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# The Impact of Ambient Scent on Evaluation, Attention, and Memory for Familiar and Unfamiliar Brands

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*Subjects were exposed to familiar and unfamiliar brand names in either a pleasantly scented or unscented environment. A computer recorded how much time they took to evaluate each brand. After a distracter task, their memory for the brand names was tested with recall and recognition measures. The results indicate that the presence of a pleasant ambient scent improved brand evaluations, especially for unfamiliar brands. Neither mood nor arousal appeared to mediate this process. The pleasant ambient scent also improved recall for unfamiliar, but not familiar, brand names. Analysis indicated that this process was mediated by attention, that is, the amount of time spent evaluating brand names. Recognition was not affected significantly by scent. Implications, limitations, and areas for future research are discussed. J BUSN RES 2000. 49:157-165. © 2000 Elsevier Science Inc. All rights reserved.*

The use of ambient scent, or atmospheric odor, as a means to affect human behavior appears to be on the rise. Proctor and Gamble has tested point-of-purchase devices that emit product smells into store aisles (Freeman and Dagnoli, 1988). Hospitals have used ambient scents to calm cancer patients during medical procedures (Owen, 1994). Some overseas corporations report emitting scents through air ducts to energize office workers (e.g., Baron and Thomley, 1994). One company has even devised a way to pump scents into the cabs of 18-wheelers to keep drowsy truck drivers from falling asleep at the wheel (Bounds, 1996). At present, annual sales in the environmental fragrancing industry total approximately \$1 billion (Goldstein, 1996).

Olfaction, or the sense of smell, however, remains a relatively underresearched topic in the fields of psychology and

consumer behavior, especially when compared with the amount of research devoted to other senses, such as vision and hearing (Cohen and Chakravarti, 1990; Gilbert and Greenberg, 1992). The field of environmental psychology has examined humans' physiological responses to other types of ambient stimuli, such as noise, light, temperature, and pollution (Bonnes and Secchi-arioli, 1995), but comparatively little attention has been devoted to scent. Moreover, the bulk of work in this area has investigated the impact of environmental stimuli in contexts such as hospitals, housing projects, and various types of institutions, rather than in environments of primary interest to marketers, such as retail stores.

In the field of marketing, environmental stimuli such as color (Crowley, 1993), clutter (Bitner, 1990), crowding (Eroglu and Machleit, 1990), and music (Yalch and Spangenberg, 1990) have been examined. As in psychology, relatively little attention has been devoted to the impact of ambient scent. Gulas and Bloch (1995) emphasized the need for researchers to investigate the impact of scent on consumer behavior and proposed a general framework for investigation (see also Bitner, 1992). Only recently have researchers begun to systematically investigate the impact of ambient scent on consumer behavior (e.g., Bone and Jantranis, 1992; Knasko, 1995; Mitchell, Kahn, and Knasko, 1995; Spangenberg, Crowley, and Henderson, 1996). Prior research has focused largely on the impact of ambient scent on product evaluation. In the present study, the impact of a pleasant ambient scent is investigated not only in terms of its effects on evaluations but also in terms of its effects on attention toward and memory for brand names.

## Conceptual Background

Although researchers have attempted to develop classification systems for odors (e.g., Henning's prism, see Goldstein, 1996),

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none have proved universally applicable. Some of the earliest research examined issues such as individuals' abilities to identify odors or to detect changes in their intensity (e.g., Cain, 1977). The sense of smell has been classified as one of the "chemical" senses, because it involves the response to gaseous molecules that, when perceived, are assimilated into the body (Cain, 1988; Scott and Giza, 1995). As such, the sense of smell is believed to act as a "gatekeeper," helping to determine which environmental stimuli contribute toward versus detract from an organism's goal of survival (Goldstein, 1996). Although the relative importance of the sense of smell to survival of the species is probably less critical for humans, who possess approximately 10 million olfactory receptors, than for other species, such as dogs, who have one billion such receptors (Goldstein, 1996), its influence on human behavior is undeniable. Individuals learn through experience to use scents as cues for either pleasant and approachable stimuli, such as food, or unpleasant ones that are better avoided, such as smoke or leaking gas (Goldstein, 1996).

### *Ambient Scent and Approach/Avoidance Behavior*

It is not surprising, then, that many studies investigating ambient scent have focused on its impact on "approach/avoidance" behavior, reflecting Mehrabian and Russell's (Mehrabian and Russell, 1974) model (M-R model) of the impact of environmental factors on human behavior. Mehrabian and Russell suggested that environmental stimuli impact individuals' behavior through the creation of affective states characterized predominantly by levels of pleasure and arousal. Pleasure refers to feelings of happiness or sadness, whereas physiological arousal refers to feelings of alertness or drowsiness (Engel, Blackwell, and Miniard, 1995).

The M-R model suggests that an individual's exposure to environmental stimuli will result in either positively valenced arousal or negatively valenced arousal. Positive arousal, they suggest, will result in approach behavior, whereas negative arousal will result in avoidance behavior. Approach behavior involves the desire to physically remain in the environment, desire to explore the environment, the willingness to communicate with others in the environment, and exhibition of enhanced task performance and satisfaction while in the environment. Avoidance behavior, on the other hand, involves the desire to physically leave the environment; the desire to remain inanimate in the environment; the avoidance of interacting with others in the environment; and occurrence of hindered task performance and lowered satisfaction while in the environment. These tendencies are often measured in terms of amount of time physically spent in a particular environment or in one's evaluation of the environment.

To date, marketers' efforts in the area of ambient scent have focused largely on its impact on approach/avoidance behavior, typically in a retail environment. Knasko (1989) (see also Knasko, 1995), for example, found that pumping pleasant scents into a store atmosphere increased the amount

of time a consumer spent in the store, although it did not affect the total amount of merchandise purchased. In a simulated shopping environment, Spangenberg, Crowley, and Henderson (1996) found that pleasant scents improved shoppers' ratings of both the store environment and the store merchandise and increased shoppers' intent to visit the store. Studies have shown therefore that the presence of a pleasant ambient scent can both lengthen the amount of time consumers spend in the environment and improve their evaluations of the environment and of stimuli encountered in the environment.

Although pleasant scents have been found in some studies to improve subjects' moods (e.g., Lawless, 1991) and/or increase physiological arousal levels (e.g., Donovan and Rossiter, 1982; Lorig and Schwartz, 1988), the results have been rather mixed (e.g., Spangenberg, Crowley, and Henderson, 1996). The psychological mechanisms underlying observed effects of ambient scent on approach/avoidance behavior therefore are not well understood. In the present study, subjects' mood and arousal levels are measured to see whether either of these affective mechanisms is responsible for any observed effects of ambient scent.

### *Attention and Stimulus Novelty*

The present study examines the impact of a pleasant ambient scent in terms of approach behavior, as does much of the prior research in this area. However, in this study approach behavior is operationalized in terms of attention, or the amount of time consumers take to evaluate stimuli encountered in the environment. More specifically, in this study, subjects are exposed to a large number of brand names and are asked to provide an evaluation of each. In this context, approach behavior will be evident in the pleasantly scented environment if subjects take more time to evaluate the brands. We also examine whether subjects rate brands more favorably in the pleasantly scented environment than in the unscented environment, as would be expected based on prior research.

The present research examines the moderating effect of stimulus novelty on these processes. It was expected that the positive impact of a pleasant ambient scent on brand evaluations would be more evident (i.e., larger) for unfamiliar brands, for which evaluations must be constructed on-the-spot. This effect should be smaller for familiar brands, for which consumers typically possess prestored evaluations. Stimulus novelty, as operationalized by brand familiarity was therefore expected to moderate the effect of a pleasant ambient scent on the brand evaluation process.

Similarly, when in a pleasantly scented environment, would consumers spend more time attending to all of the stimuli encountered there or only to stimuli that are new to them? It is well established that novel stimuli can stand out and capture added attention because they do not match one's expectations (Martindale, 1991). It seems reasonable to expect, therefore, that additional attention would more likely be expended on novel stimuli in contexts perceived (perhaps unconsciously) to be an approach environment, that is, one

which encourages approach behavior because there are potentially helpful or pleasurable stimuli in the environment.

The stimuli to which subjects are exposed in this study and on which they are later tested consist of brand names for toiletries and household products. Some of the brand names were well known and highly familiar to the subjects (e.g., Ivory soap and Safeguard deodorant), whereas others were novel and unfamiliar to them (i.e., hypothetical brands created for the study, such as Somay fragrances and Diman cleanser). Subjects were expected to be particularly motivated to devote additional attention or processing time to evaluating the brands in the pleasantly scented environment, especially the unfamiliar brands, compared with those in an unscented environment.

It was expected, in turn, that the additional time and processing efforts used to evaluate unfamiliar brand names in the pleasantly scented condition would result in better learning and stronger associations for these brands in subjects' long-term memories, which would then be evident in superior recall and recognition for these brands. This expectation is based on a robust set of findings in the memory literature suggesting that amount and depth of stimulus processing is highly correlated with strength of memory traces and hence retrieval ease and accuracy (e.g., Craik and Tulving, 1975; see Baddeley, 1990). Attention, or time spent evaluating the brands, therefore was expected to mediate the effects of ambient scent on memory processes.

## Hypotheses

The specific hypotheses to be tested are outlined below:

- H1: Subjects in a pleasantly scented environment will rate brands (especially unfamiliar brands) more favorably than will subjects in an unscented environment.
- H2: Subjects in a pleasantly scented environment will pay more attention to brands (especially unfamiliar brands) than will subjects in an unscented environment.
- H3a: Subjects in a pleasantly scented environment will exhibit higher recall of brands (especially unfamiliar brands) than will subjects in an unscented environment.
- H3b: Subjects in a pleasantly scented environment will exhibit more accurate recognition of brands (especially unfamiliar brands) than will subjects in an unscented environment.

## Method

### Subjects and Design

Fifty undergraduate students of business at a large, private university participated in the experiment in exchange for extra course credit in an introductory marketing course. The study

consisted of a 2 (ambient scent type: unscented, pleasant)  $\times$  2 (brand familiarity: familiar, unfamiliar) mixed model design. Scent type was a between-subjects factor, with subjects randomly assigned to either the unscented ( $n = 24$ ) or pleasantly scented ( $n = 26$ ) conditions for all phases of the experiment.<sup>1</sup> Brand familiarity was manipulated within-subject, with all subjects exposed to the same set of familiar and unfamiliar brand names.

### Independent Variables

**SCENT.** Prior research suggests that the most significant dimension underlying human judgments of scents is a hedonic component, typically assessed in terms of degree of pleasantness or liking (Ehrlichman and Halpern, 1988). A pretest ( $n = 27$ ) was conducted among the subject population to determine which of four pleasant scents was best liked (see Spangenberg, Crowley, and Henderson, 1996). Three floral scents that are generally rated favorably by humans (Moncrief, 1970) were included: rosemary, lavender, and geranium, as well as a tree-based scent, eucalyptus. The scents were identified by randomly assigned numbers, presented in small glass bottles containing a cotton ball with three to four drops of essential oil, and sniffed by pretest subjects in random order approximately six inches from the nose. The scents were evaluated on several nine-point semantic differential scales including measures of pleasantness, liking, and familiarity.

A univariate repeated measures ANOVA on mean favorability ratings revealed that some scents were liked more than others ( $F_{3, 78} = 4.58, p < 0.01$ ). Individual tests showed geranium was better liked than the other scents. It was rated more favorably than lavender (Paired  $t = 2.36, n = 27, p < 0.005$ ), and rosemary (Paired  $t = 2.46, n = 27, p < 0.05$ ), and directionally more favorably than eucalyptus (Paired  $t = 2.66, n = 27, p < 0.10$ ). The geranium scent therefore was chosen as the pleasant scent for the present study. The geranium scent was emitted into the atmosphere by an electric diffuser into which several drops of essential oil had been placed. In the pleasantly scented condition, the diffuser emitted the scent into the atmosphere continuously during both the learning and test phases of the experiment. In the unscented condition, no scent was emitted. The room used for the distracter task was unscented in all conditions. When running, the diffuser was placed behind a cardboard partition in a corner of the room so as to be inconspicuous. Although it was not possible to control the exact intensity of the scent emitted into the atmosphere, the same amount of essential oil was used each session, and the same amount of diffusion time was allowed to elapse before the running of the first subject for that day. One indication of the relative intensity of the scent is reported in Results in terms of the proportion of

<sup>1</sup>In addition to the unscented and pleasantly scented conditions, the study also included an unpleasantly scented condition. However, since the results of the latter condition were not readily interpretable, the results are not included in this report.

subjects aware of the presence of the scent in the atmosphere. Several days were allowed to pass between conditions to allow any lingering odors in the experimental room to clear out. Sessions were conducted on weekday mornings, afternoons, and evenings during two consecutive semesters.

**BRAND NAMES.** A total of 84 brand names were used in the study (see Appendix A). Subjects were exposed to half (42) of these brands, the target brands, during the first phase of the experiment. Thirty-four of these were well-known brands familiar to the subject population (e.g., Ivory soap and Safeguard deodorant), eight were unknown brands with which the subjects were not familiar (e.g., Somay fragrances and Diman cleanser). Only eight unfamiliar names were included so as to minimize subjects' awareness of the presence of "fake" brands. The other half (42) were distracter brands seen only in the latter part of the experiment, during the recognition task. The distracters were matched with the target brands in terms of familiarity and product category membership. The familiar brand names for both the target and distracter brands were obtained from the cosmetics/toiletries and household products/supplies categories of the list of the top 2,000 brands in the United States (ranked according to media expenditures; Superbrands, 1990).

The names for the unfamiliar (i.e., hypothetical) brands, both target and distracter, were chosen from the Kucera and Francis (1967) lexicon, which contains over one million English words ranging in frequency in print. The unfamiliar brand names were matched on length (6 letters long), frequency (lowest possible), and number of syllables (two). The names are of such low frequency that they are not generally recognizable to most speakers of English. Pretesting established that all the hypothetical names used in the study were equally liked.

### Procedure

Subjects participated individually in a laboratory setting. They entered either the unscented or pleasantly scented room and completed a screener questionnaire that assessed hunger, smoking habits, and allergies to scents (Engen, 1982). Subjects with allergies or asthma were to have been excused from participation; however, no subjects reported this condition. Subjects were then assessed for their current feelings of pleasantness, arousal, and dominance.

Subjects were told that the purpose of the experiment was to obtain their opinions about a number of brands, some of which they would be familiar with and some of which they would not have heard of before. They were not aware that their memory for this information would later be tested. The subject was then seated in front of a Macintosh computer and provided with detailed instructions on screen. In the first part of the experiment, subjects were told they would be exposed to several brands of products and that their task was to evaluate each one at their own pace. After several practice trials (using brands unrelated to the study), subjects were exposed to the

42 target brands (34 familiar, 8 unfamiliar), one by one, in random order on a computer screen. Each name appeared and stayed on the screen until the subject provided an evaluation of the product by hitting one of the numbered keys at the top of the keyboard. One second elapsed between each trial. The computer captured both the brand rating and the time taken to rate each brand.

The subject then was brought into an unscented room to complete a five-minute paper and pencil distracter task to clear out short-term memory (Baron and Thomley, 1994). Next, the subject was brought back to the original room in which they had rated the brands (unscented or pleasantly scented, as in the initial phase). The subject was asked to complete a surprise free recall task in which they listed as many of the brands they had seen in the first part of the experiment as possible in a five-minute time period. Then the subject participated in a computer-based recognition task. The subject was exposed to the 42 target brands that had been rated in the first part of the experiment as well as 42 distracter brands that were not seen before, one by one, in random order, on the computer screen. Their task was to determine as quickly but as accurately as possible whether the brand on screen was one of the brands seen in the first part of the experiment. The subject answered each trial by hitting either the lower right "?/" key marked "YES" or the lower left "Z" key marked "NO." After each response the subject was provided with feedback. When the subject responded correctly, a high beep sounded; when the response was wrong, a low beep sounded. Providing feedback is a fairly common method to encourage subjects to balance accuracy with speed in tasks such as these. Next, the subject filled out a questionnaire that assessed their beliefs regarding the purpose of the study, a probe for hypothesis guessing, evaluations of room odor, brand familiarity, and basic demographic information. The subject was debriefed and thanked for participating.

### Dependent Variables

Pleasantness, arousal, and dominance were measured with the standard Mehrabian and Russell (1974) three-factor PAD scale consisting of several seven-point semantic differential items. Brand evaluations were obtained on a scale of 1 = not at all favorable to 9 = extremely favorable. Recall was assessed by the proportions of familiar and unfamiliar brands correctly recalled by individual subjects. Recognition accuracy was measured by the number of correct hits minus the number of false alarms recorded by a subject (theoretical range of -34 to +34 for familiar brands and -8 to +8 for unfamiliar brands).

## Results

### Manipulation and Other Checks

Familiar brands were rated as significantly more familiar than the unfamiliar brands ( $M_{\text{Familiar}} = 6.47$  vs.  $M_{\text{Unfamiliar}} = 1.61$ ,

**Table 1.** Brand Evaluations, Attention, and Memory as a Function of Ambient Scent and Brand Familiarity

	Unscented	Pleasantly Scented
Evaluations (1–9 scale)		
Unfamiliar brands	2.63 (0.17)	3.43 (0.16)
Familiar brands	5.43 (0.08)	5.66 (0.08)
Attention (milliseconds)		
Unfamiliar brands	3076 (107)	3639 (102)
Familiar brands	3287 (51)	3308 (49)
Recall (%)		
Unfamiliar brands	1.6	8.7
Familiar brands	32.7	34.3
Recognition (no. Hits-FAs)		
Unfamiliar brands	3.2	3.8
Familiar brands	23.3	23.1

Standard errors in parentheses. Theoretical ranges for recognition scores: –8 to +8 unfamiliar, –3+ to +3+ familiar. FA, false alarm.

Paired  $t = 19.74$ ,  $n = 50$ ,  $p < 0.0001$  (Table 1). Most (72%) of the subjects in the scented condition reported being unaware of “anything special” about the room’s atmosphere when queried toward the end of the experiment (0% of subjects in the unscented condition reported awareness of anything special). It can be tentatively concluded from this result that the intensity of the ambient scent was not overpowering for subjects. In a subsequent question, subjects were asked more specifically about whether they detected any odor or scent in the room: most said no (79%<sub>Unscented</sub>, 42%<sub>Scented</sub>). Others said yes (8%<sub>Unscented</sub>, 31%<sub>Scented</sub>) or were not sure (12%<sub>Unscented</sub>, 27%<sub>Scented</sub>). Subjects were then asked to rate the pleasantness and their liking of the room odor (these were averaged for an overall evaluation of room odor). The odor in the pleasantly scented room was not rated any more favorably than that of the unscented condition ( $M_{\text{Scented}} = 5.19$  vs.  $M_{\text{Unscented}} = 5.77$ ,  $t_{48} = 1.43$ , not significant). This result is likely due to the fact that most subjects in the scented condition did not notice the presence of an ambient scent during the experiment.

The ambient odor did not affect subjects’ mood or arousal levels. Neither feelings of happiness ( $M_{\text{Unscented}} = 4.32$ ,  $M_{\text{Scented}} = 4.52$ , not significant) nor arousal ( $M_{\text{Unscented}} = 5.18$  vs.  $M_{\text{Scented}} = 5.44$ , not significant) differed by scent condition. Since neither subjects’ mood nor arousal levels differed by scent condition, this suggests that any observed effects of ambient scent on consumers’ brand evaluations are unlikely to be mediated by mood or arousal. That is, the mechanism underlying ambient scent’s ability to improve evaluations does not appear to be driven by a process of affective transfer (i.e., mood) or misattribution of arousal.

### Hypothesis Tests

**EVALUATION.** It was predicted in H1 that subjects in the pleasantly scented condition would rate brands, especially unfamiliar (vs. familiar) brands, more favorably than would subjects in the unscented condition. A regression was conducted on the 2,100 brand ratings (50 subjects  $\times$  42 ratings

each) as a function of scent condition (unscented, pleasantly scented), brand familiarity (familiar, unfamiliar brand names), and their interaction, with subjects a random factor nested within scent condition. The main effect of brand familiarity was significant ( $F_{1, 2048} = 337.9$ ,  $p < 0.0001$ ), with brand ratings significantly higher for familiar ( $M = 5.54$ ) versus unfamiliar ( $M = 3.03$ ) brands. The main effect of scent was marginally significant ( $F_{1, 56.46} = 2.83$ ,  $p < 0.10$ ), with brand ratings marginally higher in the pleasantly scented ( $M = 4.54$ ) versus unscented ( $M = 4.03$ ) environments. The interaction was significant ( $F_{1, 2048} = 4.40$ ,  $p < 0.05$ ). Brand ratings for unfamiliar brands improved in the pleasantly scented environment by about one point on the nine-point scale ( $M_{\text{Unscented}} = 2.63$  vs.  $M_{\text{Scented}} = 3.43$ ,  $p < .005$ , Cohen’s  $d =$  effect size = 0.65) but had only a marginally significant impact on familiar brand ratings ( $M_{\text{Unscented}} = 5.43$  vs.  $M_{\text{Scented}} = 5.66$ ,  $p < 0.10$ ,  $d = 0.39$ ). These results support H1. The fact that neither mood nor arousal levels differed by scent condition suggests neither of these affective mechanisms mediated the impact of ambient scent on the evaluation process.

**ATTENTION.** It was predicted in H2 that a pleasant ambient scent would increase the amount of attention paid to brands, especially for unfamiliar (vs. familiar) brands. This was measured by the time taken to evaluate the brand names encountered in the first phase of the experiment. A regression was conducted in a manner similar to that for the ratings, with the dependent measure time in milliseconds (ms) to rate a brand. Neither the main effect of scent ( $F_{1, (ms) 52.07} = 1.14$ ), nor of brand familiarity ( $F_{1, 2048} = 0.47$ ) were significant, but the interaction between these two variables was ( $F_{1, 2048} = 9.45$ ,  $p < 0.005$ ). The presence of a pleasant scent increased the amount of time taken to rate unfamiliar brand names by about half a second ( $M_{\text{Unscented}} = 3,076$  ms vs.  $M_{\text{Scented}} = 3,639$ ,  $p < 0.0005$ ,  $d = 0.71$ ) but had no effect on time taken to rate familiar brands ( $M_{\text{Unscented}} = 3,287$  vs.  $M_{\text{Scented}} = 3,308$ , not significant), in support of H2.

**MEMORY.** It was predicted in H3a that a pleasant ambient scent would improve brand recall, especially for unfamiliar (vs. familiar) brands. A repeated measures ANOVA was conducted on the proportion (arcsine transformed) of familiar and unfamiliar brands recalled as a function of scent, brand familiarity, and their interaction. The main effect of brand familiarity was significant ( $F_{1, 48} = 248.6$ ,  $p < 0.0001$ ), with subjects recalling a significantly higher proportion of familiar (33.5%) versus unfamiliar (5.3%) brands. (Recall proportions reported are untransformed.) The main effect of scent was marginally significant ( $F_{1, 48} = 2.99$ ,  $p < 0.10$ ), with a marginally higher proportion of brands recalled in the scented (29.4%) versus unscented (26.8%) environment. The interaction was not statistically significant ( $F_{1, 48} = 2.20$ ,  $p = 0.14$ ). Nevertheless, individual comparisons suggest that the presence of a pleasant scent significantly increased subjects’ ability to recall unfamiliar brands ( $M_{\text{Unscented}} = 1.6\%$  vs.  $M_{\text{Scented}} =$

8.7%,  $p < 0.05$ ,  $d = 0.80$ ) but had no significant effect on their ability to recall familiar brands ( $M_{\text{Unscented}} = 32.7\%$ , vs.  $M_{\text{Scented}} = 34.3\%$ ). These results support H3a.

Next, a mediation analysis was conducted to examine whether attention was driving the effect of scent on recall of unfamiliar brands. A regression of unfamiliar brand recall on scent (Model  $F_{1,48} = 5.92$ ,  $p < 0.05$ ,  $R^2 = 0.11$ ) resulted in a significant effect for scent (omega-squared = 8.9%). When attention was added to the model, it improved model fit (Model  $F_{2,47} = 10.03$ ,  $p < 0.0005$ ,  $R^2 = 0.30$ ), with attention emerging as a significant factor ( $F_{1,47} = 12.7$ ,  $p < 0.001$ , omega-squared = 17.2%). The inclusion of attention in the model reduced the variance in recall explained by the scent manipulation ( $F_{1,47} = 3.83$ ,  $p < 0.10$ , omega-squared = 4.1%); the test for the difference in variance explained was marginally significant ( $F_{1,47} = 3.53$ ,  $p < 0.10$ ). This analysis suggests that scent improves recall of unfamiliar brands via the mediating variable of attention.

It was predicted in H3b that a pleasant ambient scent would improve brand recognition accuracy, especially for unfamiliar (vs. familiar) brands. A repeated measures ANOVA was conducted on corrected recognition scores for familiar and unfamiliar brands. The main effect of brand familiarity was significant ( $F_{1,48} = 883.4$ ,  $p < 0.0001$ ), with recognition accuracy significantly higher for familiar ( $M = 23.2$  out of a theoretical maximum of 34) versus unfamiliar ( $M = 3.5$  out of a theoretical maximum of 8) brands. Neither the main effect for scent ( $F_{1,48} = 0.08$ ) nor the interaction ( $F_{1,48} = 0.3$ ) were significant, however. Recognition accuracy did not differ significantly by scent condition for either the familiar ( $M_{\text{Unscented}} = 23.3$  vs.  $M_{\text{Scented}} = 23.1$ ) or unfamiliar brands ( $M_{\text{Unscented}} = 3.17$  vs.  $M_{\text{Scented}} = 3.80$ ). These results do not support H3b.

## Discussion

The first conclusion emerging from the present research concerns the impact of ambient scent on consumer memory processes, an area that has received relatively little attention from researchers. It was discovered that the presence of a pleasant ambient odor caused subjects to expend additional processing efforts on unfamiliar brand stimuli. As a result, subjects in the pleasantly scented condition exhibited superior recall of the unfamiliar brands. The evidence from this study suggests that subjects' improved memory for the unfamiliar brands is mediated by attention, or the amount of time spent evaluating brands in the environment. Hence, it would appear that pleasant scents improve memory, at least in part, through an encoding effect.

Since encoding refers to the initial acquisition of information and involves amount and depth of processing, it should drive trace-dependent retrieval. Cue-dependent retrieval, on the other hand, which concerns the ability to access stored information, is typically affected by the absence or presence

of external contextual cues. Not tested in this study but deserving of further attention is the possibility of cue-dependent or context-based retrieval effects of ambient scent. That is, ambient scent may improve memory not only because it lengthens encoding time but also because it serves as an external retrieval cue in the surrounding environment (e.g., Tulving and Pearlstone, 1966; Godden and Baddeley, 1975; Smith, Glenberg, and Bjork, 1978). If scent's impact on memory is a function of cue-dependent retrieval, then this would be evident only when the scent-based contextual cue were present at both the time of encoding as well as at the time of retrieval. If, instead, scent affects memory via a trace-dependent process, that is, simply through an encoding effect, then it would need to be present only at learning to manifest its impact. These alternative possibilities warrant further study.

The second conclusion concerns the mediating variable responsible for improved evaluation of stimuli encountered in a scented environment. Prior research has implied that the positive affect or arousal associated with pleasant ambient scent was transferred to the items being evaluated. The present research suggests, instead, that it may be some other aspect associated with odors that is responsible for the improved evaluations. Neither subjects' mood nor arousal levels differed between the scented and unscented conditions. Hence, it does not appear that the impact of atmospheric odors on object evaluation operates through either of these affective mechanisms (such as affective transfer or misattribution of arousal). Future research could be devoted to further understanding the psychological process underlying these observed evaluation effects.

The third conclusion emerging from this study concerns the moderating effect of stimulus novelty on the impact that pleasant ambient scents have on consumer information processing including attention, memory, and evaluation. In the present study, a pleasant ambient scent increased attention and memory and improved evaluations primarily for unfamiliar rather than familiar brand names. It is interesting to note that Spangenberg, Crowley, and Henderson (1996, p. 75) reported a similar, although not identical, finding whereby ambient scent tended to improve evaluations of less pleasing products but not of products that were already evaluated positively. It would appear that pleasant ambient scents improve evaluations much more markedly for objects that are either not familiar or not well liked. It may be that these evaluations are more likely to evidence change because they are constructed spontaneously rather than retrieved from memory. Alternatively, they may be less likely to face a ceiling effect, in that disliked brands have more room for improvement. For retailers, the implications are that using a pleasant ambient scent in a store may improve evaluations of new items in the store but perhaps not of items that are already well known or well liked by shoppers.

The results of the present study are limited in that they

were conducted in a laboratory setting with a convenience sample of student subjects. The range of stimuli and dependent measures used also were limited. It was interesting to note that most subjects in the scented condition did not notice the odor in the atmosphere. This may have an impact on observed effects. Future research could examine the effect of odor intensity and awareness on evaluation and memory processes. Future studies also could employ stimuli more complex than merely brand names, such as logos or packaging. Such studies could examine whether scent impacts the amount of time spent examining brand packages and in-store point-of-purchase displays. Issues such as the likelihood of making contact with a salesperson, the amount of salesperson contact time, the likelihood or extent of complaint behavior, and the amount of items examined from an information display also could be investigated. The products used in the present research represented names of frequently purchased packaged goods. Future studies could examine the impact of ambient scent on purchases of durables (e.g., in an automobile showroom or a real estate office). Involvement may moderate the impact of atmospheric odors on processing efforts if odors are utilized primarily as heuristic cues for evaluation. These and other areas represent interesting areas for further research.

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**Appendix A.** Brand Stimuli Used in Study

Targets	Distracters
1. Ralph Lauren fragrance	1. Calvin Klein fragrance
2. Chanel fragrance	2. Vanderbilt fragrance
3. Obsession fragrance	3. Eternity fragrance
4. Brut aftershave	4. Afta aftershave
5. Listerine mouthwash	5. Scope mouthwash
6. Viadent toothpaste	6. Pepsodent toothpaste
7. Revlon cosmetics	7. Almay cosmetics
8. Cover Girl cosmetics	8. Maybelline cosmetics
9. L'Oreal cosmetics	9. Estee Lauder cosmetics
10. Nivea lotion	10. Lubriderm lotion
11. Pond's cold cream	11. Noxema cold cream
12. Head and Shoulders shampoo	12. Selsun Blue shampoo
13. Caress soap	13. Dove soap
14. Ivory soap	14. Dial soap
15. Zest soap	15. Tone soap
16. Pampers disposable diapers	16. Huggies disposable diapers
17. Safeguard deodorant	17. Right Guard deodorant
18. Arrid antiperspirant	18. Degree antiperspirant
19. Sure antiperspirant	19. Ban antiperspirant
20. Coppertone suntan lotion	20. Bain de Soleil suntan lotion
21. Drano drain cleaner	21. Liquid Plumber drain cleaner
22. Downy fabric softener	22. Snuggle fabric softener
23. Surf laundry detergent	23. Tide laundry detergent
24. All laundry detergent	24. Wisk laundry detergent
25. Era laundry detergent	25. Cheer laundry detergent
26. Sunlight dishwashing liquid	26. Dawn dishwashing liquid
27. Ajax cleanser	27. Comet cleanser
28. Clorox bleach	28. Biz bleach
29. Glass Plus window cleaner	29. Windex window cleaner
30. Renuzit air freshener	30. Glade air freshener
31. Kleenex facial tissues	31. Scott facial tissues
32. Brawny paper towels	32. Bounty paper towels
33. Charmin bathroom tissue	33. Northern bathroom tissue
34. Pine-Sol deodorizing cleaner	34. Lysol deodorizing cleaner
35. Caron aftershave	35. Triol aftershave
36. Bondi cosmetics	36. Mando cosmetics
37. Somay fragrances	37. Prexy fragrances
38. Bexar laundry detergent	38. Maser laundry detergent
39. Diman cleanser	39. Beryl cleanser
40. Ancel suntan lotion	40. Hilar suntan lotion
41. Nevah suntan lotion	41. Patil suntan lotion
42. Samar suntan lotion	42. Arcus suntan lotion