit et al., 1994; Machleit et al., 2000; Rompay et al., 2008). The retail literature also noted that ambient scent can have a positive effect on consumers' affective and behavioural responses. The present study sought to investigate the efficacy of ambient scent at mitigating the negative effect of crowding on consumers' affect and behavioural intent.

The results of the present study suggest that scent alone is not enough to influence behaviour, however it could interact with competition to exert influence on behaviour. When there was no competition, those who were exposed to a relaxing scent were more friendly and indicated higher intention to return to crowded environment, compared to those in the no-scent group. On the other hand, when there was competition, those who were exposed to a stimulating scent indicated lower intention to return to the crowded environment, compared to those in the no-scent group. This result was opposite from what was hypothesized, however this reaction could be explained by experienced pleasure. Those in the stimulating scent group reported a trend towards displeasure, compared to their no-scent counterpart. And as per the literature, there is a direct effect of pleasure on approach behaviour (Hui & Bateson, 1991; Rompay et al., 2008; Machleit et al., 2000). Given that the competition-stimulating condition was not pleasing, those exposed to this condition responded with less approach intention.

In particular, competition was shown to have a direct effect on arousal, pleasure, and behavioural intention. Those in the competition condition, reported higher arousal, lower pleasure, and lower intention to return to the setting, compared to those in the no competition condition. Analysis found that the lower behavioural intention was a consequent of the combined effects of high arousal and low pleasure. Competition also had a negative effect on friendliness, and this was because of lower pleasure as well.

7.2. Theoretical Contributions

The present study has three theoretical contributions: (1) the introduction of ambient scent to the literature of human crowding, (2) the utilization of a live manipulation of human density, (3) the proposal of pleasure as predictor of human crowding.

Past research on the topic of retail crowding has mostly look at internal factors of the customer, such as expectation and tolerance for crowding, to understand the relationship between retail crowding and consumer behaviour. With the exception of studies on shopping goals, there have been few studies that aimed to manipulate environmental stimuli to control for the negative consequence of retail crowding. The present study is the first to introduce the use of ambient scent and perception of competition as tools to mitigate the effect of crowding on consumers' shopping experience. Although this research did not find support for many of the hypotheses, there were several interesting findings. Future studies could further explore the relationship among scent, competition, and retail crowding.

The second theoretical contribution of the present study is in the methodology. To our knowledge, since the beginning of the literature of retail crowding dating back to the 1980s, this is the first study to utilize real participants to induce the perception of human crowding. Past laboratory research, on the other hand, had relied on pictures/videos and scenarios as manipulation tools (Hui & Bateson. 1991; Machleit et al., 2000; Pan & Siemens, 2011; Pons et al, 2006; Rompay et al., 2008). The fundamental operationalization of crowding resides in the component of movement restriction. As such, past human crowding manipulations had limited ecological validity.

The final contribution of this research is the proposal of pleasure as a predictor of human crowding. Past literature have pointed to arousal as the mediator between human density and human crowding (Stokols, 1972; Worcherl & Teddlie, 1976). In accordance with the literature, the results showed that there was indeed an effect of high human density on crowding, and consequently, crowding on avoidance behaviour. However, this relationship was not mediated by arousal. In the present study, arousal and pleasure were considered at both stages of the model. Based on the analysis, although the evidence does support pleasure as the mediator between human density and perception of human crowding, pleasure had a direct effect at eliciting perception of human crowding, whereas arousal did not. Such that individuals would only perceived high human crowding in a dense environment when they experience displeasure from the environment. Given that this finding is the first to propose direct effect, future studies should revaluate the reliability of the results.

7.3. Managerial Implications

With the increase in population density and limited land, the human (and spatial) crowding in retail stores will increasingly affect retailers and shoppers. Given the fact that retailers will not be able to directly decrease the natural flow of shopper, or increase the size of their retail location (without incurring high cost), retailers need to find a method to combat the negative affective and behavioural effects that crowding has on consumers.

This research suggests that a relaxing scent is likely a good option to handle retail crowding. A relaxing scent can increase pleasure and prompt approach intention. On the other hand, the perception of competition, such as the presence of promotional sales, can have the potential to be detrimental to shopping satisfaction and approach behaviour. Due to the combination of high arousal and low pleasure, this affective response can lead to avoidance behaviours. If retailers want to utilize promotional sales as a marketing strategy, it would be advisable to increase the hedonic property of the shopping experience.

As a final note regarding managerial implications, there needs to be thematic congruency between the ambient scent and the store's offering (Bosman, 2006; Douce, Poels, Janssens, & De Backer, 2013; Fiore et al., 2000; Gulas & Bloch, 1995; Mitchell et al., 1995; Parsons, 2009). Parsons (2009) found that for stores that are usually odourless, an association between the store brand personality and the ambient scent is important. Presence of a pleasant but non-associated scent can lead to negative affective or behavioural customer responses. For instance, the use of an ambient floral scent in a motorcycle store would not be fitting (Gulas & Bloch, 1995).

7.4. Limitations and Future Research

There were five several limitations to this research. Firstly, even though the simulated retail shopping environment was designed to closely replicate a retail setting (i.e., display shelves), co-shoppers and human crowding, and shopping goal (i.e., utilitarian shopping list), it is important to acknowledge that the creation of a complete retail shopping experience may not have been achieved in the laboratory. Therefore, we expect that the present design may be limited in terms of its external validity. In future studies, it would be advantageous to explore the research question with an experimental field study.

The second limitation was in the measures of the study. A possible reason for the insignificant results may be due to the fact that we did not control for potential moderators of human crowding. In particular, need for control (Hui & Bateson, 1991; Rompay et al., 2008) and hedonic shopping goals (Eroglu et al., 2005; Pons et al., 2006). The participants did not have a choice over their engagement with the shopping environment. This lack of control may have had potentially contributed to some of the displeasure that the participants felt. Additionally, although the use of a shopping list was intended to simulate a utilitarian shopping goal, the study design could be considered to be entertaining for undergraduate students, who are usually more accustomed to simple questionnaire experiment studies. As such, regardless of our utilitarian set-up, the participants may have had a hedonic shopping goal when they were under testing. Although, we are uncertain the exact manner with which these moderators may have had influenced the results; in future studies, it would still be advisable to measure and then control for them statistically, so that result interpretation could be done with more certainty and clarity.

The third limitation of the present study was the scent intensity manipulation. Even through multiple pre-tests, it was still difficult to control for (1) high scent detection and (2) equal perceived intensity across scent manipulations. Nonetheless, we did control for this limitation by setting intensity as a covariate in analysis. In future studies, more extensive pre-tests should be done in order to ensure high detection rate and equal perceived scent intensity.

On a related note of scent manipulation, the third limitation lay in the limited selection of scents that we tested in our study. Due to the importance of congruency between scent personality and store personality that was noted by Bosman (2006) and Parsons (2009), the small number of scents that we tested limits the expanse of managerial application of our results. Not all stores are suited to have a lavender ambient scent.

The final limitation was in the manipulation of the retrieval shopping task. The average duration that it took the participants to complete the task was within 2 minutes. Although it was likely that the arousing and pleasing properties of the scents took effect immediately, it would have been more informative to examine if there was a time effect on the scent. For example, had participants been exposed to the scent for a longer period, would they have displayed more positive affective and behavioural responses? Or, would the effect fade away over time? Furthermore, had the duration of time spent in the simulation room been longer, more behavioural responses could have been observed, particularly, with regard to shopping time and time perceptions. Purchase intention would also be an additional behavioural variable to examine. Due to limited resources, the current manipulation had only 80 clothing items in the simulation room. In future studies, the number of clothing items displayed could be higher, in order to increase the difficulty of the retrial task, and subsequently, prolong the time spent in the simulation room.

Fourth, it is important to acknowledge that this research examined the interaction of scent and competition under high levels of human density only. To complement the current design, future studies should include a low density condition to explore potential three-way interactions regarding human density, competition, and ambient scent. At the very least, low density conditions could provide as useful baseline in determining the level of efficacy of ambient scent as a means to manage consumers' arousal and pleasure under varying conditions of competition.

Finally, the sample size of the present study was limited. In the present study, cell sizes per testing condition were all above of 30, the quatity required for ANOVA testing at 80% power (VanVoorhis & Mogan, 2007). Nonetheless, future studies should replicate the present study on a bigger sample.

While the present study is among the first of its kind and even with its limitation, the findings are nonetheless suggestive of the use of ambient scent in controlling for retail crowding. As such, this is a promising start to a bridge between the ambient scent and retail crowding lines of research.

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APPENDIX A: SCENT USED

Brand	Scent
Lotus Aroma (100% essential oils)	Grapefruit Lavender

APPENDIX B: QUESTIONNAIRE

Questionnaire: Store Environment and Customer Shopping Experience

Q1 Testing ID number (the number is on the right hand corner of your consent form)

____

Q2Gender

- ❍ Male
- ❍ Female

Q3Age

____

Q4 Please rate your responses according to your experience while completing the retrieval task in the stimulated store.

	Strongly Disagree 1	2	3	Neutral 4	5	6	Strongly Agree 7
The room seemed very crowded to me.							
The room was busy.							
There wasn't much traffic in the room.							
There were a lot of people in the room.							
The room seemed very spacious.							
I felt cramped moving around the room.							
The room felt confining (i.e. restricted- trapped).							
The room had an open, airy feeling to it.							

Q5 Please rate your responses according to your experience while completing the retrieval task in the stimulated store.

	Strongly Disagree 1	2	3	Neutral 4	5	6	Strongly Agree 7
I felt competition with other individuals.							
I was conscious about other individuals' behavior.							
I felt like I was competing with other individuals for products.							
I felt like running a race.							
I like the environment.							
I would avoid returning to the room.							
I felt friendly with the other individuals in the room.							
I avoided the other individuals in the room.							
I spent more time than I set out to.							
I avoided exploring the room.							

Q6 Please rate your responses according to your experience while completing the retrieval task in the stimulated store.

	Not At All 1	2	3	Moderately 4	5	6	Extremely 7
High Energy							
Pleased							
Tensed							
Anxious							
Pleasant							
Excited							
Stimulated							
Friendly							
Tired							
Annoyed							
Patient							
Relaxed							
Agitated							
Unpleasant							
Calm							
Bored							

Q7 Did you detect any ambient scent in the stimulated store?

- ❍ Yes
- ❍ No

Q8How would you rate the intensity of the ambient scent in the stimulated store? Circle the intensity level.

Note: Skip this question if you've answered "No" to the previous question.

➔ *Researcher's note: For the online version, there was a skip logic for Question 8. In order to avoid prompting answers, Question 8 only appeared for participants who indicated "Yes" to Question 7.)*

Too Light			Moderate			Too Strong
1	2	3	4	5	6	7

Q9 Do you have any medical condition (i.e. a cold or allergy) that could affect your ability to detect scent?

- Yes
- No

Q10There are two containers on the desk, marked #1 and #2. Inside the containers are cotton balls that have been infused with essential oils.
Indicate how you feel about the scent in **container #1.**

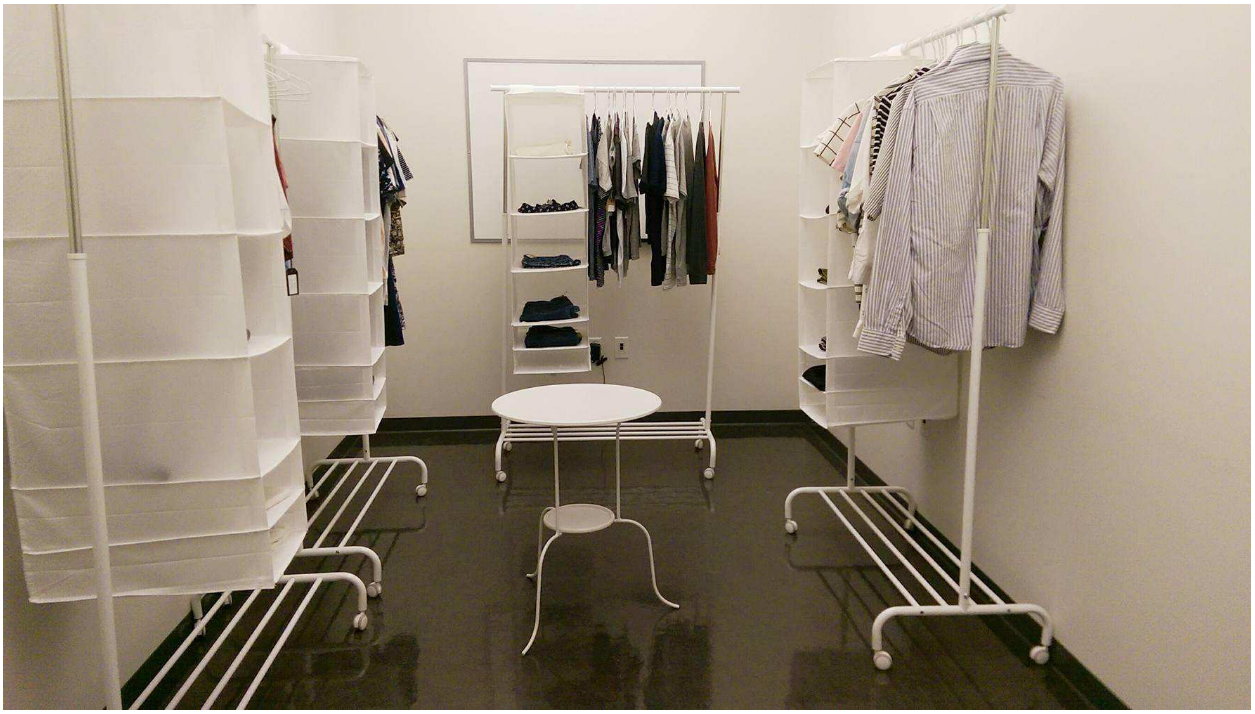
	Strongly Disagree			Neutral			Strongly Agree
	1	2	3	4	5	6	7
Exciting							
Soothing							
Stimulating							
Calming							
Relaxing							
Refreshing							
Pleasant							
Familiar							

Indicate how you feel about the scent in **container # 2**.

	Strongly Disagree 1	2	3	Neutral 4	5	6	Strongly Agree 7
Exciting							
Soothing							
Stimulating							
Calming							
Relaxing							
Refreshing							
Pleasant							
Familiar							

You have reached the end of the survey. Thank you for your participation!
Please raise your hand to indicate to the researcher that you are done.

APPENDIX C: TESTING SET-UP



APPENDIX D: RETRIEVAL TASK SHOPPING LIST

Retrieval Task

Instructions: Please find and collect the following clothing items. Once all three items are found, bring them back to the computer lab. You may end the study at any time you wish.

Item 1
Brand: Forever 21
Description: long sleeves high-neck top
Color: white with black strips
Size: M
Price: $27.99

Item 2
Brand: Gap
Description: long sleeves button-up
Color: white with blue stripes
Size: M
Price: $29.99

Item 3
Brand: The Blues
Description: jeans
Color: red
Size: 30
Price: $20.00

APPENDIX E: PROCEDURAL SCRIPT

This is your consent form, please read it carefully and signed it before we start this session.
Give consent form
Retrieve consent form and give participant a list of items
Hello, my name is Trang Trinh, thank you for coming today. I am a Master's student here at JMSB, and this study was designed with Professor Bianca Grohmann. There is two parts to this study, a retrieval task and a short questionnaire.
I have designed the lab next door to be exactly like a clothing store and today, I want you to go shopping for me. The list I have given you is your shopping list. You are to find these three items and bring them back here. Afterwards, you will complete a short questionnaire about your shopping experience.
While you are shopping…
Competition manipulation
…I want you to imagine that there is a big sale. You will be competing others for the items, so you need to get to the items are quickly as possible.
[OR]
...you can take as long as you want, this is not a competition.
Do you have any questions? Great.
Lead participant to the laboratory

Collect items and lead the participant to a computer
Great! The questionnaire for the study is loaded onto the computer. Please read the questions carefully and try the best of your ability to answer them. Do you have any questions? Please notify me once you are finished.
End the questionnaire
Thank you for your participation.

APPENDIX F: GLM SYNTAX

```
glm RAV_1 BY COMP SCENT with AVG_SC Intensity
 /emmeans = tables(COMP*SCENT)compare(SCENT).

glm AVG_AR BY COMP SCENT with AVG_SC Intensity
 /emmeans = tables(COMP*SCENT)compare(SCENT).

glm AVG_PL BY COMP SCENT with AVG_SC Intensity
 /emmeans = tables(COMP*SCENT)compare(SCENT).
```

Table 10: PROCESS Model 6 Competition Mediation

```
Model = 6
    Y = RAV_1
    X = AVG_COM
   M1 = AVG_PL
   M2 = AVG_AR

Statistical Controls:
CONTROL= AVG_SC   INTENSIT

Sample size
        233

**************************************************************************
Outcome: AVG_PL

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3633      .1320     1.1183    11.6065     3.0000   229.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     7.1304      .6346    11.2365      .0000     5.8800     8.3807
AVG_COM      -.1519      .0411    -3.6954      .0003     -.2329     -.0709
AVG_SC       -.5486      .1215    -4.5168      .0000     -.7879     -.3093
INTENSIT     -.0315      .0269    -1.1725      .2422     -.0845      .0215

**************************************************************************
Outcome: AVG_AR

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .5078      .2579      .9572    19.8054     4.0000   228.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     3.2024      .7313     4.3794      .0000     1.7615     4.6433
AVG_PL       -.0797      .0611    -1.3032      .1938     -.2001      .0408
AVG_COM       .3119      .0392     7.9655      .0000      .2347      .3890
AVG_SC       -.1146      .1173     -.9771      .3296     -.3456      .1165
INTENSIT      .0402      .0250     1.6097      .1088     -.0090      .0894

**************************************************************************
Outcome: RAV_1

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3253      .1058     3.6855     5.3725     5.0000   227.0000      .0001

Model
              coeff         se          t          p       LLCI       ULCI
constant     7.4127     1.4940     4.9617      .0000     4.4689    10.3566
AVG_PL        .1822      .1204     1.5130      .1317     -.0551      .4194
AVG_AR       -.0702      .1299     -.5405      .5894     -.3263      .1858
AVG_COM      -.1467      .0869    -1.6892      .0926     -.3179      .0244
AVG_SC       -.8100      .2306    -3.5130      .0005    -1.2644     -.3557
```

```
INTENSIT     -.0332      .0492     -.6743      .5008     -.1303      .0638

******************** DIRECT AND INDIRECT EFFECTS *************************

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
     -.1467      .0869    -1.6892      .0926     -.3179      .0244

Indirect effect(s) of X on Y
           Effect    Boot SE   BootLLCI   BootULCI
Total:     -.0504      .0499     -.1529      .0422
Ind1 :     -.0277      .0233     -.0856      .0075
Ind2 :     -.0009      .0023     -.0097      .0015
Ind3 :     -.0219      .0449     -.1152      .0608

Indirect effect key
 Ind1 :   AVG_COM  ->       AVG_PL   ->       RAV_1
 Ind2 :   AVG_COM  ->       AVG_PL   ->       AVG_AR   ->       RAV_1
 Ind3 :   AVG_COM  ->       AVG_AR   ->       RAV_1
```

Table 11: Means Table

Competition	Manipulation	*M*	*SD*	*n*
Arousal				
Not Present	None	3.26	1.24	34
	Lavender	3.39	1.03	34
	Grapefruit	3.80	0.99	45
Present	None	3.77	0.87	35
	Lavender	4.00	1.15	39
	Grapefruit	4.09	1.23	46
Pleasure				
Not Present	None	3.82	1.18	34
	Lavender	3.72	1.06	34
	Grapefruit	3.93	1.08	45
Present	None	3.67	0.94	35
	Lavender	3.88	1.19	39
	Grapefruit	3.30	1.21	46
Intention toReturn				
Not Present	None	2.76	1.94	34
	Lavender	3.56	2.36	34
	Grapefruit	3.33	1.89	45
Present	None	3.60	1.88	35
	Lavender	3.08	2.08	39
	Grapefruit	2.61	1.83	46

Table 12: PROCESS Model 10 (Lavender/No-Scent)

```
Model = 10
    Y = RAV_1
    X = AVG_HC
   M1 = AVG_PL
   M2 = AVG_AR
    W = SCENT
    Z = COMP

Statistical Controls:
CONTROL= AVG_SC   INTENSIT

Sample size
        142

**************************************************************************
Outcome: AVG_PL

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4376      .1915     1.0096     4.5339     7.0000   134.0000      .0001

Model
              coeff         se          t          p       LLCI       ULCI
constant     6.7371      .8666     7.7740      .0000     5.0231     8.4512
AVG_HC       -.2375      .1194    -1.9899      .0486     -.4736     -.0014
SCENT         .0805      .0967      .8333      .4062     -.1106      .2717
int_1        -.0100      .1054     -.0949      .9246     -.2184      .1984
COMP         -.0800      .0870     -.9193      .3596     -.2521      .0921
int_2        -.1726      .1070    -1.6138      .1089     -.3842      .0389
AVG_SC       -.5904      .1746    -3.3816      .0009     -.9357     -.2451
INTENSIT     -.0321      .0364     -.8811      .3799     -.1042      .0400

Product terms key:

 int_1    AVG_HC      X     SCENT
 int_2    AVG_HC      X     COMP

**************************************************************************
Outcome: AVG_AR

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3322      .1103     1.1616     2.3738     7.0000   134.0000      .0256

Model
              coeff         se          t          p       LLCI       ULCI
constant     3.5507      .9295     3.8199      .0002     1.7123     5.3892
AVG_HC        .2362      .1280     1.8447      .0673     -.0170      .4894
SCENT         .0409      .1037      .3943      .6940     -.1642      .2459
int_1         .1547      .1130     1.3689      .1733     -.0688      .3783
COMP          .3222      .0933     3.4517      .0007      .1376      .5068
int_2        -.1094      .1147     -.9538      .3419     -.3363      .1175
AVG_SC       -.0024      .1873     -.0130      .9897     -.3728      .3680
INTENSIT      .0166      .0391      .4245      .6719     -.0607      .0939
```

Product terms key:

int_1	AVG_HC	X	SCENT
int_2	AVG_HC	X	COMP

****
Outcome: RAV_1

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3654	.1335	4.0065	2.2606	9.0000	132.0000	.0219

Model

	coeff	se	t	p	LLCI	ULCI
constant	4.4380	2.2343	1.9863	.0491	.0183	8.8577
AVG_PL	.2892	.1756	1.6467	.1020	-.0582	.6366
AVG_AR	-.1019	.1637	-.6221	.5349	-.4257	.2220
AVG_HC	-.5701	.2431	-2.3446	.0205	-1.0511	-.0891
SCENT	.1178	.1933	.6096	.5432	-.2645	.5001
int_3	-.1556	.2114	-.7363	.4629	-.5738	.2625
COMP	-.0154	.1809	-.0852	.9322	-.3733	.3425
int_4	.2133	.2165	.9854	.3263	-.2149	.6415
AVG_SC	-.3739	.3630	-1.0302	.3048	-1.0919	.3440
INTENSIT	-.0018	.0728	-.0246	.9804	-.1458	.1422

Product terms key:

int_3	AVG_HC	X	SCENT
int_4	AVG_HC	X	COMP

******************** DIRECT AND INDIRECT EFFECTS ************************

Conditional direct effect(s) of X on Y at values of the moderator(s):

SCENT	COMP	Effect	SE	t	p	LLCI	ULCI
-1.0282	-1.0423	-.6324	.3813	-1.6583	.0996	-1.3867	.1219
-1.0282	.9577	-.2058	.3181	-.6469	.5188	-.8350	.4235
.9718	-1.0423	-.9437	.4547	-2.0754	.0399	-1.8431	-.0443
.9718	.9577	-.5171	.3873	-1.3349	.1842	-1.2833	.2491

Conditional indirect effect(s) of X on Y at values of the moderator(s):

Mediator

	SCENT	COMP	Effect	Boot SE	BootLLCI	BootULCI
AVG_PL	-1.0282	-1.0423	-.0137	.0693	-.1815	.1044
AVG_PL	-1.0282	.9577	-.1135	.0841	-.3335	.0097
AVG_PL	.9718	-1.0423	-.0195	.0768	-.2520	.0888
AVG_PL	.9718	.9577	-.1193	.0999	-.3949	.0143

Mediator

	SCENT	COMP	Effect	Boot SE	BootLLCI	BootULCI
AVG_AR	-1.0282	-1.0423	-.0195	.0538	-.2178	.0373
AVG_AR	-1.0282	.9577	.0028	.0262	-.0344	.0812

```
AVG_AR      .9718    -1.0423     -.0510      .0917     -.3171      .0796
AVG_AR      .9718      .9577     -.0287      .0632     -.2450      .0453

Values for quantitative moderators are the mean and plus/minus one SD from
mean.
Values for dichotomous moderators are the two values of the moderator.

***************** INDEX OF PARTIAL MODERATED MEDIATION ******************

Moderator:
 SCENT

Mediator
            Index   SE(Boot)   BootLLCI   BootULCI
AVG_PL     -.0058      .0710     -.2002      .1129
AVG_AR     -.0315      .0667     -.2481      .0522

Moderator:
 COMP

Mediator
            Index   SE(Boot)   BootLLCI   BootULCI
AVG_PL     -.0998      .1016     -.4101      .0212
AVG_AR      .0223      .0557     -.0357      .2286

When the moderator is dichotomous, this is a test of equality of the
conditional indirect effects in the two groups.
```

Table 13: PROCESS Model 10 (Grapefruit/ No-Scent)

```
Model = 10
    Y = RAV_1
    X = AVG_HC
   M1 = AVG_PL
   M2 = AVG_AR
    W = SCENT
    Z = COMP

Statistical Controls:
CONTROL= INTENSIT AVG_SC

Sample size
        160
```

****
Outcome: AVG_PL

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3779	.1428	1.1470	3.6178	7.0000	152.0000	.0012

Model

	coeff	se	t	p	LLCI	ULCI
constant	5.1014	.8305	6.1427	.0000	3.4606	6.7422
AVG_HC	-.2508	.1006	-2.4939	.0137	-.4496	-.0521
SCENT	-.0395	.0901	-.4383	.6618	-.2176	.1386
int_1	.0943	.0877	1.0762	.2835	-.0789	.2675
COMP	-.2534	.0878	-2.8847	.0045	-.4270	-.0799
int_2	-.0371	.0950	-.3903	.6968	-.2247	.1505
INTENSIT	-.0421	.0386	-1.0929	.2762	-.1183	.0340
AVG_SC	-.2756	.1663	-1.6570	.0996	-.6042	.0530

Product terms key:

```
 int_1    AVG_HC      X     SCENT
 int_2    AVG_HC      X     COMP
```

****
Outcome: AVG_AR

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3243	.1052	1.1862	2.5527	7.0000	152.0000	.0163

Model

	coeff	se	t	p	LLCI	ULCI
constant	5.1575	.8446	6.1066	.0000	3.4889	6.8261
AVG_HC	.1220	.1023	1.1928	.2348	-.0801	.3241
SCENT	.1495	.0917	1.6304	.1051	-.0317	.3306
int_1	.0369	.0892	.4139	.6795	-.1392	.2130
COMP	.1981	.0893	2.2172	.0281	.0216	.3746
int_2	-.0035	.0966	-.0365	.9709	-.1943	.1873
INTENSIT	.0687	.0392	1.7530	.0816	-.0087	.1462
AVG_SC	-.3077	.1691	-1.8195	.0708	-.6419	.0264

Product terms key:

int_1	AVG_HC	X	SCENT
int_2	AVG_HC	X	COMP

****
Outcome: RAV_1

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3678	.1353	3.3399	2.6078	9.0000	150.0000	.0080

Model

	coeff	se	t	p	LLCI	ULCI
constant	7.0803	1.7890	3.9576	.0001	3.5454	10.6153
AVG_PL	.1824	.1404	1.2991	.1959	-.0950	.4599
AVG_AR	-.0119	.1381	-.0859	.9316	-.2847	.2610
AVG_HC	-.0195	.1755	-.1109	.9119	-.3661	.3272
SCENT	-.0697	.1552	-.4491	.6540	-.3763	.2369
int_3	.2088	.1503	1.3891	.1669	-.0882	.5059
COMP	.0308	.1554	.1982	.8432	-.2763	.3379
int_4	-.1551	.1621	-.9566	.3403	-.4755	.1653
INTENSIT	-.0917	.0666	-1.3777	.1704	-.2233	.0398
AVG_SC	-.9118	.2905	-3.1385	.0020	-1.4858	-.3378

Product terms key:

int_3	AVG_HC	X	SCENT
int_4	AVG_HC	X	COMP

******************* DIRECT AND INDIRECT EFFECTS ************************

Conditional direct effect(s) of X on Y at values of the moderator(s):

SCENT	COMP	Effect	SE	t	p	LLCI	ULCI
-1.1375	-1.0125	-.1000	.3192	-.3132	.7546	-.7306	.5307
-1.1375	.9875	-.4102	.2785	-1.4730	.1428	-.9604	.1400
.8625	-1.0125	.3177	.3146	1.0100	.3141	-.3039	.9393
.8625	.9875	.0075	.2111	.0356	.9717	-.4096	.4246

Conditional indirect effect(s) of X on Y at values of the moderator(s):

Mediator

	SCENT	COMP	Effect	Boot SE	BootLLCI	BootULCI
AVG_PL	-1.1375	-1.0125	-.0585	.0617	-.2494	.0235
AVG_PL	-1.1375	.9875	-.0720	.0720	-.2428	.0431
AVG_PL	.8625	-1.0125	-.0241	.0521	-.1819	.0456
AVG_PL	.8625	.9875	-.0376	.0662	-.2351	.0270

Mediator

	SCENT	COMP	Effect	Boot SE	BootLLCI	BootULCI
AVG_AR	-1.1375	-1.0125	-.0010	.0350	-.0918	.0635
AVG_AR	-1.1375	.9875	-.0009	.0253	-.0690	.0438

AVG_AR	.8625	-1.0125	-.0019	.0371	-.0995	.0618
AVG_AR	.8625	.9875	-.0018	.0344	-.0958	.0566

Values for quantitative moderators are the mean and plus/minus one SD from mean.
Values for dichotomous moderators are the two values of the moderator.

***************** INDEX OF PARTIAL MODERATED MEDIATION *******************

Moderator:
SCENT

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_PL	.0344	.0553	-.0295	.2320
AVG_AR	-.0009	.0323	-.0861	.0559

Moderator:
COMP

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_PL	-.0135	.0593	-.1867	.0610
AVG_AR	.0001	.0330	-.0729	.0709

When the moderator is dichotomous, this is a test of equality of the conditional indirect effects in the two groups.

Table 14: PROCESS Model 10 (Lavender/Grapefruit/ No-Scent)

Model = 10
Y = RAV_1
X = AVG_HC
M1 = AVG_PL
M2 = AVG_AR
W = SCENT
Z = DENSITY

Statistical Controls:
CONTROL= INTENSIT AVG_SC

Sample size
233

****
Outcome: AVG_PL

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3397	.1154	1.1599	4.1928	7.0000	225.0000	.0002

Model

	coeff	se	t	p	LLCI	ULCI
constant	3.2136	4.6176	.6960	.4872	-5.8856	12.3129
AVG_HC	.2733	.7298	.3744	.7085	-1.1649	1.7114
SCENT	-.7626	.5023	-1.5182	.1304	-1.7525	.2272
int_1	.1081	.0792	1.3639	.1740	-.0481	.2643
DENSITY	.4483	.4731	.9475	.3444	-.4840	1.3807
int_2	-.0570	.0756	-.7544	.4514	-.2060	.0919
INTENSIT	-.0260	.0284	-.9173	.3600	-.0819	.0299
AVG_SC	-.4166	.1352	-3.0812	.0023	-.6830	-.1502

Product terms key:

int_1	AVG_HC	X	SCENT
int_2	AVG_HC	X	DENSITY

****
Outcome: AVG_AR

Model Summary

R	R-sq	MSE	F	df1	df2	p
.2047	.0419	1.2523	1.4053	7.0000	225.0000	.2041

Model

	coeff	se	t	p	LLCI	ULCI
constant	2.8116	4.7979	.5860	.5585	-6.6429	12.2662
AVG_HC	.3460	.7583	.4563	.6486	-1.1483	1.8404
SCENT	-.0583	.5219	-.1117	.9112	-1.0868	.9702
int_1	.0356	.0823	.4327	.6656	-.1266	.1979
DENSITY	.0941	.4916	.1914	.8484	-.8747	1.0628
int_2	-.0269	.0785	-.3425	.7323	-.1817	.1279
INTENSIT	.0366	.0295	1.2431	.2151	-.0214	.0947
AVG_SC	-.1320	.1405	-.9397	.3484	-.4088	.1448

```
Product terms key:

 int_1    AVG_HC      X     SCENT
 int_2    AVG_HC      X     DENSITY

**************************************************************************
Outcome: RAV_1

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3803      .1446     3.5889     4.1886     9.0000   223.0000      .0001

Model
              coeff         se          t          p       LLCI       ULCI
constant     9.2860     8.1404     1.1407      .2552    -6.7560    25.3279
AVG_PL        .1589      .1191     1.3335      .1837     -.0759      .3936
AVG_AR       -.1466      .1147    -1.2789      .2023     -.3726      .0793
AVG_HC      -1.0120     1.2850     -.7876      .4318    -3.5443     1.5203
SCENT       -1.1124      .8884    -1.2522      .2118    -2.8632      .6383
int_3         .1369      .1401      .9771      .3296     -.1392      .4130
DENSITY       .0034      .8341      .0040      .9968    -1.6404     1.6472
int_4         .0592      .1332      .4445      .6571     -.2033      .3217
INTENSIT     -.0250      .0501     -.4987      .6185     -.1238      .0738
AVG_SC       -.7242      .2440    -2.9685      .0033    -1.2049     -.2434

Product terms key:

 int_3    AVG_HC      X     SCENT
 int_4    AVG_HC      X     DENSITY

******************** DIRECT AND INDIRECT EFFECTS ************************

Conditional direct effect(s) of X on Y at values of the moderator(s):
      SCENT    DENSITY     Effect         SE          t          p       LLCI
ULCI
     -.4431     9.0924     -.5343      .2098    -2.5470      .0115     -.9477
-.1209
     -.4431    10.4979     -.4511      .2679    -1.6841      .0936     -.9789
.0768
     -.4431    11.9033     -.3679      .4118     -.8934      .3726    -1.1794
.4436
      .7983     9.0924     -.3643      .2030    -1.7950      .0740     -.7644
.0357
      .7983    10.4979     -.2811      .1585    -1.7732      .0776     -.5936
.0313
      .7983    11.9033     -.1979      .2814     -.7034      .4825     -.7524
.3565
     2.0000     9.0924     -.1998      .3100     -.6445      .5199     -.8108
.4112
     2.0000    10.4979     -.1166      .1941     -.6009      .5485     -.4990
.2658
     2.0000    11.9033     -.0334      .2220     -.1504      .8806     -.4709
.4041

Conditional indirect effect(s) of X on Y at values of the moderator(s):

Mediator
```

	SCENT	DENSITY	Effect	Boot SE	BootLLCI	BootULCI
AVG_PL	-.4431	9.0924	-.0466	.0427	-.1512	.0206
AVG_PL	-.4431	10.4979	-.0593	.0546	-.1970	.0240
AVG_PL	-.4431	11.9033	-.0720	.0718	-.2732	.0259
AVG_PL	.7983	9.0924	-.0252	.0353	-.1302	.0128
AVG_PL	.7983	10.4979	-.0380	.0399	-.1417	.0162
AVG_PL	.7983	11.9033	-.0507	.0544	-.2020	.0204
AVG_PL	2.0000	9.0924	-.0046	.0456	-.1227	.0713
AVG_PL	2.0000	10.4979	-.0173	.0405	-.1431	.0253
AVG_PL	2.0000	11.9033	-.0301	.0471	-.1765	.0178

Mediator

	SCENT	DENSITY	Effect	Boot SE	BootLLCI	BootULCI
AVG_AR	-.4431	9.0924	-.0126	.0284	-.1111	.0182
AVG_AR	-.4431	10.4979	-.0070	.0306	-.0969	.0374
AVG_AR	-.4431	11.9033	-.0015	.0468	-.1089	.0918
AVG_AR	.7983	9.0924	-.0191	.0338	-.1284	.0187
AVG_AR	.7983	10.4979	-.0135	.0223	-.0869	.0109
AVG_AR	.7983	11.9033	-.0080	.0313	-.1007	.0363
AVG_AR	2.0000	9.0924	-.0253	.0506	-.1882	.0335
AVG_AR	2.0000	10.4979	-.0198	.0342	-.1312	.0188
AVG_AR	2.0000	11.9033	-.0142	.0300	-.1171	.0187

Values for quantitative moderators are the mean and plus/minus one SD from mean.
Values for dichotomous moderators are the two values of the moderator.

NOTE: For at least one moderator in the conditional effects table above, one SD above the mean was replaced with the maximum because one SD above the mean is outside of the range of the data.

***************** INDEX OF PARTIAL MODERATED MEDIATION *******************

Moderator:
SCENT

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_PL	.0172	.0217	-.0079	.0943
AVG_AR	-.0052	.0193	-.0646	.0205

Moderator:
DENSITY

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_PL	-.0091	.0161	-.0612	.0100
AVG_AR	.0039	.0169	-.0188	.0576

Table 15: EFA Results for Arousal and Pleasure Scale

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.694	29.338	29.338	4.694	29.338	29.338	4.036	25.224	25.224
2	3.234	20.214	49.552	3.234	20.214	49.552	3.334	20.839	46.063
3	1.574	9.841	59.393	1.574	9.841	59.393	2.133	13.329	59.393
4	.996	6.222	65.615						
5	.720	4.498	70.113						
6	.690	4.310	74.423						
7	.618	3.864	78.286						
8	.588	3.675	81.962						
9	.544	3.401	85.363						
10	.466	2.912	88.275						
11	.423	2.646	90.922						
12	.376	2.352	93.273						
13	.324	2.028	95.301						
14	.303	1.894	97.195						
15	.254	1.584	98.779						
16	.195	1.221	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component		
	1	2	3
High Energy	.320	.695	
Pleased		.750	
Tensed	.720		
Anxious	.715		.303
Pleasant	-.341	.695	
Excited		.848	
Stimulated		.747	
Friendly	-.511	.477	
Tired			.731
Annoyed	.466		.645
Patient	-.600		
Relaxed	-.793		
Agitated	.596		.449
Unpleasant	.534		.542
Calm	-.761		
Bored		-.330	.611

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 10 iterations.

Table 16: Means Table for Friendliness

Competition	Scent	*M*	*SD*	*n*
Not Present	None	3.62	1.44	34
	Lavender	4.53	1.38	34
	Grapefruit	4.13	1.44	45
Present	None	3.31	1.55	35
	Lavender	4.08	1.69	39
	Grapefruit	3.3	1.62	46

Table 17: PROCESS Model 10 (DV: Friendliness)

```
Model = 10
    Y = AP_2
    X = AVG_HC
   M1 = AVG_AR
   M2 = AVG_PL
    W = SCENT
    Z = COMP

Statistical Controls:
CONTROL= AVG_SC   INTENSIT

Sample size
        233

**************************************************************************
Outcome: AVG_AR

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .2852      .0814     1.2007     2.8465     7.0000   225.0000      .0073

Model
              coeff         se          t          p       LLCI       ULCI
constant     3.5736      .7904     4.5215      .0000     2.0161     5.1310
AVG_HC        .1112      .1032     1.0773      .2825     -.0922      .3145
SCENT        -.0048      .3659     -.0132      .9895     -.7258      .7161
int_1         .0197      .0595      .3308      .7411     -.0975      .1369
COMP          .1746      .5399      .3234      .7467     -.8893     1.2385
int_2         .0109      .0857      .1269      .8991     -.1581      .1798
AVG_SC       -.1383      .1368    -1.0112      .3130     -.4078      .1312
INTENSIT      .0311      .0290     1.0741      .2839     -.0260      .0882

Product terms key:

 int_1    AVG_HC      X     SCENT
 int_2    AVG_HC      X     COMP

**************************************************************************
Outcome: AVG_PL

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3620      .1310     1.1394     4.8473     7.0000   225.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     7.4134      .7699     9.6288      .0000     5.8962     8.9306
AVG_HC       -.2482      .1005    -2.4685      .0143     -.4463     -.0501
SCENT        -.4272      .3564    -1.1986      .2319    -1.1295      .2751
int_1         .0655      .0579     1.1300      .2597     -.0487      .1797
COMP          .2883      .5259      .5481      .5842     -.7481     1.3246
int_2        -.0741      .0835     -.8869      .3761     -.2387      .0905
AVG_SC       -.4269      .1332    -3.2046      .0015     -.6895     -.1644
INTENSIT     -.0257      .0282     -.9125      .3625     -.0813      .0298
```

```
Product terms key:

 int_1    AVG_HC      X     SCENT
 int_2    AVG_HC      X     COMP

**************************************************************************
Outcome: AP_2

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .5362      .2875     1.8418     9.9964     9.0000   223.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      .1669     1.2284      .1359      .8920    -2.2537     2.5876
AVG_AR        .0920      .0835     1.1015      .2719     -.0726      .2566
AVG_PL        .6105      .0857     7.1192      .0000      .4415      .7794
AVG_HC        .3187      .1297     2.4573      .0148      .0631      .5742
SCENT         .9388      .4546     2.0649      .0401      .0429     1.8347
int_3        -.1431      .0739    -1.9355      .0542     -.2887      .0026
COMP         1.4294      .6694     2.1354      .0338      .1103     2.7484
int_4        -.2636      .1064    -2.4782      .0139     -.4732     -.0540
AVG_SC       -.2370      .1740    -1.3615      .1747     -.5800      .1060
INTENSIT      .0729      .0360     2.0246      .0441      .0019      .1438

Product terms key:

 int_3    AVG_HC      X     SCENT
 int_4    AVG_HC      X     COMP

******************** DIRECT AND INDIRECT EFFECTS *************************

Conditional direct effect(s) of X on Y at values of the moderator(s):
      SCENT       COMP     Effect         SE          t          p       LLCI
ULCI
     -.4431    -1.0000      .6457      .1984     3.2549      .0013      .2547
1.0366
     -.4431     1.0000      .1184      .1650      .7178      .4736     -.2067
.4436
      .7983    -1.0000      .4681      .1813     2.5820      .0105      .1108
.8253
      .7983     1.0000     -.0592      .1251     -.4729      .6368     -.3057
.1874
     2.0000    -1.0000      .2961      .2065     1.4344      .1529     -.1107
.7030
     2.0000     1.0000     -.2311      .1432    -1.6142      .1079     -.5132
.0510

Conditional indirect effect(s) of X on Y at values of the moderator(s):

Mediator
            SCENT       COMP     Effect    Boot SE   BootLLCI   BootULCI
AVG_AR     -.4431    -1.0000      .0084      .0241     -.0163      .0965
AVG_AR     -.4431     1.0000      .0104      .0193     -.0083      .0888
AVG_AR      .7983    -1.0000      .0107      .0226     -.0109      .0990
AVG_AR      .7983     1.0000      .0127      .0191     -.0089      .0793
AVG_AR     2.0000    -1.0000      .0128      .0253     -.0121      .1120
```

AVG_AR	2.0000	1.0000	.0149	.0236	-.0121	.0945

Mediator

	SCENT	COMP	Effect	Boot SE	BootLLCI	BootULCI
AVG_PL	-.4431	-1.0000	-.1240	.1001	-.3328	.0621
AVG_PL	-.4431	1.0000	-.2144	.0875	-.3985	-.0618
AVG_PL	.7983	-1.0000	-.0744	.0877	-.2491	.1016
AVG_PL	.7983	1.0000	-.1648	.0892	-.3533	-.0163
AVG_PL	2.0000	-1.0000	-.0263	.1061	-.2273	.2005
AVG_PL	2.0000	1.0000	-.1168	.1187	-.3651	.0802

Values for quantitative moderators are the mean and plus/minus one SD from mean.
Values for dichotomous moderators are the two values of the moderator.

NOTE: For at least one moderator in the conditional effects table above, one SD
above the mean was replaced with the maximum because one SD above the mean
is outside of the range of the data.

***************** INDEX OF PARTIAL MODERATED MEDIATION *******************

Moderator:
SCENT

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_AR	.0018	.0083	-.0089	.0278
AVG_PL	.0400	.0446	-.0430	.1323

Moderator:
COMP

Mediator

	Index	SE(Boot)	BootLLCI	BootULCI
AVG_AR	.0020	.0236	-.0366	.0680
AVG_PL	-.0904	.1230	-.3405	.1316

When the moderator is dichotomous, this is a test of equality of the conditional indirect effects in the two groups.