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# The Signal Function of Thematically (In)congruent Ambient Scents in a Retail Environment

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## Abstract

An odor emitted by an object signals the presence of that object and may draw attention to it. Can odors that are not actually emitted by an object also function as a signal? We investigated whether the degree of thematic congruency between an ambient odor and a magazine affected magazine sales in a retail store. We selected two odors: a grass odor, congruent with soccer, animal/nature and gardening magazines; and a sunflower odor, congruent with personal care and women's magazines. In a field study in three bookstores, the ambient odors did not increase sales for thematically congruent magazines, nor did they decrease sales for incongruent magazines. Several explanations for these unexpected findings are discussed.

## Introduction

Several studies on the effects of ambient scents in retail stores have investigated whether pleasant ambient scents improve store atmosphere, thereby improving store and product evaluations, and, possibly, increasing product sales. These studies have shown, for example, that pleasant odors do improve the store image and the intention to visit the store (Spangenberg *et al.*, 1996; Mattila and Wirtz, 2001). Furthermore, they improve product evaluations and increase buying intentions for products that are not (dis)liked extremely (Spangenberg *et al.*, 1996; Morrin and Ratneshwar, 2000). Also, pleasant odors can increase the time spent in a store (Knasko, 1989; Nixdorf *et al.*, 1992; Leenders *et al.*, 1999), the number of times products are examined (Spangenberg *et al.*, 1996) and the amount of time taken to evaluate products (Knasko, 1995; Morrin and Ratneshwar, 2000), whereas they decrease the subjectively perceived amount of time spent in a store (Spangenberg *et al.*, 1996). Although these effects do not necessarily imply that pleasant odors increase the number of items purchased or the total amount of money spent (Knasko, 1989), they do suggest that consumers are more interested in shopping when the shopping environment smells good.

Besides an overall improvement of the pleasantness of the shopping experience, an ambient odor can also draw attention to specific products. It can provide concrete information about the presence and the characteristics of one or more products in the perceiver's vicinity. The smell then serves as a cue that activates cognitive and affective information about these products. An anecdotal example involves the pleasant

smell of freshly baked bread: when consumers smell bread, it not only gives them a pleasant experience (this smells good!), but it also announces the presence of bread, and it communicates that the bread is fresh and probably still warm. These signals and the corresponding inferences increase consumers' appetite for bread, increase their willingness to buy bread and make them think about whether they need to buy any other bakery products. Thus the smell of freshly baked bread can have consequences for the evaluation of the buying situation in general, the purchase probability of the focal product (bread) and the purchase probability of related products. Below, we discuss three ways in which odors can become a signal or a facilitator for drawing attention to specific products: paired-associate learning, contextual cueing and thematic associations.

One of the ways in which an odor can acquire a signal function for an object is by *paired-associate learning*. Consumers have often experienced the smell of bread consecutively or simultaneously with the sight, touch, and taste of bread and with hearing its name. As a result of learning which sensory signals co-occur with a particular object, the smell of bread thus acts as a cue in recalling the concept, semantic label, and expected sensory properties of bread. Furthermore, the retail outlets that sell bread often contain a number of bakery products, such as pastry, cakes, and chocolate. Because the smell of freshly baked bread is often experienced in these stores, people may come to associate the smell of bread with bakery products in general.

Experimental studies on paired-associate learning typic-

ally consist of a learning stage, during which signal–target pairs are presented, followed by a test stage. In some studies, only the signals (odorants) are presented at the test stage, and subjects are asked to recall the targets with which these signals have been paired. Comparative studies using this approach have shown that odors are equally effective as verbal, visual, tactile and musical cues in accurately recalling target stimuli. However, odors generally elicit more emotional memories than the other memory cues (Herz and Cupchik, 1995; Herz, 1998). Other studies have investigated whether the associations formed during the learning stage affect the extent to which the signal fits the target. In this case, subjects may remain unaware of the signal–target combinations to which they have been exposed. For instance, Degel and colleagues (Degel and Köster, 1999; Degel *et al.*, 2001) found that subjects who had performed a task in a scented room rated the degree of congruency between the odor and the room higher than subjects who had not been exposed previously to that scent in the room. Stevenson and colleagues (Stevenson *et al.*, 1995; Stevenson, 2001) found that odors acquired the qualitative properties of the tastes and smells with which they had been presented previously. For instance, after smelling a mixture of odorants, the smells of the separate components were judged to be more similar (Stevenson, 2001). In both sets of studies, learning effects were smaller or even absent for odors that subjects could identify (Degel *et al.*, 2001; Stevenson, 2001), suggesting that these implicit associations were formed, retained or retrieved mainly if an odor could not be identified.

When an odor functions as a *contextual cue*, its presence at both the learning and test stages improves performance on abilities acquired or associations learned during the learning stage. According to the encoding specificity principle (Tulving and Thomson, 1973), salient elements of the environmental context are stored in memory together with learned pairs of associations. The size of this effect is larger when the odor is more distinctive (Herz, 1997). In everyday life, the smell of bread can act as a contextual cue when it facilitates the cognitive inference that seeing a bakery implies that you are in the vicinity of some of your favorite pastries. The facilitating effect of odorants in retrieving memories has been shown by the power of odorants to prompt seemingly forgotten autobiographical information (Rubin *et al.*, 1984; Aggleton and Waskett, 1999; Chu and Downes, 2000) and to improve memory performance in experimental tests (Cann and Ross, 1989; Schab, 1990; Smith *et al.*, 1992; Herz, 1997; Parker and Gellatly, 1997; Pointer and Bond, 1998; Parker *et al.*, 2001).

In both paired-associate learning and contextual cueing, the odorant and the target object need to be presented consecutively or simultaneously. We propose that an odor can also function as a signal for an object with which it has never been paired on previous occasions as a result of the *thematic associations* elicited by the odor. In that case, the

odor acts as a cue that either consciously or unconsciously activates stored knowledge—images, information, personal memories—related to the target object. The extent to which the activated knowledge is relevant for the object is likely to be related to the degree of thematic congruency between the smell and the object. When people have not encountered specific odor–object combinations on previous occasions and thus have not been able to form perceptual associations, the degrees of thematic congruency are based on conceptual associations only. When the odor activates appropriate information, this may lead to a greater depth of processing, more elaboration and a greater number of inferences ( Craik and Lockhart, 1972) for thematically congruent products. An odor that activates inappropriate information, on the other hand, may produce cognitive interference (Wolpin and Weinstein, 1983; Mitchell *et al.*, 1995). Since congruency effects are more often due to the detrimental effects of an incongruent odor than to the improvement by a congruent odor (Bone and Ellen, 1999), both the positive and negative effects of an ambient odor need to be monitored to understand the effect of thematic (in)congruency.

Note that besides odor–object combinations that are (in)congruent in theme, others have investigated combinations (in)congruent in pleasantness (Ehrlichman and Halpern, 1988; Hermans *et al.*, 1998; Pauli *et al.*, 1999) or arousing quality (Mattila and Wirtz, 2001). However, because judgements of (thematic) odor–object fit are unlikely to be contaminated by the degree of affective (in)congruency (Degel and Köster, 1998), we do not provide a detailed discussion of these studies in the present paper.

Odors can activate stored knowledge in several different ways. When an odor unconsciously starts an automatic knowledge activation process, this process can be referred to as odor priming. One effect of priming is that it temporarily increases the accessibility of certain knowledge units. The increased accessibility, in turn, increases the likelihood that these knowledge units will be activated by subsequent stimulus information. The greater the overlap between the features of a stored knowledge unit and the attended features of a stimulus, the greater the likelihood that the knowledge unit will be activated in the presence of the stimulus (Higgins, 1996). Thus, if you smell a grass odor unconsciously, an odor-priming process will automatically increase the accessibility of knowledge related to grass (e.g. gardening), and the subsequent encounter of a book about gardening will evoke a different reaction than if you had not smelled grass. Alternatively, when you are aware that you smell something but you do not know exactly what it is, you may try to figure out where the odor comes from, and you will generate associations with the odor. Since you cannot identify the odor, some of these associations are correct, whereas others are not. A third possibility is that you smell an odor and recognize it. In that case, the odor will activate your associations with this smell. For example, when you smell grass, you may be reminded of your garden and

think that it would be nice to buy a book about gardening. Therefore, the conscious perception of the smell may induce search behavior for specific products. These three mechanisms suggest that if some products in a store are thematically congruent with the ambient smell in that store whereas others are not, sales of the congruent products may benefit from the smell, whereas sales of the incongruent products may be hampered by it.

Although it may be interesting to distinguish theoretically between the three different cases outlined above, it is extremely difficult to distinguish between them practically. Olfaction is generally characterized as a slow sense (Herz and Engen, 1996), and thus it may be impossible to rule out the interference of conscious processes with the automatic processing. Therefore, several interesting studies on knowledge activation by odors are discussed jointly below, without making a strict distinction between the types of processes activated.

The question of whether odor priming exists can be answered in the affirmative. However, studies on odor repetition priming, in which presenting an odorant during the learning stage is expected to facilitate the response to the same (or a similar) stimulus presented during the test stage, have generally concluded that empirical support for repetition priming in olfaction is weaker than for other modalities, such as vision (Wippich *et al.*, 1993; Schab and Crowder, 1995; Olsson and Cain, 2002). Furthermore, odor identification may interfere in this process: although response speed after priming increases for unidentifiable odors, it decreases for identifiable odors (Olsson, 1999). It also cannot be ruled out that all odor repetition priming effects found are due to verbal processing rather than to perceptual processing (Olsson *et al.*, 2002), implying that these effects are not necessarily due to unconscious, automatic processing.

Only one previous study investigated the effect of a thematically (in)congruent odor in a retail setting: Fiore and colleagues (Fiore *et al.*, 2000) found that the purchase intentions and the prices consumers were willing to pay were higher for products in an appropriately fragranced display than for those in an inappropriately fragranced display. In addition, they found an effect of fragrancing on imagery: an appropriate smell increased the level of seeing oneself in a fantasy image, whereas an inappropriate smell interfered with the formation of a fantasy image.

### The present study

Several studies cited above investigated the effects of ambient scents on consumer self-reports. In a commercial environment, the final test of the effectiveness of changes in strategy, however, is its effect on sales. Therefore, in the present study we investigated the effects of ambient odors on product purchases. First of all, we investigated whether the presence of a pleasant ambient scent increased sales for products in general, compared with an unscented control

condition. In line with previous studies (Knasko, 1989), we expected to find no effect of an ambient product-unrelated smell on sales in general. In addition, we investigated whether an ambient odor could function as a signal for products that did not emit that odor but were thematically congruent with it. We hypothesized that an ambient odor would increase sales for thematically congruent products and would decrease sales for thematically incongruent ones. To avoid any effect of affective (in)congruency, we used odorants that elicited equally pleasant sensations.

The main study was performed in bookstores. In the first test, we studied the effect of ambient scents on purchases in all product categories, whereas in the second test we determined their effect on purchases for thematically (in)congruent magazines. We investigated the effect of thematically (in)congruent ambient odors for the magazine product category, because the magazines were sold at one designated area in the store, they differed widely in themes and they had a relatively high turnover rate.

## Materials and methods

### Prestudy

We performed a prestudy to select two odorants that were typically associated with different themes and were judged to be congruent with different (types of) magazines.

### Respondents

We interviewed 25 respondents (10 male, 15 female), ranging in age from 18 to 63 years (average age 35 years). The characteristics of the respondent sample corresponded roughly to those of the book retailer's customer profile. Respondents were recruited in shopping malls, on school playgrounds or at home.

### Stimuli

Five fragrances were selected in cooperation with an agency specialized in the use of odorants for marketing purposes. All odorants had very different characters and were expected to be thematically congruent with different types of magazines. They were described as freshly cut grass, apple/cinnamon/vanilla, cosmetics (a fragrance with a violet/rosy character), sunflower (a floral/fruity fragrance) and cool water.

All fragrances were composed of several different ingredients. They consisted of essential oils combined with nature-identical synthetic substances. Fragrance materials were absorbed on cylindrically shaped pellets composed of synthetic microporous polymers, ~3 mm in length and diameter. The pellets were presented between two balls of cotton wool in 200 ml glass jars, capped with a sheet of aluminum foil to prevent diffusion of the odorant into the lid, and closed by a black plastic lid.

### Procedure

Interviews were conducted at respondents' homes, in their

living room at a quiet time during the day. For each odorant, respondents were instructed to open a jar near their nose, smell the odor carefully and then close the jar. At the beginning of every new page of the questionnaire, they smelled the sample again. When respondents forgot the odor characteristics while filling in a page, they smelled the odor again. After completing the questionnaire for an odor, they waited 1 min before smelling the next one. Every respondent judged all five odors in a random order.

First of all, the respondents judged each odor on four 7-point scales: pleasantness (very pleasant–very unpleasant), familiarity (very familiar–very unfamiliar), stimulating power (very calming–very stimulating) and intensity (very weak–very strong). These scales assessed four important general odor characteristics (Herz and Cupchik, 1992; Spangenberg *et al.*, 1996). To be selected for the main study, the odors needed to obtain similar ratings on all four scales.

Secondly, to measure general associations elicited by the odors, respondents were instructed to pick the most appropriate word(s) from several lists of words. These words referred to abstract relationships with concepts like the four seasons, the four basic elements (earth, water, fire and air), gender, types of drinks, types of plants, and so on. Thirdly, respondents rated the degree of congruency with 13 magazine categories (name given) and with 13 separate magazines (full color cover given) on 7-point scales, ranging from ‘does not fit at all’ to ‘fits very well’. The categories included all major magazine categories distinguished by the book retailer (animals & nature, gardening, water sports, football, computers, men, women, personal care, raising children, cooking, home decoration, needlework, and gossip). The separate magazines consisted of the magazines with the highest turnovers in the categories expected to be congruent with one or more of the five odors. The odorants selected for the main study should differ markedly with respect to general associations activated and should vary in congruency ratings for the different (types of) magazines.

Finally, respondents judged the degree to which each odor was congruent with a bookstore in general on the 7-point scale described above. The odors for the main study should obtain similar ratings on this scale. The interview ended by filling in a short socio-demographic questionnaire. Interviews lasted ~30 min.

#### Data analysis

Ratings on 7-point scales were transformed into numbers,

and were subjected to repeated-measures analysis of variance (ANOVA), with Odor as the within-subjects factor. Because the number of subjects was small compared with the number of measurements within each subject, the results of the univariate tests are reported in this paper (Stevens, 2002). The degrees of freedom were adjusted with the Huynh–Feldt epsilon if the Greenhouse–Geisser epsilon was  $>0.7$ , or with the mean of the two epsilons if it was  $<0.7$  (Stevens, 2002). Individual differences between odorants were investigated using *t*-tests with Bonferroni correction. Differences between frequencies of choices of words from lists were evaluated using  $\chi^2$  tests. Throughout this paper,  $P < 0.05$  was used as the criterion for statistical significance.

#### Main study

The main study consisted of a field study conducted in three bookstores, in which the effects of two odorants on consumer purchase behavior in general and on purchases for six specific magazines were quantified.

#### Design

We used a  $3 \times 3$  Latin square design (Winer, 1971) with three experimental conditions: no scent (control), sunflower scent and grass scent. Each condition was tested in a balanced order in every bookstore during one of three measurement periods (Table 1). This design allowed the estimation of the main effect of odor condition corrected for the main effects of store and time period. To avoid fluctuations in sales due to holiday periods, the study was conducted during a 15 week period between Christmas and Easter.

Each condition was presented during 5 weeks in each store. The first week of each condition was an adoption period in which the new scent was installed in the store, staff members were informed on health and safety aspects of the use of ambient scents, they were acquainted with the new smell and they were instructed on how to use the scent dispersion units. No data were collected during the adoption period. During the next 4 weeks, the appropriate scents were dispersed in the air continuously, and sales were recorded. These 4 weeks constituted one measurement period.

#### Locations and stimuli

The field study was conducted in three bookstores that were comparable in size and design. In each store, one or more scent units were placed that dispersed the fragrances into the air. Each scent unit consisted of an air cleaner system

**Table 1** Design of the main study

	Adoption	Measurement	Adoption	Measurement	Adoption	Measurement
Week	1	2–5	6	7–10	11	12–15
Store 1	no scent	no scent	sunflower	sunflower	grass	grass
Store 2	sunflower	sunflower	grass	grass	no scent	no scent
Store 3	grass	grass	no scent	no scent	sunflower	sunflower



(Philips Air Cleaner Naturalis type HR4342) in which a ventilator blew a current of air through a cartridge with fragrance pellets. To avoid visual cues, scent units were placed behind screens, in the vicinity of the magazine display(s) of each store. Magazine displays were organized in themes, so that magazines from the same category were more likely to be located near to one another than those belonging to different categories. During the entire experimental period, store conditions were kept as constant as possible.

To make sure that an odor was detectable by most of the store customers without annoying staff members or customers, the odorant was dispersed at a level slightly above threshold. The appropriate dosage was determined at the start of each adoption period by the authors and the odor marketing agency, together with the local staff. The dosage was determined for each store separately, because the levels and patterns of air circulation differed substantially. When determining the dosage, we made sure that the odor was perceptible near the magazine display(s). Due to customer movement and airflow dynamics, the odor would usually be perceptible at various other locations in the store as well but not throughout the entire store, which prevented complete sensory adaptation. Local staff switched on the scent dispensers every morning before opening the store, and switched them off after closing time. Cartridges were replaced with fresh ones every Monday. Local staff checked daily whether the odor was still clearly perceptible, and replaced the scent cartridges if necessary. The authors regularly visited the stores to solve problems and to check whether the local staff complied with the experimental procedure.

#### Dependent measures

During the measurement period, weekly sales were recorded in the local currency for all the different product categories distinguished by the book retailer: books, magazines, newspapers, comic books, postcards, tobacco, writing materials, CD-ROMs and 'other'. In addition, the numbers of items sold were recorded for six individual magazines, from the magazine categories soccer (*Voetbal International*), gardening (*Mijn Tuin*), women (*Libelle* and *Viva*), personal care (*Santé*) and home decoration (*Eigen Huis*).

#### Data analysis

The weekly sales for the nine product categories and the numbers of individual magazines sold in each store were used as dependent variables in two Scent  $\times$  Store  $\times$  Period ( $3 \times 3 \times 3$ ) main effects multivariate analyses of variance (MANOVAs). We used Wilk's  $\Lambda$  as the test criterion and we report the corresponding values of Rao's  $F$  (Stevens, 2002). Interesting Scent effects were investigated further by univariate ANOVAs for individual product categories or magazines. In all analyses, the 4 weeks within each measurement period were regarded as replications.

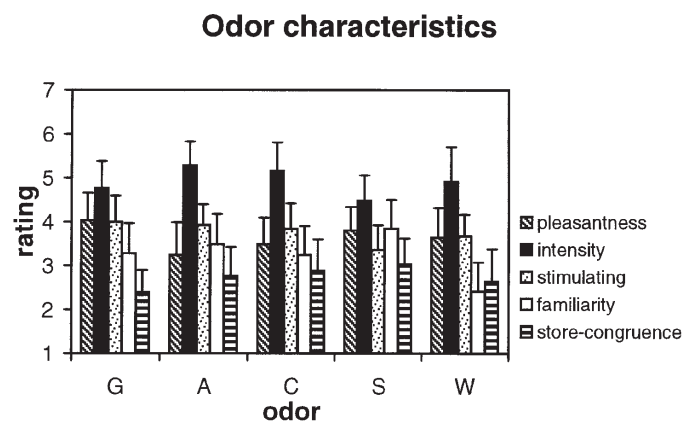
## Results

### Results of the prestudy

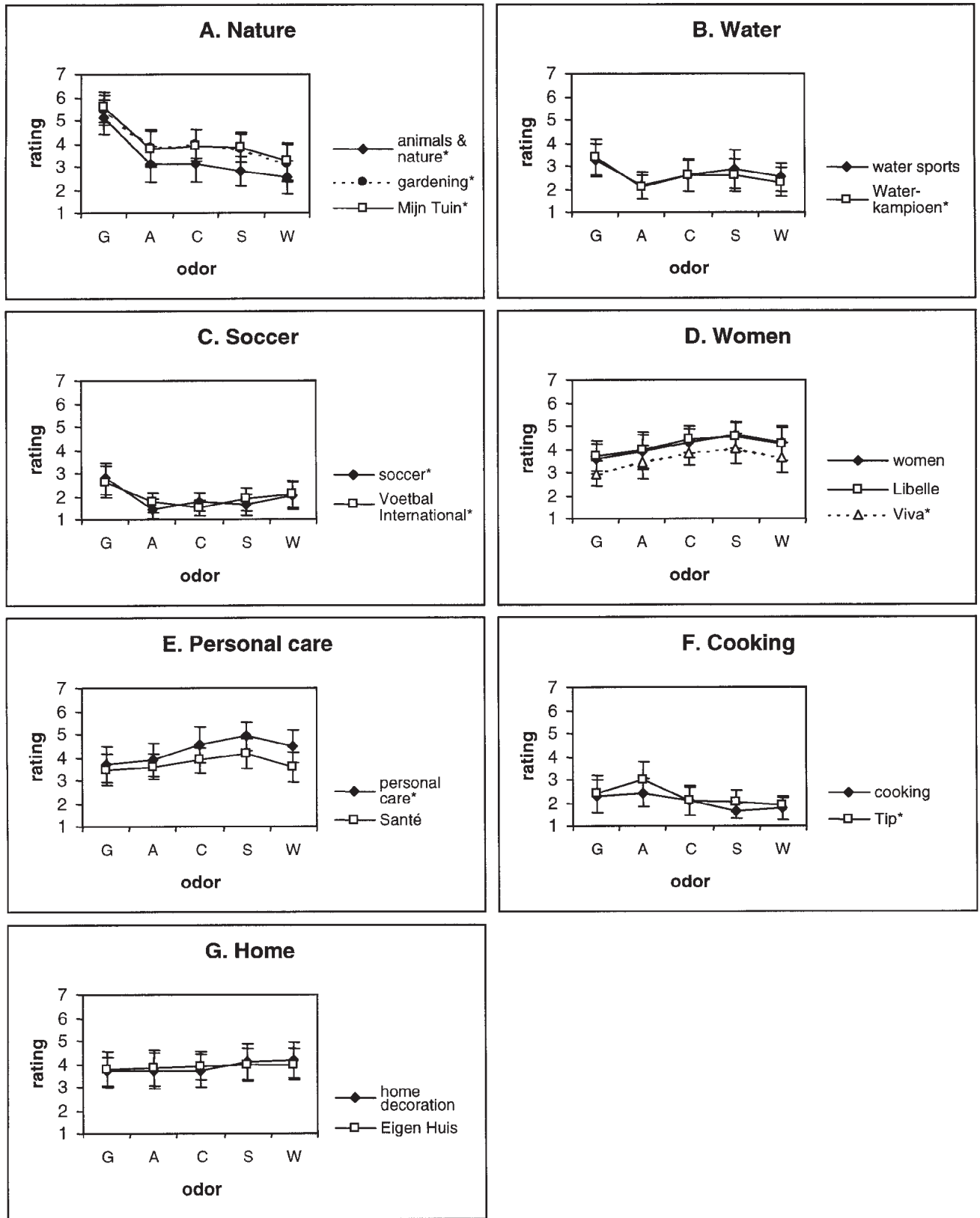
The five odors obtained similar average ratings for pleasantness, intensity and stimulating power [ $F(4,96) < 1.1$ ,  $P > 0.2$ ] (Figure 1). For familiarity, a significant difference was found [ $F(4,92) = 2.7$ ,  $P = 0.03$ ]. Cool water odor was judged to be less familiar than the other odors; this difference in familiarity rating was significant for sunflower odor [ $P = 0.03$ ]. The five odors did not differ in the extent to which they were judged to be congruent with a bookstore [ $F(4,96) = 0.7$ ,  $P > 0.2$ ]. In conclusion, four of these five scents produced similar ratings on these five scales, and could thus be used for the main experiment.

Figure 2 shows the average congruency ratings of the five odors for a selection of magazines and magazine categories. Each magazine (category) for which a significant difference was found between odors [ $P < 0.05$ ] is shown. In addition, average ratings for several magazines and categories are shown for illustrative purposes. Significant odor differences were found in the categories nature, water, soccer, women, personal care and cooking.

As expected, the grass odor was judged to be more congruent with nature and gardening than the other odors (Figure 2A). All paired comparisons of grass odor with the other odors were significant [ $P < 0.05$ ]. Similarly, grass odor was judged to be more congruent with soccer magazines than the other odors (Figure 2C): the average congruency rating was significantly higher for grass odor than for cosmetics odor and for apple/cinnamon/vanilla odor. The difference with the cosmetics odor was also significant for the *Voetbal International* magazine. Note the differences in absolute ratings in Figure 2A,C: whereas the average ratings were all relatively high in the nature category, they were all quite low in the soccer category. Surprisingly, grass odor was



**Figure 1** Average ratings (+ 2 SE) on 7-point scales for pleasantness, intensity, stimulating power, familiarity and congruency with a bookstore for the five odors grass (G), apple/cinnamon/vanilla (A), cosmetics (C), sunflower (S) and cool water (W).



**Figure 2** Average ( $\pm 2$  SE) congruence ratings for categories (lower case initials) and individual magazines (upper case initials) for the five odors grass (G), apple/cinnamon/vanilla (A), cosmetics (C), sunflower (S) and cool water (W), classified within the themes nature (panel A), water (panel B), soccer (panel C), women (panel D), personal care (panel E), cooking (panel F) and home (panel G). Significant differences between the five odors for a magazine (category) are indicated by \* [F-test,  $P < 0.05$ ].

also judged to be the most congruent with water sports magazines (Figure 2B). The cool water odor we used in this study did not elicit the associations with water sports we expected. Grass obtained a significantly higher rating than apple/cinnamon/vanilla for the water sports magazine *Waterkampioen*.

In the women and personal care categories, the ratings for the grass odor were generally the lowest, whereas those for sunflower were the highest (Figure 2D,E). Although an overall odor effect was found for the women's magazine *Viva*, none of the differences between individual odors reached statistical significance. Sunflower obtained significantly higher ratings than grass and apple/cinnamon/vanilla for the personal care category. As expected, in the cooking category the congruency ratings were highest for apple/cinnamon/vanilla (Figure 2F). Despite an overall odor effect, differences between individual odors were not significant in paired comparisons for the cooking magazine *Tip*. In the home decoration category, no differences were found between smells (Figure 2G).

Although several significant differences were found between odors in the word selection task, we restrict our report to cases in which one odor differed from all the other ones. In all these instances, grass odor differed from the other four. First of all, we found that 60% of our respondents associated grass odor with male, whereas the other odors were mainly associated (80–88%) with female [ $\chi^2(4) = 20.0$ ,  $P < 0.01$ ]. Furthermore, grass odor was mainly associated with soft drinks (40%) and beer (44%), whereas the other odors were primarily associated with soft drinks (48–65%) and wine (26–48%) [ $\chi^2(8) = 26.2$ ,  $P < 0.01$ ]. Also, grass odor was only rarely associated with flowers (8%) and mostly with green plants (92%), whereas all the other odors were frequently associated with flowers (40–52%) and less often with green plants (48–60%) [ $\chi^2(4) = 14.3$ ,  $P < 0.01$ ].

To obtain two scents that differ markedly on the general associations they evoke and in their perceived congruency with magazine (categories), we chose grass and sunflower. To contrast the differences between these two scents, we tested again for specific differences using  $\chi^2$  and paired  $t$ -tests [ $P < 0.05$ ]. Note that more significant differences are likely to result from this paired comparison than reported above, because Bonferroni correction was used to correct the previous analyses, whereas no adjustment was used in the present comparison. Average congruency ratings are given between parentheses.

Grass odor was associated with male, natural and authentic, and it was judged significantly more appropriate for the magazine categories soccer (2.80), animal/nature (5.16), gardening (5.44) and men's magazines (3.44). The sunflower odor was associated with female and relaxing, and it was judged more appropriate for personal care (4.92) and women's magazines (4.60).

Our hypotheses predict that when an ambient scent is congruent with the theme of a magazine, it is more likely to

be bought. Therefore, the effect of a congruent ambient scent in comparison to the control condition is expected to be largest when the average congruency rating for a magazine is high ( $>4$ ). For grass, this was the case for the gardening magazine *Mijn Tuin* (5.56), whereas for sunflower it was the case for the women's magazines *Libelle* (4.52) and *Viva* (4.04), the personal care magazine *Santé* (4.16), and the home decoration magazine *Eigen Huis* (3.96).

In addition, a differential effect between the grass odor and the sunflower odor may be expected for the magazines that showed a significant difference in congruency rating between the two scents. Such a difference was found for *Mijn Tuin* (5.56 versus 3.84), *Voetbal International* (2.64 versus 1.88), *Viva* (2.96 versus 4.04), *Libelle* (3.72 versus 4.52), *Santé* (3.48 versus 4.16), *Story* (gossip: 2.52 versus 3.12) and *Kinderen* (raising children: 2.68 versus 3.48). We decided to test our hypothesis for six magazines: four that showed both a high congruency rating and a significant difference between the two scents (*Mijn Tuin*, *Viva*, *Libelle*, and *Santé*), one that showed only a high congruency rating (*Eigen Huis*) and one that showed only a significant difference (*Voetbal International*). An incongruent odor negatively affecting the sales for a magazine is most likely to be found for *Voetbal International* when sunflower scent is presented (1.88).

## Results of the main study

The weekly turnovers in each store for the various product categories distinguished by the book retailer were analyzed using a Scent  $\times$  Store  $\times$  Period (3  $\times$  3  $\times$  3) main effects MANOVA. We found no significant effect of ambient Scent in the overall test [ $F(18,42) = 0.9$ ,  $P > 0.20$ ]. In addition, none of the effects for individual product categories showed any effect in univariate ANOVAs [ $F(2,29) < 1.2$ ,  $P > 0.20$ ]. Differences between Stores were significant in the overall analysis [ $F(18,42) = 40.4$ ,  $P < 0.01$ ] and for each individual category [ $F(2,29) > 18.0$ ,  $P < 0.01$ ], whereas differences between Periods [ $F(18,42) = 3.0$ ,  $P < 0.01$ ] were significant for books, magazines, newspapers, writing materials and postcards [ $F(2,29) > 4.0$ ,  $P < 0.05$ ], but not for comics, tobacco, CD-ROMs and 'other' [ $F(2,29) < 3.0$ ,  $P > 0.05$ ].

Contrary to our hypotheses, a MANOVA of the numbers of items sold for the six magazines yielded no significant Scent effect [ $F(12,48) = 1.3$ ,  $P > 0.20$ ]. To check whether the data provided any support for our hypotheses, we inspected the results of the univariate ANOVAs for the separate magazines, despite the absence of an overall effect. In the univariate ANOVAs, we found a significant Scent effect for *Voetbal International* [ $F(2,29) = 3.5$ ,  $P < 0.05$ ] and a marginally significant Scent effect for *Libelle* [ $F(2,29) = 2.6$ ,  $P = 0.09$ ]. Figure 3 shows the average number of items sold in the three conditions for each of these magazines. None of these findings were in the expected directions. The ambient sunflower scent increased sales for *Voetbal International* by 38%, whereas grass scent decreased sales by 3%. Sunflower scent decreased sales for *Libelle* by 25%, whereas grass



**Figure 3** Estimated marginal means of the numbers of items sold (+ 2 SE) for the magazines *Libelle* (women) and *Voetbal International* (soccer) in the unscented control condition (O), the grass odor condition (G) and the sunflower odor condition (S).

scent decreased sales by 15%. Therefore, these results do not support our hypotheses.

The effect of Store was significant in the overall MANOVA [ $F(12,48) = 16.0, P < 0.01$ ] and for virtually all magazines [ $F(2,29) > 3.8, P < 0.05$ ] except for *Mijn Tuin* [ $F(2,29) = 0.2, P > 0.20$ ]. The effects of Period were significant [ $F(12,48) = 4.4, P < 0.01$ ] for *Eigen Huis* and *Mijn Tuin* [ $F(2,29) > 6.6, P < 0.01$ ], but not for *Santé*, *Voetbal International*, *Viva* and *Libelle* [ $F(2,29) < 2.1, P > 0.10$ ].

## Discussion

In line with previous studies (Knasko, 1989), we found that the presence of a pleasant ambient scent did not affect sales in general in a retail store. Unfortunately, our hypothesis that an ambient scent increases sales for a thematically congruent product but decreases sales for a thematically incongruent product was not supported. To account for our discrepant findings, we discuss the assumptions behind our effect of interest and our experimental procedure in more detail. To facilitate the discussion, we decompose our effect of interest into two stages. First of all, the smell needs to prompt the correct associations (for grass: nature, garden, soccer). Secondly, these associations have to trigger the consumers' desire for magazines with the corresponding topics, and the effect has to be strong enough to induce a purchase. After discussing these two stages, we discuss the role of gender differences in the effects studied here.

### Odor-evoked associations

In the present study, the associations between odors and magazines were inferred from consumers' judgements regarding the degree to which an odor fitted with a certain magazine. Although this approach is intuitively appealing, it disregards the possibility that consumers may not immediately think of a soccer magazine when they smell grass. To make sure that an odor reminds a person of a particular product, the stimulus selection procedure should assess the spontaneous associations elicited by an odor. The associ-

ations thus obtained may vary from concrete (objects, events, people) to abstract (sensory experiences, feelings), and the experimenter can then decide which associations comply with the desired function. Hence, if an odor is supposed to function as a signal for an object, the stimulus selection procedure should focus on the odor's concept-evoking power and not merely on its congruency to products.

Since we used odorants as signals in the present study, we can compare their function to those of pictorial symbols that are used in public spaces to convey important messages. In an evaluation of symbolic public information signs (Mackett-Stout and Dewar, 1981), one group of subjects wrote down what they believed to be the meaning of each stimulus, whereas others rated on a 6-point scale how adequately, or clearly, each symbol conveyed its intended meaning. The first measure assesses spontaneous associations, whereas the second measure resembles a measure of congruency. The two measures showed a significant, positive correlation ( $r = 0.76$ ), which implies that they are related. However, since the correlation is not perfect, it suggests that the two measures do not measure exactly the same construct. Hence, our experimental procedure may be improved by assessing the spontaneous associations elicited by the odor cues. By using such a procedure, we can select odors that are equally powerful in eliciting product-related associations.

Furthermore, several authors have shown that the context in which symbols are evaluated greatly affects their comprehension (Cahill, 1975; Wolff and Wogalter, 1998). Therefore, when odors are pretested, they should be presented in an environment similar to the experimental test situation, to be sure that they evoke the associations required. Relevant context cues have been shown to be helpful in the identification of odors, whereas irrelevant cues hamper identification (Davis, 1981; Zellner *et al.*, 1991). Providing the test context may be more critical in pretesting ambient odors than in testing verbal or visual information, because people react more emotionally and more instinctively to odors than to other types of cues (Herz, 1998). This can be understood if we realize that several important biological functions of odors require instant action, such as the presence of rivals, sexual partners or food (Doty, 1986). When subjects sniff odorants from bottles or jars, they can easily identify the odor's source, and can freely come up with any associations. If a scent is dispersed in the environment, however, and subjects do not expect its odor in that particular environment, they may feel uncomfortable, and may leave the location because it smells bad. In the present study, people may have had difficulty in recognizing the odor of freshly cut grass in a bookstore, because this odor is not usually encountered in this context. The bookstore environment may thereby have hampered the formation of the required associations.

Discussing the similarities between pictorial symbol comprehension and the signal function of ambient odors may



give the impression that odor recognition is a necessary condition for odors to function as signals. However, in our case, odor recognition is mainly regarded as helpful in arriving at the correct associations. Since correctly identified odors are more likely to evoke memories (Gilbert and Wysocki, 1987), more appropriate associations are expected when an odor is identified correctly. However, odor identification is not necessary: Herz and Cupchik (Herz and Cupchik, 1992) found that 32% of the autobiographical episodes in their study were retrieved without subjects being able to name the odor. Note that odor identification may also hamper the elicitation of the desired associations, because a person who smells freshly cut grass may remember the unpleasant activity of mowing the lawn, instead of enjoying a game of soccer or enjoying a beautiful garden.

### Effect on product sales

Even if an odor triggers associations with a product, it does not necessarily have an effect on the product's sales. When clients are already determined to buy the target product, they will buy it anyway, irrespective of whether they smell an odor or not. Customers who do not want to buy the product, because they do not need it or do not have the money, will not buy it anyway. Therefore, an odor that prompts the correct associations can only affect buyers who have some interest in the product, but who do not think about it if they are not reminded. As this is only a limited portion of the total number of buyers, an odor's effect on sales is likely to be small for products that are only bought incidentally, like magazines.

Spangenberg *et al.* (Spangenberg *et al.*, 1996) found strong effects of pleasant ambient scents on evaluations of store environment, but weaker effects on product judgments. This may occur because an ambient odor is a diagnostic for the store atmosphere, but not for a particular product if that product does not emit the scent. Olfactory information needs to compete with other information for the attention of the observer and, since it is in many cases rather ambiguous, it may often lose this battle. Therefore, the effect of an ambient scent on the evaluation of individual products may be rather small.

### Gender differences

In the present study, we did not analyze gender differences in odor–magazine congruency ratings. Nevertheless, spontaneous associations and judged congruencies may have differed quite substantially, because men and women differ in their sensitivity to smells (Koelega and Köster, 1974), odor identification performance (Cain, 1982), the scented products they use and the magazines they read. Gender differences between associations elicited or between congruencies perceived may have had opposite effects on the sales of our target products. In our study, we could not determine

the effect of gender because we did not gather sales data for men and women separately. We have eliminated this effect by matching the sample in the prestudy to the customer profile of the book retailer. Nevertheless, it would be an interesting variable in a future study.

### Conclusion

In the present study, we found no effect of an ambient scent on the sales for a thematically (in)congruent product that did not emit the scent. Thus, although a range of thematically related products presented in a display may benefit from a congruent ambient scent (Fiore *et al.*, 2000), our findings imply that the existence of thematic (in)congruency alone is not sufficient for an odor to affect the sales of a particular product competing for the buyer's favor with products from the same category.

Possibly, joint odor–product presentations on previous occasions are necessary to obtain an effect on within-category choices. In such cases, people have learned that presentation of a particular odor coincides with a certain product (paired-associate learning) or that an odor acts as a contextual cue that facilitates remembering a cue–product association. The effect of a contextual odor cue increases if it is affectively or thematically congruent with the to-be-remembered object (Tulving and Thomson, 1973; Herz and Cupchik, 1995; Parker *et al.*, 2000) and if it is distinctive (Herz, 1997). In real life, a beneficial effect of an ambient scent on sales is most likely to be found if that scent is actually emitted by the product. In that case, the scent is expected in the environment, which facilitates identification and promotes the formation of the expected associations. In addition, the smell is judged as appropriate and relevant for the product, and is thus most likely to have a positive effect on the product's evaluation.

### Acknowledgements

This study was conducted with the help of Desirée Struijk and Janine Verbeek (Senta Aromatic Marketing, Amersfoort, The Netherlands). The authors greatly appreciate the comments provided by three anonymous reviewers.

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Accepted May 9, 2002