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## *Sensory Factors and Consumer Behavior*

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### INTRODUCTION

As Colleen arrives at the entrance of the store, she scans the inside noticing the layout of merchandise, where the sales racks are located, and the table of sweaters just to the left of the entrance. She then hears the screaming of a baby in a stroller and the customer complaining to a sales person that a blouse she had purchased was the wrong size. At the same time, Colleen takes a sip of coffee from the Caribou store next door, notices the scent of flowers in the air, while she moves toward the table of sweaters. Picking up the pale blue sweater she strokes the collar and is impressed by the softness of the cashmere fabric. All of Colleen's impressions occur within seconds as she makes decisions about whether to remain in the store or move along to another shopping experience. Yet contained in those brief seconds was an integration of her "windows to the world" through her five senses. Our judgments about a store, its products, and even its personnel, are driven in part by the smells we encounter (our olfactory system), the things we hear (our auditory system), the objects we come into physical contact with (our tactile system), our taste experiences (the gustatory system), and what we see (the visual system).

Consumer research has approached the study of consumer behavior from a wide and varying set of perspectives. The chapters in this book provide a synthesis of these perspectives and the research that has followed. Among these perspectives is how information in the environment relates to the forms in which it is received and processed by individuals. Particularly for the latter, is how the perceptual system is organized to receive inputs in different forms or senses. The primary human senses consist of smell, taste, hearing, touch, and sight. Although each of these is a potentially important system for the processing of information, the sense of sight has perhaps received the greatest amount of attention and is discussed in a separate chapter (see Petrova & Cialdini, chapter 19 of this volume). In this chapter, we narrow our focus on the varied effects of the remaining four senses.

In psychology and the cognitive sciences, perception is the process of acquiring, interpreting, selecting, and organizing sensory information (Grohol, 2005). Perception is one of the oldest fields within scientific psychology. Many cognitive psychologists hold that, as we move about in the world, we create a model of how the world works. That is, we sense the objective world, but our sensations map to percepts, and these percepts are interpreted within the context of the environment we find ourselves in, such as the atmospherics of our store example. As we acquire this new information and consider it relative to the knowledge we have in memory from prior experiences, our perceptions shift as we select further pertinent information to aid our judgments and purchase decisions.

In this chapter, we examine research in the field of consumer behavior published over the past twenty five years on four of the senses. We first examine research on smell and the olfactory system, followed by a discussion of past research on the sense of taste (gustatory), then research on hearing, particularly music, (auditory), and finally research on touch (tactile and haptic system). We then discuss areas where future research might be directed, particularly in terms of implications for the study of individual differences, the role of mental imagery, the promise of more neurocognitive approaches, and the need for more consideration of the multi-sensory interactions of our senses on consumption behavior

## METHODOLOGY

A search of articles concerning the senses of taste, hearing, smell and touch was performed through an examination of seven journals that are primarily, or in part, focused on the study of consumer behavior. A total of 81 articles were compiled from the *Journal of Consumer Research* (24 articles), the *Journal of Marketing Research* (15 articles), *Journal of Marketing* (9 articles), *Journal of Consumer Psychology* (10 articles), the *Journal of Business Research* (14 articles), the *Journal of Retailing* (7 articles) and *Psychology & Marketing* (2 articles). The most researched sense is the auditory sense (33 articles) with the majority of this research examining some form of music. Taste follows with 24 articles, smell with 14 and finally, touch with 10 articles. Interest in sensory research appears to be growing, with only 6 of the research articles published before 1980, 18 articles published in the 1980s, 29 in the 1990s and 28 articles in the last 5 years.

## REVIEW OF PAST RESEARCH ON SENSORY FACTORS SENSE OF SMELL

The olfactory sense, or the sense of smell, has been the subject of study in several papers published in the marketing field. While some previous studies have looked at the scents of specific products (e.g., Schmitt & Shultz, 1995, men's fragrances; Schneider, 1977, package fragrance), research in the past ten years has focused on ambient scent. Ambient scent is defined as a scent that is present in the environment but not emanating from a particular object. In general, various scents have been classified by the affective quality of the scent (e.g., how pleasing the scent is), the arousal level of the scent (how likely it is to evoke a physiological response) and the intensity of the scent (e.g., how strong it is). Spangenberg, Crowley, and Henderson (1996) extensively pretested 26 individual scents and separated them into the affective dimension and the arousing or activating dimension and found that the affective dimension explained most of the variance. In this same paper, Spangenberg et al. (1996) manipulated the scent affect (neutral vs. pleasing) and scent intensity (low, medium, high) with an additional control group. The authors found that whether the scent was neutral or pleasing did not matter, nor did the intensity of the scent, compared to the control, no scent condition. Subjects in the scent condition perceived that they had spent less time in the store compared to the no scent condition. In addition, subjects in the no scent condition perceived hav-

ing spent significantly more time in the store than they actually did. Subjects in the scented condition did not show this discrepancy. Evaluations of the store overall and of the store environment were more positive when the store was scented versus not scented. Authors found mixed evidence of scent on specific product evaluations and suggest that the congruency of product and scent may be an important dimension for further study.

This notion of congruency has been pursued by other researchers. Mitchell, Kahn, and Knasko (1995) manipulated whether the ambient odor was congruent with a product category. In the congruent conditions, a chocolate scent was paired with a candy assortment choice and a floral scent with a flower arrangement choice. When the odor was congruent with the product class, subjects spent more time processing the data, generated more self references, were more likely to make additional inferences and were more likely to exhibit variety seeking behavior. Interestingly, the researchers found no main effect of scent versus no scent. In general, cognitive elaboration was greater in the congruent conditions.

### Scent and Music

In another variant of congruency, two studies concerning the interaction of scent and music have been conducted. Mattila and Wirz (2001) manipulated scent arousal (no scent, pleasant low arousal, and pleasant high arousal) and music arousal (no music, pleasant low and high arousal music) and examined whether scent and music were matched on arousal level or mismatched. When scent and music matched in terms of arousing qualities, consumers satisfaction with the shopping experience, approach behavior and impulse buying were significantly higher than in the mismatched conditions. This was true of both the high arousal match (scent of grapefruit and fast tempo music) and low arousal match (scent of lavender and slow tempo music). Spangenberg, Grohmann, and Sprott (forthcoming) also examined the effects of ambient scent and music by using a Christmas theme. They set up a lab experiment and manipulated scent (no scent vs. Christmas scent) and the type of music (non-Christmas music vs. Christmas music) in a mock retail store. Similar to previous research, they found that the matched condition of Christmas scent and Christmas music resulted in more favorable evaluations for the store, its merchandise, the store environment, and intentions to visit the store. When music and scent did not match, evaluation and behavior intentions were not affected, or, in some cases, negatively affected.

### Scent and Other Moderators

Michon, Chebat, and Turley (2005), in the context of a field experiment varied scent along with retail density (how crowded the mall was) and examined shopper's perceptions of product quality, mall environment and positive affect. The authors found a u-shaped relationship in that the positive effect of ambient scent on shoppers' perceptions of the mall atmosphere was observed only at the medium retail density level. Further, a favorable perception of the retail environment influenced the perception of product quality. Shoppers' mood did not have a significant direct effect on the perceptions of product quality.

Morrin and Ratneshwar (2000, 2003) crossed ambient scent (unscented, pleasant) with brand familiarity (familiar, unfamiliar) and examined the evaluation, attention, and memory for familiar and unfamiliar brands. The authors (Morrin & Ratneshwar, 2000) found that a pleasant ambient scent improved evaluations for objects that were not as familiar or well liked. However, they were concerned about potential ceiling effects for the familiar brands as well as allowing only a 5-minute delay before the memory measures. In their subsequent research (Morrin & Ratneshwar, 2003), the authors examined the memory effects in more detail to determine if ambient scent influences

memory of brands at encoding, retrieval, or both. In a two-phase experiment, 24 hours apart, the authors manipulated ambient scent (no scent, scent congruent to household cleaning products (geranium), scent incongruent to household cleaning products (clove)) and brand familiarity. In Study 1, the same scent was used at encoding and retrieval and it was found that ambient scent improved recall and recognition of familiar and unfamiliar brands. This was true whether or not the scent was congruent with the product category. In Study 2, the authors manipulated whether the scent was present at encoding or retrieval and found that the enhancement of brand memory was due to the presence of an ambient scent at encoding rather than retrieval. The ambient scent increased attention in terms of longer viewing times.

### Process Explanations

Why does ambient scent influence consumer behavior? The two explanations most often used can be separated by whether scent primarily influences affect such as mood or whether a scent primarily influences cognition. In the area of retail atmospherics, Mehrabian and Russell (1974) discuss mood as a mediating factor between environmental cues and behavior. The environmental psychologists assert that shoppers react to environmental cues with approach (e.g., desire to stay in the environment, explore, etc.) or avoidance (e.g., desire to leave) behaviors and that mood mediates this relationship. However, in the marketing literature, this explanation has not received strong support. Bone and Ellen (1999), in a review article, found that only a small percentage of studies (16.1%) showed any influence of scent on mood. Another process explanation is that scent influences cognitive processes. Morrin and Ratneshwar (2003) found no effect of scent on mood, but found that scent increased attention to brands as measured by viewing times of various brands (Morrin & Ratneshwar, 2000, 2003). Mitchell et al. (1995) found that scent influenced the extent of information processing and cognitive elaborations. Chebat and Michon (2003) tested various process theories and concluded that cognitions pertaining to product quality and the shopping environment are influenced by scent, which in turn influenced the mood of the shopper. Hirsch (1995) examined the effects of ambient odors in a Las Vegas casino. While the specific odors used are not identified in the research, the author found that an ambient odor significantly increased slot-machine usage. The author suggests (but does not test) a cognitive process whereby the odor may have induced nostalgic recall of memories which enhanced the gambling mood. There seems to be more support for the influence of scent on cognitive processes but, given the interaction between cognition and affect, this is clearly a complicated question. Bone and Ellen (1999) suggest that accessibility and availability theories may be a more useful theoretical basis for understanding ambient scent research. We next turn to a discussion of past research in consumer behavior and marketing on the sense of taste.

### Sense of Taste

Research on the sense of taste (or the gustatory sense) is quite varied and includes administration of taste tests, changes in taste as it relates to new product formulations, store-sampling, branding, packaging and taste as a form of direct product experience. Each of these topics will be discussed in turn.

### Taste Discrimination

At the most basic level, some researchers have examined various methods of administering taste tests (e.g., Buchanan, Givon, & Goldman 1987). One of the key issues is to identify which type or

method of taste test can best determine an individual's ability to discriminate between different tastes. This is important to marketing for several reasons. In some instances, a manufacturer may want to test the similarity of two alternative product formations to assess the consistency of taste from batch to batch of a product. Often, these tests involve in-house trained experts (Greenhalgh, 1966). Also, a taste test may be used to identify consumers who have greater ability to discriminate products by taste or to test alternative formulations. A common test, termed the triangle test asks consumers to identify the one sample of three that is different from the other two, which are identical. Researchers (Morrison, 1981; Moskowitz, Jacobs, & Firtle, 1980) have examined whether subjects who do well on this type of test are actually discriminating between the tastes or are simply guessing. The authors make statistical suggestions for improving the quality of the results of triangle tests.

Another common taste discrimination task involves consumers making several paired comparisons and noting their preferred choice following each comparison. Once subjects have completed several paired comparisons, the consistency of their choices is used to determine their discrimination ability. Finally, a preference rank procedure is used where subjects are given three taste samples, one different from the other two and are asked to rank the three from most to least preferred. A subject who ranks the different sample as most or least preferred is judged to have made a correct choice, regardless of the preference. A subject who ranks the odd sample as between the two identical samples is judged not to have discriminated. In an empirical investigation examining the three procedures, Buchanan et al. (1987) found that the repeated pair comparison method was the most sensitive discrimination task and preference ranking was the least sensitive. The researchers also found that the discrimination ability measured by triangle tests was significantly correlated with that measured by paired comparisons, which supports the validity of the tests.

In the area of product reformulations, Villani and Morrison (1976) investigated a method for estimating demand for a new product formulation and recommended that estimates for current users and non-users be made separately for more accuracy. In arguably the most famous product reformulation, the New Coke experience is discussed by Dubow and Childs (1998). These researchers explain the gradualist approach hypothesis which uses the perception and psychophysical concepts of just noticeable difference (when a consumer can just notice a change) and just unnoticeable difference (where the change is undetectable). In the gradualist approach to product reformulation, the manufacturers would change the taste of a product in a sequence of small, constant, just unnoticeable difference steps so that, at no point would tasters perceive the reformulation differences. Arguing against the gradualist approach hypothesis, the flavor balance hypothesis suggests that a gradualist approach is impossible in a multi-ingredient formula as unexpected interaction effects of various ingredients may be perceptible. Using New Coke and Coca-Cola Classic, Dubow and Childs (1998) conduct an empirical test which suggests that Coke may have been better off using a gradualist approach to reformulation and not announcing the product change.

### Taste and Store Samples

The area of taste and sampling food items in stores has also been researched. Johnson, Sommer, and Matino (1985) unobtrusively observed consumer behavior at bulk food bins in fourteen supermarkets. The most frequent problem behaviors were consumers using their hands to retrieve products and consumers snacking on products. Not surprisingly, these two problem behaviors were correlated. Besides this unsanctioned behavior of snacking, stores often encourage taste by offering product samples. Steinberg and Yalch (1978) examined obese and nonobese shoppers in a supermarket, how hungry the shoppers were, and the effect of sales of other grocery items when shoppers

were offered an in-store sample (a doughnut in the bakery section). For the nonobese, if a shopper was hungry, the food sample seemed to satisfy some of their hunger and they reduced their additional buying compared to the nonobese shoppers who were not hungry. For the obese shoppers, offering a food sample increased additional buying and this was only slightly moderated by their level of hunger. The authors conjecture that obese shoppers are not as sensitive to their internal cues of hunger so offering a sample may have increased further the salience of food and they purchased more.

Some research (Nowlis & Shiv, 2005; Shiv & Nowlis, 2004) looked at whether or not to distract shoppers as they tasted a food sample. Contrary to industry wisdom, these researchers found that distraction of the shopper increased subsequent choice for the sampled food. The authors explain these results using a two-component model in which the ultimate pleasure a shopper derives from tasting a food sample is a function of an informational and an affective component. The affective component involves the emotional responses of the shopper and is associated with relatively automatic processes. The informational component is a more objective feature of the tasting experience and related to aspects such as quality. This information component is comprised of more controlled processes. Distracting a consumer influences subsequent choice by increasing the impact of the affective component.

### Taste and Branding

Another area of taste research concerns the relationship between taste and brand name. In an early marketing study, Allison and Uhl (1964) found that, in a blind taste test, experienced beer drinkers (they drank beer at least three times per week) were unable to distinguish their preferred brand from other brands of beer. However, when the brands of beer were identified, these same beer drinkers rated the taste of their preferred brand significantly higher than in the blind taste test. Similarly, Bellizzi and Martin (1982) found that whether a brand was national or generic significantly influenced the taste of the product (national brands ranked higher). Sprott and Shimp (2004) examined the interaction of brand status (store brand, national brand) and quality of the tasting experience. They revealed that sampling a store brand substantially increased evaluation for the store brand compared to the group that did not have the opportunity to taste the product (juice) only if the sample store brand was high quality. No benefit was demonstrated with the national brand. The authors theorize two explanations that may be likely. When consumers make quality judgments, they base these judgments on inherent product features, or intrinsic cues and on extrinsic cues such as price and brand name. Intrinsic cues, such as taste, tend to dominate extrinsic cues when intrinsic cues can be evaluated with confidence at the time of purchase. When intrinsic cues cannot be evaluated (i.e., taste), consumers base their judgments more on extrinsic cues (i.e., brand name). By providing consumers with the opportunity to taste the store brand, an intrinsic cue was provided that influenced product perceptions.

The other theoretical explanation used is schema congruity theory (Mandler, 1982). Schema congruity theory asserts that affect for a particular brand will be most positive when a person perceives moderate incongruity between the product category schema compared to extreme congruity or incongruity. The expected schema for store brands is that they are lower quality compared to national brands. Participants who tasted the store brand learned that the juice was of high quality and consequently their store brand schema and their actual experience were moderately incongruent, thus resulting in more positive affect compared to the subjects who did not have the opportunity to taste.

LeClerc, Schmitt, and Dubé (1994) examined the effect of foreign branding (French) on product perception and attitudes. In Experiment 3, the authors crossed whether a participant could taste the product (yogurt) with whether the brand was foreign (English, French). They found that with no taste test, a French brand name generated higher ratings on the hedonic dimensions of the product (i.e., pleasantness, sweet, delicious, creamy) and lower ratings on the utilitarian dimension (healthy, wholesome, nutritious). Additionally, a French sounding brand name affected product perception and evaluation even after a taste test but only on the hedonic dimension.

The effect of brand awareness on sampling of brands and choice revealed that when subjects do not have any brand awareness, they tended to sample more brands and were more likely to select the high quality brand (Hoyer & Brown, 1990). If subjects were aware of one brand in a set (this study used brands of peanut butter), they tended to sample fewer brands and tended to choose the known brand even when it was lower quality than other brands in the sample. In a related area to branding, one study on product packaging and taste found that packaging influenced the taste of the product. McDaniel and Baker (1977) examined consumer reactions to identical potato chips placed in a wax coated potato chip bag or a “new” polyvinyl bag. In a blind taste test, subjects rated the chips as identical. However, when the taste test was conducted with the bags, even though the polyvinyl bags were extremely difficult to open (subjects had to use their teeth, stand on the bag and pull, etc.), the chips in the polyvinyl bags were viewed as crispier and tastier. The authors interpret the findings that a negative packaging attribute (hard to open) can enhance product quality perceptions since consumers infer other attributes such as crispier or fresher, even when no difference in the actual product quality exists.

### Taste, Direct Experience, and Product Perceptions

Taste can be conceptualized as a form of direct product experience. Smith and Swinyard (1983) researched product trial (tasting a salted snack product) and attitude-behavior consistency. When attitudes were based on the taste of the product, the attitude-behavior correlation was much higher than without this tasting experience. The authors emphasize the information value of direct product experience. Scott and Yalch (1980), using Bayesian analysis, examined consumer acceptance of experiential information about a new product. Consumers who were given a reward for sampling a new product and who were encouraged to attribute their behavior to this situational factor (and thus discount their intrinsic interest in the product) were receptive to unfavorable product information and unreceptive to favorable information. The authors maintain that their research demonstrates a tendency for people to accept information consistent with their perceptions about the causes of their behavior and to reject information when it contradicts these attributions. Similarly, Roberts and Taylor (1975) demonstrate that even with a tasting experience, it is difficult to change consumer's previously held perceptions.

Some researchers consider that product trial through tasting can be diagnostic and influence perceptions and choice. Levin and Gaeth (1988) vary the temporal order of tasting a product (before or after reading a ground beef label) and the valence of the label information (positive, 75% lean; negative, 25% fat). The framing effect of the labeling was reduced when consumers sampled the product compared to when they did not. The authors note that product experience will have greater weight when it is unambiguous or diagnostic. Also, using diagnosticity, Pechmann and Ratneshwar (1992) varied the diagnosticity of a taste test as well as the objective correlation of price and quality. Four samples of orange juice varying in quality were used. In one condition taste was perfectly correlated with price and in another the correlation was zero. Diagnosticity of the taste

test was manipulated by either allowing participants to go back and forth between the four samples (high diagnosticity) or by presenting the samples sequentially with some time in between and no opportunity to go back to previous samples (low diagnosticity). It was found that prior beliefs biased judgments of the samples less when diagnosticity was high rather than low (Study 1). When subjects were allowed to use a memory aid (Study 2), they tended to be relatively accurate in their judgments, even though they had the same constraints as the low diagnosticity subjects in the first study. The authors conclude that the degree to which prior beliefs and actual direct taste experience are used depends on the diagnosticity of the mental representations of the taste experience. The higher the diagnosticity, the greater the impact of the actual taste experience relative to prior beliefs. The lower the diagnosticity, the greater the impact of prior beliefs relative to the actual taste experience.

Braun (1999) looked at a different aspect of taste and memory. She asked the question of whether advertising received after a direct product experience (tasting orange juice) altered how consumers remember their experience. This research found that consumer recall of a past direct experience with a product (tasting) was subject to distortions. Post-experience advertising made consumers think they had tasted a better tasting juice by altering their memories of the tasting experience through advertising. Altering the time between the tasting experience and the advertising exposure, this research revealed that the post experience is working at the memory reconstruction phase of recall rather than as a source confusion problem at encoding. Another study found that imagining a taste experience, even of a hedonic product (ice cream) may actually be a more affective experience than actually eating the product (Compeau, Grewal, & Monroe, 1998).

### Taste as More Incidental

In some reach, the actual product tasting is not a key part of the research question yet product taste plays a role. Maison, Greenwald, and Bruin (2004) used a Coke-Pepsi taste test in a pretest to determine subjects who could identify each of the brands in a blind taste test. The primary focus of this research was to compare the predictive validity of implicit versus explicit preferences for brands. When separating subjects by their ability to identify Coke or Pepsi in a blind taste test, this research found that subjects who exhibited higher taste discrimination in the blind taste test had more extreme implicit preferences. This research suggests that implicit preference measures are more sensitive measures of preference than explicit preference measures.

Kahn and Isen (1993) did not include actual tasting in their study, but rather taste perceptions. They found that a positive affect manipulation increased variety seeking behavior relative to the control when unpleasant or negative features of the items were not made salient. However, when salient negative features were introduced into the choice set with the inclusion of products that potentially tasted bad (i.e., low salt and high fiber crackers—Experiments 1 and 2), or by alerting subjects to the negative health risks of familiar items (Experiment 3), there was no difference between positive affect and a control group on variety seeking behavior. We next turn to the discussion of research on hearing or auditory effects on consumer behavior.

### Sense of Hearing

The auditory sense or hearing has been studied in marketing mostly in the context of background music in advertising and in retail stores. Researchers have examined the effects of music on consumers' moods, product evaluation and choice, fit with an ad or store, time perceptions, and as part of a retail store's atmosphere. A few studies have examined non-music elements such as voice pitch

and the interaction between auditory information and visual information. First, the auditory sense as it relates to music in marketing will be discussed followed by studies concerning the interaction between audio and visual information.

### Music and Mood

Bruner (1990), in a review article on music and mood, stressed the complexity of music and its influence on individual's moods. Bruner also provided a taxonomy of musical elements and the emotional expressions ascribed to each structural element. The three main structural features of music are tempo or time of the music (how fast or slow it is), pitch related characteristics (includes major, minor keys), and texture (includes volume, instrumentation). (Please see Bruner, 1990, Appendix, p. 102, for a more complete description of the elements.) Bruner stressed that people assign emotional meaning to music and experience affective reactions. For example, fast music is considered happier than slow music. Kellaris and Kent (1994) identify three basic musical properties similar to those of Bruner (1990) which are tempo (fast, moderate, slow), tonality (major, minor, atonal) and texture (classical, pop). These authors produced original compositions with digital sound technology to provide orthogonal manipulations of the three structural properties of music. They also identified three dimensions of response (pleasure, arousal, and surprise) that were elicited by the three properties of music. They call for a better understanding of the multidimensional nature of both musical stimuli and listener response. Similarly, Scott (1990) advocated using an interpretist approach in research to understand the complexity of consumer meaning and response to music.

In arguably one of the most famous research studies in marketing, Gorn (1982) used classical conditioning and illustrated that hearing liked music (music from the movie *Grease*) or disliked music (classical Indian music) while being exposed to a product (a pen) can directly affect product preferences as measured by product choice. Both Kellaris and Cox (1989) and Allen and Madden (1985) attempted to replicate Gorn (1992) but failed to do so. Kellaris and Kent (1994) note that Gorn (1992) did not control for the different structural properties of music. They argue that when fast tempo, upbeat music is used to operationalize the positive unconditioned stimulus, the valence of the music may have been confounded with the arousing quality of the music which may have altered the level of attention of participants. In classical conditioning, music is assumed to induce a mood which is directly transferred to the product.

The influence of music on mood states and new product evaluations was researched by Gorn, Goldberg, and Basu (1993). Mood was manipulated by music to induce either a good or a bad mood and subjects' awareness of the music as a source of their mood was also manipulated. When subjects were not aware of the source of their mood, their mood biased their evaluations of the product so that the product was evaluated more favorably when in a good mood than when in a bad mood. However, when subjects were made aware of the source of their mood (the music), there was no difference in product evaluations between those in a good or bad mood. The authors explained the results with a mood-based cognitive heuristic "How do I feel about it?" (Schwarz, 1990), which suggests that people observe their own feelings and draw conclusions from them. If a person is not aware of the source of their mood, they assume the feelings are information to be used in product evaluation.

Music was also used to induce either a pleasant or unpleasant affective state and examine its interaction with the affective tone of an advertisement (Gorn, Pham, & Sin 2001). While controlling for arousal (Study 1), music was used to manipulate a pleasant or unpleasant affective state. In Study 2, both arousal and pleasure were manipulated with music. Results showed that the valence of a person's affective state influenced judgment in a mood congruent direction especially if an ad

had an ambiguous affective tone. The arousal dimension, but not the valence dimension, influenced ad evaluations. Ad evaluations were more polarized in the direction of the ad's affective tone under high arousal than under low arousal.

Dubé and Morin (2001), in a field setting, examined the pleasure induced by music (measured, not manipulated) and its impact on store evaluations. No main effect of pleasure intensity induced by music on store evaluations was found and they explain that there was no support that mood induced by music directly influenced store perceptions. Instead, this is mediated by attitude toward the servicescape and attitude toward the sales personnel.

While the preceding studies focus on the influence of music on mood, some researchers have examined the cognitive processes resulting from background music. Olsen (1997) manipulated whether background music was present (2 levels, silence and music) and the amount of time between consecutive information presented in ads (0, 1, 2, 3, second) in two studies. Relative to silence, background music hindered recall when information was presented at 2 seconds or shorter but enhanced recall at 3 seconds. Using a resource matching explanation (cf. Anand & Sternthal, 1990), music had a detrimental effect on recall at shorter times because it distracted cognitive resources from the rehearsal of brand information thereby hindering attention. As cognitive resources increased to the point when those available matched those required, information was sufficiently processed and a higher level of recall was exhibited.

### Music and Congruence

Park and Young (1986) examined the effect of music (present, absent) and three types of involvement (low involvement, cognitive involvement, affective involvement) on the formation of attitudes toward a brand in the context of TV commercials. Music increased the brand attitude for subjects in the low involvement condition but had a distracting effect for those in the cognitive involvement condition. Its effect for those in the affective involvement condition was not clear. They argue that music acted as a peripheral persuasion cue.

While the notion of fit was not specifically studied in Park and Young (1986), the music was selected since it was "best suited" for the commercial. MacInnis and Park (1991) examine two dimensions of music including its fit with the ad and the extent to which it arouses emotion laden memories. Fit was defined as a participant's perception of the music's relevance to the central advertising message. These two dimensions of music were fully crossed with two levels of involvement. The emotion laden quality of the music had similar effects on attention to the music and affective response for both high and low involvement participants. Yet, it had different effects on their message based processing. For low involvement participants, the emotion laden quality enhanced message processing while it seemed to distract high involvement participants from processing the message. Similarly, while fit had similar effects on high and low involvement participants by focusing attention on the music and the message, it created different effects on their affective responses. Lack of fit created more negative emotions for low than for high involvement participants. An unexpected finding of this research was the strong impact of fit on both positive emotions and attitude toward the ad.

Kellaris, Cox, and Cox (1993) examined the fit or congruency of music and the message (low, high) and the attention getting value of music (low, high) along with a no music control group. The dependent measures consisted of recall and recognition of brand names and message arguments in the context of a radio ad. This research found that when background music was congruent, attention getting music increased recall and recognition of brand names. When the music was attention getting and the message incongruent, it pulled listener's attention away from the message and

negatively influenced recall. The no music ads performed as well or better than the musical ads in terms of recall and recognition.

The relationship between the fit of the mood induced music (happy/sad) and the purchase occasion (happy/sad) and its effect on purchase was studied by Alpert, Alpert, and Maltz (2005). While mood induced by music did not exhibit a main effect on purchase intentions, its interaction with fit was significant. The authors conclude that when music is used to evoke emotions congruent with the symbolic meaning of the product, the likelihood of purchase is increased.

### Music and Atmospheric

Music is a key element in determining the atmosphere of a service or retail environment. Numerous studies have examined the role of music in these settings.

### Music and Tempo

Milliman (1982, 1986) researched the influence of background music tempo in a supermarket and in a restaurant. In the supermarket study, Milliman (1982) varied the tempo of classical music (fast, slow) and found that the pace of the in-store traffic was significantly slower with slow tempo music compared to fast tempo music. Also, higher sales volume was associated with slower tempo music and lower sales figures were associated with faster tempo music. Interestingly, when shoppers were asked about their awareness of background music, the majority of participants were not sure if music was in the background or they were incorrect. In the context of restaurant dining, Milliman (1986) varied the tempo of the background music (slow, fast) and found that with slower music, patrons stayed longer, ate about the same amount of food but consumed more alcoholic beverages. The author conjectured that the slower, more relaxing environment created a greater approach condition for the diners.

In the context of a travel agency service, participants viewed a video in which the four music conditions varied in the arousal quality through changes in tempo (Chebat, Chebat, & Vaillant, 2001). The classical music was pretested to be equally pleasurable. This research found that highly arousing music hampered cognitive activity and the authors argue that the “fit” between the highly arousing music and their context of the message from the travel agency was low. Similar to MacInnis and Park (1991), this study showed that when highly arousing music drew attention to itself, the effect was to reduce cognitive resources available for information processing and also reduce recall. In contrast, the slow tempo music did not attract attention to itself and did not interfere with the cognitive resources used to process the message. However, the authors caution that the deeper the cognitive activity, the more negative the attitude toward the employee and toward the visit.

### Music and Atmospheric

Several studies have not simply manipulated an aspect of music but rather manipulated the image or atmosphere of a retail setting with music as an element. For example, Meyer (1981) manipulated the décor of a pizza restaurant and had an elaborate décor condition, which included live music, or plain décor condition with no music. The purpose of the research was not related to music but was to advance a model for the study of consumer evaluation of choice alternatives given uncertainty about the alternative and attributes.

Using videotape technology, Baker, Levy, and Grewal (1992) combined music and lighting to manipulate ambient cues in a retail environment. They found that ambient cues (low and high) interact with social cues (number and friendliness of employees) to influence shoppers' pleasure

and subsequently their willingness to purchase. Again, music is confounded with lighting making the results from music alone impossible to interpret. Finally, while not the main focus of their study, Grewal, Baker, Levy, and Voss (2003) use classical music versus no classical music as one manipulation in the atmosphere of a jewelry store. (The number of store employees and the number of customers was also varied). Results found that classical music had a positive effect on store atmosphere and, in turn, intentions to shop at the store. The authors also point out that classical music “fit” with the jewelry store.

Schlosser (1998) manipulated music along with other components in order to operationalize a prestige and a discount condition. In the prestige condition, the store was described as having classical music, soft lighting, hardwood floors, and wide aisles; in the discount condition the music was top 40, the floors were linoleum, and the aisles were narrow. The primary conclusion from this research was that different types of products are differentially affected by the atmosphere of a store. Products were divided by whether they have a utilitarian function (more related to product performance) or a social identity function (more related to the expression of self-concept). Store atmosphere influenced perceptions of social identity products but not utilitarian products.

### Music and Time Perceptions

Time perceptions are an active area of research in marketing. In the area of retail atmospherics Yalch and Spangenberg (2000) used a simulated shopping experiment and varied whether the music played was familiar or not. Participants reported shopping longer when exposed to familiar music but they actually shopped longer when exposed to unfamiliar music. The shorter actual shopping times in the familiar music condition were related to increased arousal. Emotional states were not directly related to the music manipulation.

Besides familiarity of music and time perceptions, researchers have looked at the valence of the music and time perceptions. Kellaris and Kent (1992) varied the tonality of the music (major, minor, atonal) and used a synthesizer so that other aspects of the music were equal. The music in a major key was positively valenced while the atonal music was negatively valenced. Results showed that perceived duration was the longest for participants exposed to positively valenced music and shortest for those exposed to negatively valenced music. They used Ornstein's (1969) storage size model to account for the findings. This model suggests that perceived time duration is a function of the amount of memory dedicated to storing stimulus information encountered during a given interval. Larger allocations of memory space are associated with longer perceived time durations. The relative pleasantness of the major key music motivated listeners to devote more attention to the music and allocate greater cognitive resources to processing it. This may have both reduced the allocation of processing to some internal clock used to judge the duration of an event and created the perception that more stimulus information was heard.

Hui, Dubé, and Chebat (1997) had people watch a video of a person waiting in line at a bank and varied the valence of the music. Results demonstrate that positively valenced music increased the perception of wait duration compared to negatively valenced music (similar to Kellaris and Kent 1992) and compared to the no music condition. But, they note that the perceived wait time did not have a negative impact on attitude toward the service organization (the bank). In fact music, regardless of its valence, made the service environment seem more positive to customers waiting in lines. Related to this finding, Cameron, Baker, Peterson, and Braunsberger (2003) manipulated valence of music and found that while music likeability influenced both wait length evaluations and mood, only mood contributed to participants' evaluation of their overall experience. So, even though positively valenced music may influence wait length duration perceptions negatively, it also impacts mood positively and mood influences the overall evaluation of the experience.

In a field study concerning telephone wait times, music was used as one of the conditions to fill silence when people were waiting on a phone (Antonides, Verhoef, & VanAalst, 2002). Besides playing music, other conditions included wait duration information, queue information, or silence. Music had a significantly positive effect on the evaluation of the wait but did not influence the perceived duration of the wait.

### VOICE CHARACTERISTICS AUDITORY RESEARCH

While the overwhelming majority of auditory studies in marketing involve music, there is some research examining other aspects of hearing. Both MacLachlan and Siegel (1980) and Chattopadhyay, Dahl, Ritchie, and Shahin (2003) investigated aspects of announcer speech. MacLachlan and Siegel (1980) found that a 25% time compression of TV commercials increased unaided and aided recall. However, they note that voice pitch was not changed with the compression. Chattopadhyay et al. (2003) varied three characteristics of announcer speech: voice pitch (high, low), syllable speed (normal, high), and pause length (normal, short). A voice with faster than normal syllable speed and low pitch produced less negative advertising directed cognitive responses and more favorable attitudes toward the ad and toward the brand. No significant results were found for pause length suggesting that participants had sufficient opportunity to process the information. Instead, the authors suggest that while the opportunity to process did not diminish with increased speed, the motivation to process did.

#### Auditory and Visual Processing

Using hemisphere specialization, Anand, Holbrook, and Stephens (1988) transmitted instrumental music to one ear of participants and verbal text in the other ear. Results showed that there was increased affect toward familiar stimuli and toward words transmitted to the right ear and music transmitted to the left ear. The authors argue that this evidence supports a cognitive affective model in which affective responses are formed with cognitive mediation rather than the independence of the affective and cognitive systems.

In the context of product placement, Russell (2002) examined the modality of presentation (auditory, visual) of the product placement as well as the connection between the plot of a show (more or less connected). An auditory placement refers to the brand being mentioned in the dialog of the show while a visual placement is the appearance of the brand on the screen. The author stated that since the auditory channel carries the plot of the show, it is inherently more meaningful than the visual channel in the context of product placement. Thus, a congruent modality/plot connection exists when either the product placement is audio and the product is integrated into the plot of the show or the product placement is visual and the connection to the plot is minor. A product/plot mismatch occurs when either the placement is audio and the product is not integrated into the plot or the placement is visual and the product is integrated into the plot. Memory improved when the modality and plot connection were incongruent but persuasion was enhanced by congruency. Incongruent placements adversely affected brand attitudes because they seemed out of place and were discounted.

The effects of presentation modality (audio, visual) along with the modality of imagery (audio, visual) and the influence on learning was researched by Unnava, Agarwal, and Haugtvedt (1996). Results showed that there was greater advertising recall when the presentation modality differed from the imagery modality. The cognitive resources that were used in the process of imaging were the same that were used in perceptual tasks of the same modality so mutual interference between imaging and perceptual tasks inhibited message learning. In a related study, Costley, Das, and

Brucks (1997) asked the question of whether the modality of the retrieval cue (audio or visual) affects the recall of information originally presented in the same versus different modalities. Support was found for a “modality match” hypothesis in which retrieval cues enhance recall better within modality rather than across modality. Results are explained using the encoding specificity principle (Tulving & Thomson, 1973). This principle states that the likelihood of recall improves as the features present in the environment when the memory is encoded match those present in the retrieval environment. Features can include aspects of the stimulus context such as the modality of the information presented.

Tavassoli and Lee (2003) examined auditory and visual elements in advertising in the context of Chinese logographs (which rely more on visual processing) and English works (which rely more on audio and sound based processing). Findings indicated that auditory elements interfered more with the learning of and cognitive responding to English ad copy than with Chinese copy and vice versa for visual elements. However, auditory elements are better retrieval cues for English than for Chinese copy and vice versa of visual elements. The authors concluded that non-verbal elements in advisements such as auditory cues can compete for cognitive resources during message encoding but can also serve as effective memory cures. While music was not the focus of this research, various forms of music were used throughout the three experiments.

In one study, preschoolers and school aged children were used to examine information presented using audio messages and visual messages (Macklin, 1994). Children that only heard the information and children who only saw the information performed equally well on learning (there was no visual superiority effect). However, presenting information both visually and by audio was the most effective. When incomplete visuals were presented, school aged children had the ability to imagine the remainder of the visual while preschool aged children could not. The author argues that a critical element in processing is the comprehensibility of the information rather than the modality.

### Sense of Touch

The sense of touch, or haptics (touch with the hands) has historically been the least studied sense in marketing. Perhaps the rise of online and catalog shopping, and an inability to physically examine products prior to purchase has spurred this area of research. The primary categories of touch and haptic research include the differences in product attributes that encourage touch, individual differences in the motivation to touch, and situational influences that encourage touch. Finally, one research study examined the interaction between vision and touch and the elongation bias. Each of these areas will be discussed.

### Touch and Product Differences

Products differ in whether consumers will be motivated to touch them prior to purchase. Touch excels at ascertaining what Klatzky and Lederman (e.g., Klatzky & Lederman, 1992; 1993) call material properties which include texture, softness, weight, and temperature. If a product category varies in a diagnostic way on one of or more of these attributes, consumers will be more motivated to touch the product prior to purchase. For example, clothing varies on texture and weight and will likely encourage pre-purchase touch more than books or CDs, which do not vary on material properties in a diagnostic manner. Since marketing uses many self-report measures, Peck and Childers (2004) asked the question of whether participants’ verbal reports actually correspond to their behavior in the area of touch and product evaluation. They videotaped the hand movements

of participants as they concurrently verbalized during product evaluations. They found that in the area of behavioral reports and actions, there was correspondence between what people say and what they do. Product categories that varied most in material properties (e.g., sweater, tennis racket), were touched longer than those that varied somewhat (e.g., calculator, cell phone) and these were touched longer than categories with no diagnostic material properties (e.g., cereal, toothpaste).

Another logical question to ask is whether consumers can be compensated for an inability to touch a product during evaluation. Holbrook (1983), when using sweaters as stimuli for study, noted the strong role played by tactile cues when participants were evaluating the product. He encouraged using, or at least being aware of using, actual products compared to visual representations of products such as pictures in research. McCabe, Brown, and Nowlis (2003) varied whether the products differed on material properties and whether participants had the actual product to evaluate, a picture of the product, a list of attributes, or some combination. The primary dependent variable was purchase likelihood. Results showed that product categories that vary in the diagnosticity of touch (e.g., bath towels, carpeting) were more likely to be preferred in shopping environments that allow physical inspection than in those where touch is unavailable. However, there was no difference in the preference of products across the shopping environments (touch, no touch) when a product category did not vary on material properties (e.g., videotape, rolls of film) since for these categories, vision was diagnostic. Results also found that the differences in preference between the two environments were reduced when the material properties of the products were verbally described. In effect, compensation for lack of touch was possible with a written description (see also, Peck & Childers, 2003a).

### Touch and Individual Differences

Peck and Childers (2003a) also examined whether compensation for lack of touch was possible and considered the type of material properties to be compensated for as well as an individual difference in the preference for touch information. They conjectured that not all material properties create the same type of response in consumers. Specifically, the pleasant sensory feedback experienced when assessing softness may differentially influence the person touching compared to a more functional material property such as weight. In addition, they considered an individual difference in the preference for touch information. Peck and Childers (2003b) developed the Need for Touch scale (NFT) and tested the scale in seven studies. NFT is defined as a preference for the extraction and use of information obtained through touch. It includes two dimensions, an instrumental and an autotelic dimension. The instrumental dimension of NFT refers to those aspects of touch that reflect outcome directed touch with a salient purchase goal. The image of a consumer involved in instrumental touch is that of a problem solver consciously engaged in the goal directed activity of searching for information and arriving at a final judgment. The other dimension of NFT is the autotelic factor. Autotelic touch involves a consumer seeking fun, sensory stimulation and enjoyment with no purchase goal necessarily salient. The autotelic factor is defined as the enjoyment and affect of touch along with the compulsive or irresistible urge to explore via touch.

Peck and Childers (2003b) found that NFT moderated the relationship between direct experience and confidence in product judgments. For individuals higher in NFT, a lack of direct experience (an inability to touch) resulted in less confidence in the judgment. For low NFT individuals, confidence in judgment was unaffected by a barrier to touch provided there was a clear visual of the product. In a related study on compensation and an inability to touch products, Peck and Childers (2003a) found that high NFT participants were more confident and less frustrated when they could touch to evaluate products where low NFT subjects' confidence in judgment did not change on the

basis of whether they could touch the product. The researchers also found that for individuals high in NFT, compensation for an inability to touch was possible. For more functional haptic information, such as weight, a written description compensated for the inability to touch. However, for a material property with pleasant sensory feedback (softness), a written description did not provide this compensation. In effect, there are certain types of product attributes for which there is no substitute for actual touch. Low NFT subjects required a visual cue and the authors conjecture that visual information compensated for actual haptic exploration.

Similar to the instrumental dimension of Need for Touch, Citrin, Stem, Spangenberg, and Clark (2003) developed an individual difference scale titled, "Need for Tactile Input," and found that it was negatively related to products purchased over the internet, especially those categories that vary with respect to material properties. They also found that women showed a higher Need for Tactile Input than men.

An individual difference in the preference for touch information has been found to moderate the time touching products to ascertain information (Peck & Childers, 2004). Specific stereotypical hand movements termed EPs (exploratory procedures) have been linked to the haptic perception of material properties. For example, when individuals need to assess texture, they engage in the lateral motion EP which consists of rubbing the fingers back and forth across the surface of the objects. Peck and Childers (2004) videotaped subject's hand movements as they were evaluating products. They found that for all material properties except texture, high NFT individuals spent less time exploring with their hands than did individuals low in NFT. The authors note that since touch information is more accessible for high NFT individuals, they are more efficient at extracting this information. Higher accessibility of haptic information for high NFT individuals was exhibited thorough a free recall exercise and through a timed response measure (Peck & Childers, 2003b). However, since texture provided a pleasant sensory feedback (a soft sweater), high NFT individuals spent a longer time assessing texture than their low NFT counterparts.

### Touch and Situational Factors

While the forgoing research involved judgments related to actual products, some research on touch expands the use of touch in marketing. Peck and Wiggins (2006) examined touch completely unrelated to a product but in the context of a persuasive ad. They varied the valence of a touch element attached to a pamphlet (negative, neutral, and positive) as well as fit of the touch element with the ad. They found that adding a touch element that felt good, for example a feather on a pamphlet requesting donations to a local arboretum, increased persuasion measured as attitude toward the ad as well as the likelihood of donating time and/or money to the organization. An unexpected finding was that the fit of the touch element with the ad did not matter for those high in autotelic NFT. Any touch element was better than no touch element for the high autotelic NFT participants. However for people low in autotelic NFT, it was important that the touch element fit with the message or it had no influence on persuasion.

In another study, not related to product touch, Hornik (1992) examined touch as non-verbal communication in an interpersonal touch context. He found, in three field settings (Study 1, a bookstore; Study 2, a restaurant; Study 3, a supermarket) that an unobtrusive touch by an employee on the arm of a customer enhanced the positive feeling for the external stimuli (e.g., the bookstore) as well as the touching source (the employee). Customers touched by a requester tended to comply more than those customers that were not touched.

Peck and Childers (forthcoming) manipulated the environment in a study in a grocery store examining impulse purchase behavior and environmental stimuli encouraging touch. They

varied point of purchase signs (either no sign or “feel the freshness” encouraging touch) and found that the sign encouraging touch resulted in more unplanned purchasing than the no sign condition. In addition, there was a main effect of the individual difference in autotelic NFT. Individuals high in autotelic NFT made more unplanned purchases than low autotelic NFT individuals.

Finally, Krishna (2006) investigated the elongation bias and shows that sensory modality (touch or vision) affects the extent and the direction of the elongation bias. The elongation bias predicts that with two containers of equal volume, the taller of the two is judged to have a larger volume. The author hypothesized that in a visual perception task, height is the salient dimension, thus the taller container appears larger. However, in another condition, when the participants had only haptic cues (they handled the objects blindfolded), width became the salient dimension and there was a reversal in the elongation bias (wide containers appeared bigger).

## SUMMARY OF STUDIES

Research in the areas of olfactory, auditory, gustatory, and tactile senses can be grouped for the purposes of further discussion by whether the focus is on individual consumer factors, product or features of the stimuli, or on factors in the environment.

### Individual Factors

Some research has looked at individual sensitivity to sensory input. In the area of haptics or touch research, researchers have delineated an individual difference in consumers' motivation to touch. Scales have been developed to measure this difference (Citrin et al., 2003, Peck & Childers, 2003b) and this individual difference has been found to have numerous effects. Consumers higher in their preference to touch have touch information more accessible in memory (Peck & Childers, 2003b), are not as likely to shop where they can't touch, such as on-line (Citrin et al., 2003, Peck & Childers, 2003b), are more difficult to compensate for an inability to touch (McCabe & Nowlis, 2003, Peck & Childers, 2003a), and are more likely to make impulse purchase decisions (Peck & Childers, 2003b; Peck & Childers, forthcoming).

In other areas of sensory research, an individual difference in the preference for information has not been as prevalent. In gustatory or taste research, taste discrimination has been an area of interest (Buchanan et al., 1987; Morrison, 1981; Moskowitz et al., 1980) and some individuals are better at discriminating various tastes compared to others. In fact, in the research on product reformulations, the goal may be to ensure that even the most taste sensitive individuals will not notice the taste change in a reformulation (Dubow & Childs, 1998). Individual differences in behavior have been the focus of some work in the taste area. In-store sampling was the context for the observation of obese and nonobese shoppers (Steinberg & Yalch, 1978) as well as consumer behavior around bulk food bins (Johnson, Sommer, & Martino, 1985). In some taste research, differential results have been found for different levels of users and non users of brands (Maison, Greenwald, & Bruin., 2004) and researchers have called for a consideration of this individual difference in research (Vilani & Morrison, 1976).

Similarly, a call has been made in the area of music to consider individual listener characteristics in response to different types of music (Bruner, 1990, Kellaris & Kent, 1994). Individual differences have been manipulated by manipulating involvement (MacInnis & Park, 1991; Park & Young, 1986) but, in general, individual responses to music or other auditory stimuli have not been examined in marketing.

### Product or Stimuli Factors

Besides individual factors, some research focuses on the differences in products or stimuli and sensory research. Using real products versus pictures or sketches can produce differential product evaluations (Holbrook, 1983). This is at least partially due to information that is available through direct product experience versus another medium such as advertising (Smith & Swinyard, 1983). Both touch and taste are more directly related to specific products as compared to scent and music which may be ambient and may or may not be associated with a specific product. It can be argued that when judging physical products, touch and taste may give relatively more information about products when touch or taste is available compared to when it is not.

The sense of touch has been found to matter more for different types of product categories, those that vary on product attributes best determined by touch such as texture or weight (McCabe & Nowlis, 2003, Peck & Childers, 2003a). Tasting in the context of in-store sampling seems to be more critical for store versus national brands (Bellizzi & Martin, 1982; Sprott & Shrimp, 2004) presumably because in these instances of touch and taste, sensory experience is diagnostic with respect to product quality. Yet, taste may be overridden by inferences regarding packaging (McDaniel & Baker, 1977) or brand name (LeClerc, Schmitt, & Dubé, 1994). Although it may be assumed that there is no substitute for direct product experience through taste or touch, the framing of the experience can influence customer perceptions (Levin & Gaeth, 1988). In fact, the memory of the actual experience can be altered through post experience advertising (Braun, 1999).

Products have also been examined in terms of familiarity of brands and sensory influences. An ambient scent had more impact on less familiar brands (Morrin & Ratneshwar, 2000; Spangenberg, Crowley, & Henderson, 1996), thereby providing an outcome similar to the research on taste influencing store or generic brands more than national brands (Bellizzi & Martin, 1982; Sprott & Shrimp, 2004). However, Morrin and Ratneshwar (2003), in a follow up study, found that ambient scent improved recall and recognition of both familiar and unfamiliar brands through an increase in attention.

In examining the product/stimuli factors, the idea of fit or congruence is a common theme. In general, the notion of fit has to do with a consumer's perception of the relevance of two elements. Whether the product class was congruent with the sensory element didn't matter as far as recall or recognition of brand names (Morrin & Ratneshwar, 2000, 2003), yet congruency encouraged more thorough decision making (Mitchell et al., 1995). In a background music study, Schlosser (1998) found that only social identity and not utilitarian product evaluations were influenced by retail atmospherics. Here, music was only one element of the retail atmosphere that fit with the other elements to convey either a prestige or a discount environment. Whether a sensory element fit with an advertisement has been manipulated with music (Kellaris, Cox, & Cox, 1993; McInnis & Park, 1991) and touch (Peck & Wiggins forthcoming). Fit of the affective tone of an ad (Gorn et al., 2001) and purchase occasion (Alpert et al., 2005) with a person's mood evoked by music has also been examined. In general, a fit tends to facilitate processing.

### Environmental Factors

While individual and product differences have been studied in consumer behavior, the majority of research involves manipulating elements of the environment to determine various consumer processing and behavior effects. Since scent and music are often ambient, it follows that an environmental manipulation is logical. Much of the research in scent and music falls into the retail atmospherics category and will be discussed first. Environmental factors associated with taste con-

cern the opportunity to taste and in-store sampling. Similarly, the opportunity to touch has been manipulated, sometimes in the context of online versus in-store shopping environments. Finally, notions of fit or congruency of the environment and various sensory elements will be discussed.

In-store environments have been altered by sensory elements. Perceptions of the retail environment have been found to be influenced by scent (Chebat & Michon, 2003) and music (Dubé & Morin, 2001), which ultimately influenced the positive affect of the shopper. Sensory elements have been manipulated along with social cues and the density of the retail environment (scent, Michon et al., 2005) and the number of visible employees and customers (music, Baker et al., 1992). Music has also been shown to influence mood, which influences product choice (Gorn 1982), especially when a shopper is not aware of the source of their mood (Gorn et al. 1993).

An active area of research concerns sensory stimuli in retail environments and actual time shopping or waiting as well as time perceptions (Antonides et al., 2002; Cameron et al., 2003; Hui et al., 1997; Kellaris & Kent, 1992, Milliman, 1982, 1986; Spangenberg et al., 1996; Yalch & Spangenberg, 2000). Research has examined actual time in an establishment (e.g., Milliman 1982 (music tempo), Spangenberg et al. 1996 (scent)) as well as perceived time (e.g., Yalch & Spangenberg, 2000). It is clear that sensory elements in the environment can alter time perceptions. For example, a positive scent (Spangenberg et al., 1996) and familiar music (Yalch & Spangenberg, 2000) resulted in shoppers thinking they had spent more time in the store than they actually did.

Similarly, pleasant music has shown to result in longer perceived wait times (Antonides et al., 2002; Hui et al., 1997; Kellaris & Kent, 1992), but a more positive evaluation of the service or retail establishment (Antonides et al., 2002; Cameron et al., 2003).

The opportunity to taste has been examined in the context of in-store sampling. The choice of a generic or store brand versus a national brand can be influenced by in-store sampling (Bellizzi & Martin, 1982; Sprott & Shrimp, 2004), but brand awareness can limit the choices sampled and the quality of the choice (Hoyer & Brown, 1990). An in-store distraction when tasting can also increase the purchase likelihood of the sampled food (Nowlis & Shiv, 2005; Shiv & Nowlis, 2004). In touch research, environmental salience of touch has been manipulated through a point of purchase sign encouraging touch (Peck & Childers, forthcoming). Increasing the environmental salience of touch increased impulse purchasing. The opportunity to touch has been manipulated, and researchers have examined types of compensation for when touch is unavailable (McCabe & Nowlis, 2003; Peck & Childers, 2003a). Hornik (1992) brings together taste and touch by examining the influence of interpersonal touch and in-store sampling (Study 3) and finds that unobtrusive interpersonal touch increased compliance behavior (larger number of people sampled).

Similar to product/stimuli factors, the notion of fit or congruency has been an active area of study. In some cases, the fit of the task to the particular sense has been examined. Krishna finds that the elongation bias is visual, and touch or haptic exploration reversed this bias. Russell (2002) noted that a congruency between type of product placement (audio or visual) and how embedded the placement is in the script differentially influenced memory and persuasion. While memory was enhanced for incongruity, persuasion was enhanced for congruency. Similarly, Unnava et al. (1996) found that a mismatch between sensory modality (audio or visual) and imagery modality increased recall for advertising information. Costley et al. (1997) investigated the nature of the modality of a retrieval cue (audio or visual) and found that recall was greatest when a modality match was present.

Other elements of fit or congruency that have been investigated concern the fit of scent and music (Mattila & Wirtz, 2001, Spangenberg et al. forthcoming), music and the retail store (Chebat et al., 2001; Grewal et al., 2003; Meyer 1981, Spangenberg et al. (forthcoming)), music with the advertising message (Gorn et al. 2001; MacInnis & Park., 1991), touch and the advertising message

(Peck & Wiggins, forthcoming), music and purchase occasion (Alpert et al., 2005), and scent and product class (Mitchell et al., 1995). In general, positive effects of congruency or fit have been found. Following this synthesis of past research studies, we next consider some significant gaps that emerge from our review and discuss their potential for future research on sensory factors on consumer behavior.

## FUTURE RESEARCH

### Individual Differences—Ability and Preferences

An area for future investigation concerns whether an individual difference in sensory perception is a result of a differential ability or sensitivity of individuals to different types of sensory input or more of a motivation or preference for certain types of sensory information. The ability of individuals to obtain information refers to the capability of an individuals' sensory system. In the area of taste discrimination, it appears that some individuals may have greater sensitivity to variations in taste, or a greater ability to determine differences (e.g., Buchanan et al., 1987). However, in touch research, the focus has been on the motivation or preference for touch information by different individuals (e.g., Citrin et al., 2003; Peck & Childers, 2003b). Similarly, a preference for visual versus verbal information has been documented (Heckler, Childers, & Houston, 1993). Why do some individuals prefer different types of sensory information?

A logical step in sensory research would be to identify whether sensitivity to one type of sensory input translates to other types of sensory information. For example, women have been found to be more affected by scent (Bone & Ellen, 1999), music (Grewal et al., 2003), and touch (Citrin et al., 2003) compared to men. Do the individuals with a preference for a type of sensory information also have a greater ability or sensitivity to that type of information? Are people that are motivated to obtain one type of sensory input generally motivated to explore with their other senses as well? Perhaps taste and touch, being more direct senses are related more than smell and hearing. There are all unanswered questions in our literature.

### Multi-Sensory Integration

Another major area in need of future research is the need to move from a more "sense by sense" perspective to investigations of the multi-sensory integration of sensory inputs. As Calvert, Spence, and Stein (2004, p. xi) note, "There can be no doubt that our senses are designed to function in *concert* and that our brains are organized to use the information they derive from their various sensory channels *cooperatively* in order to enhance the probability that objects and event will be detected rapidly, identified correctly, and responded to appropriately" (emphasis added). Ernst, Bulthoff, and Newell (2003; cited in Newell 2004) found that bimodal recognition was enhanced by 10% versus learning that occurred either visually or haptically. Recent research has examined how such cross modal interactions can affect the processing of texture perception (Lederman & Klatzky, 2004), recognition (Newell, 2004), as well as selective attention (Marks, 2004). For instance, Marks (2004) reviews studies on congruence across vision, audition, and tactile inputs. He distinguishes between cross modal interactions that facilitate versus interfere with judgments that can be differentiated by their perceptual (more semantic) versus stimulus similarities. Soto-Faraco, Lyons, Gazzaniga, Spence, and Kingstone (2002) found strong congruence effects for vision and hearing when the stimuli co-occurred temporally and spatially. One implication is that perceptual congruence rests on multi-sensory relativity within context, whereas stimulus congruence is more likely to be driven by the absolute values of the stimulus features. This research might bear additional insight on the

perceptual versus conceptual effects of fluency on, for example, logos (Janiszewski & Meyvis, 2001). Likewise, Lederman and Klatzk (2004) conclude there is no sensory dominance of texture by vision and haptics, but rather processing is driven by the contextual emphasis of an object's surface (e.g., roughness or spatial density). These authors propose the modality appropriateness hypothesis, which focuses on the weights given sensory stimuli under unimodal performance when predicting the effects for multi-sensory integration judgments.

### Multi-Sensory Mental Imagery

Mental imagery is a mental representation of something (esp. a visible object), not by direct perception, but by memory representation, i.e., a mental picture or impression, an idea, or conception (Richardson, 1999). This definition, like the work in consumer behavior, places much emphasis on visual mental imagery. However, imagery may be elicited by all of the senses and the papers reviewed in this chapter are conspicuous in the lack of attention directed toward gustatory, auditory, olfactory, and tactile imagery. How these images might affect consumer processing need to be investigated from both an individual differences perspective as well as how these forms of imagery would mediate the kinds of stimulus congruency, memory, attitude, and judgment effects summarized in this review. Some research suggests that tactile discrimination is mediated by visual imagery (Sathian, Zangaladze, Hoffman, & Grafton, 1997). Grunwald, Weiss, Krauss, Beyer, Rost, and Gutbertlet (2001) also report the involvement of visual areas of the brain in haptic object recognition and suggest a spatially-based integration of information (also see Kosslyn, Pascual-Leone, Felician, Camposano, Keenan, & Thompson, 1999). In her review, Newell (2004) concludes that visual imagery mediates, and is perhaps necessary, for tactile tasks, but given findings on cross modal facilitation it may be that other imaginal modalities may play a role as well. For instance, how might olfactory imagery affect gustatory cues in flavor perception (Dalton, Doolittle, Nagata, & Breslin, 2000).

### Brain Imaging Techniques and Sensory Factors

Investigation of these effects across modalities also raises an opportunity for research in consumer behavior using alternative methodologies. Yoon, Gutchess, Feinberg, and Polk (forthcoming) used functional magnetic resonance imaging (fMRI) to investigate whether judgments about products and persons share similar neural correlates. Their results show that human descriptor judgments are processed in the medial prefrontal cortex, whereas judgments about products occurred in the left inferior prefrontal cortex. The use of a variety of human imaging techniques, including EEG, MEG, PET, as well as fMRI, represent a significant challenge to researchers trained in more behaviorally based experimental paradigms, but the multi-sensory nature of consumption experiences represents a rich context for the application of these techniques. Using fMRI, Grill-Spector, Kushnir, Edelman, Itzhak, and Makach (1998) found that the lateral occipital complex (occipitotemporal areas) responds to visual objects defined by motion or texture. Amedi, Malach, Hender, Peled, and Zohary (2001) also report activity in the same visual area for haptic based object identification. These results are also consistent with fMRI results reported by James, Humphrey, Gati, Servos, Menon, and Goodale (2002) for haptic priming on visual object recognition. One application of these techniques would be to support the validation efforts of psychometric assessments of new measures of individual difference scales, particularly in the area of multi-sensory imagery. Another would be a deeper understanding of how different specialty populations process sensory factors.

### Sensory Interactions with Specialty Populations

To date, only a limited amount of consumer research has examined how disabled consumers fare in their consumption environment (cf., Kaufman-Scarborough, 1999). However, considerable research on brain plasticity (how neighboring cortical areas can remap as a result of sensory deprivation) suggests this population offers much potential for a deeper understanding of how sensory information is processed, stored, and utilized (for an indepth discussion, see sections VI and VII in Calvert, Spence, & Stein, 2004). Sadato, Pascual-Leone, Grafman, Ibanez, and Dold (1996) using PET found activation in primary visual areas of the brain in visually impaired individuals while reading Braille letters. However, no similar pattern of activation was found for sighted participants (see also, Kujala, Huutilainen, Sinkkonen, Ahonen, Alho, & Hamalainen 1995) for auditory stimulation of the visual cortex). Similarly, visual stimulation has also increased activation of the auditory primary cortex for deaf, but not hearing-abled individuals (Finney, Fine, & Dobkins, 2001). These results raise interesting questions of how the visually impaired shop online using audio-based screen readers and how the addition of tactile-based graphics might affect their purchasing versus their sighted counterparts. Also, what effect would visual imagery instructions have on online visually impaired shoppers? Would resource consuming imagery overload these consumers as they are externally paced through a Web page through this assistive technology?

In addition to disabled consumers, sensitivity to sensory inputs likely varies by age. While one study with children has looked at the processing of audio and visual information (Macklin, 1994), it is clear that much more research could be done. The aging population also has implications for sensory exploration. In general, sensitivity to stimuli declines with age (c.f. touch, Thornbuy & Mistretta, 1981; Stevens & Patterson, 1995) so that it may take an increase in intensity of sensory stimuli to be perceived by older populations. For example, ambient scent may need to be more concentrated, and music may need to be louder. Beside a differential ability in perception, preferences are likely to differ by age, at least for some sensory stimuli, such as music.

### CONSCIOUS VERSUS NON-CONSCIOUS SENSORY PROCESSING

“When he (Freud) said that consciousness is the tip of the mental iceberg, he was short of the mark by quite a bit—it may be more the size of a snowball on top of that iceberg” (Wilson 2002, p. 6). Does the individual have to be conscious of the sensory input in order for it to be influential? There seems to be some evidence that awareness may not be critical. Although not the focus of the studies, research in both scent (Hirsch, 1995; Morrin & Ratneshwar, 2000) and music (Milliman, 1982) has found that consumers may not even be aware of these environmental stimuli. Holland, Hendriks, and Aarts (2005) found that when individuals were exposed to citrus-scented cleaner, the accessibility of cleaning was increased (Studies 1 and 2) and cleaning behavior increased (Study 3). In addition, subjects were unaware of the influence of scent on both their memory accessibility and their behavior. The nonconscious processing of sensory information may be more likely for sensory stimuli present in the environment in which the consumer is passively surrounded with the sensory information (i.e., olfactory and auditory) compared to when direct physical contact is necessary for sensory input (i.e., gustatory and haptic). Given the rise in interest and knowledge of nonconscious processing and some evidence that individuals can be influenced without their awareness in various sensory domains, this area is worthy of further study.

## IN CONCLUSION, TO MAKE A FULL TURN; IF IT TASTES, SMELLS, SOUNDS, AND FEELS LIKE

A Duck, Then it Must Be A ... (Duck)". "Perhaps," would seem to be the best answer. Sensory stimuli can aid in our processing of information and sometimes can bias and mislead us in forming our impressions. This fascinating contradiction, however, makes the study of sensory factors in consumer behavior challenging and all the more rewarding as we further our investigations of how consumers make sense of their world.

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