



The unconscious perception of smells as a driver of consumer responses: a framework integrating the emotion-cognition approach to scent marketing

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Abstract

Previous research demonstrates that odors affect consumers' behavioral, cognitive, and affective responses to products and environments. Sensory and scent research have prioritized an emotional approach in which consumer responses are primarily affective reactions to smells. However, individuals' perceptions of their environment are frequently regulated by an unconscious mechanism that does not necessarily involve rational thinking. Therefore, their responses to odors may result from automatic and unconscious cognitive processes that occur without their awareness. We propose that the unconscious odor interpretation better regulates consumers' responses to odors and behaviors than emotions and that the way in which olfactory information is cognitively processed and integrated into knowledge may address the extent to which odors help individuals to perceive their environment holistically and attribute meanings to events and social phenomena. Through a systematic review of 55 empirical studies on olfaction, we i) discuss the current theoretical approaches to scent marketing and the most relevant empirical findings; ii) propose a cognition-based framework to investigate the underlying mechanisms through which odors are mentally processed to influence consumers' behavioral, cognitive, and affective responses; and iii) develop a research agenda to encourage further studies on the cognitive processing of scents.

Keywords Scent marketing · Unconscious cognition · Odor perception · Emotion · Cognitive processing

Introduction

Traditional research on scent marketing stresses the emotional effects of environmental stimuli on consumer decisions and behavior. This line of research has conceptualized consumers' scent-aroused pleasure via the Stimulus-Organism-Response (SOR) model (Mehrabian and Russell 1974), in which environmental cues are the stimuli (S) that jointly influence the organism's psychological reactions (emotions) (O) and induce approach or avoidance responses (R). Most work in environmental psychology focuses on the pleasure, arousal, and dominance

(PAD) dimensions of affective responses, which is in line with the widely accepted SOR paradigm. The *pleasure* dimension taps into the pleasantness of emotion, the *arousal* dimension describes the intensity of emotion, and *dominance* captures whether an emotion is controlling or submissive in nature.

However, despite the wide application of the SOR and PAD models, there is no consensus on whether and how emotional processes relate to odor perceptions. For example, Morrin and Ratneshwar (2000) found that ambient odors did not affect subjects' arousal levels. Spangenberg and colleagues (Spangenberg et al. 1996) found no effects of scent on emotion or mood (i.e., pleasure and arousal). Chebat and Michon (2003) suggested that odors may be more effective in arousing concepts and meanings than in arousing emotions. Cirrincione and colleagues (Cirrincione et al. 2014) found that a pleasant ambient scent does not necessarily lead to a more positive perception of a product, so the relation between the pleasantness of the odor and the evaluation of objects does not appear to be linearly positive. Consumers' pleasurable responses, as manifested in evaluations (Doucé and Janssens

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2013; Morrin and Chebat 2005), memory (Lwin et al. 2010; Morrin and Ratneshwar 2003), and behaviors (Parsons 2009; Spangenberg et al. 1996), seem to occur independently of emotional processes.

Empirical evidence suggests that odors may unconsciously bias (Gaillet et al. 2013) individuals' perceptions of unrelated stimuli (Madzharov et al. 2015; Stevenson et al. 2012) and behaviors (Holland et al. 2005), so individuals rely on odor associations organized in a semantic network (i.e., odors and other cues or modalities [visual, auditory, gustatory, haptic]) that share the same meanings (for example, the odor of citrus, which is associated with cleanliness). This is confirmed in studies demonstrating that odors may induce information subconsciously associated with them, such as product attribute recall (Morrin et al. 2011), olfactory and visual imagery (Lwin et al. 2010), and memory for product information (Krishna et al. 2010a, b). It is still unclear how unconscious processes modulate consumers' judgments and behaviors through olfactory perceptions, but some studies provide initial evidence that consumers' responses to environmental stimuli may be result from automatic and unconscious cognitive processes that occur without consumers' awareness (Li et al. 2007). For example, a study conducted by Li and colleagues (Li et al. 2007) suggests that social preferences are subject to influences by odors of which individuals are not consciously aware, whereas the availability of conscious odor information may disrupt such effects. Therefore, it is in the absence of conscious awareness that odors most significantly exert their effects. Neuropsychological studies provide support for the theory that conscious and unconscious processes are realized in independent substrates of the brain (the primal "low road" to the amygdala and the conscious "high road" to the cortex), and unconscious reactions to stimuli might occur prior to cognitive processing and via separate neural pathways (Berridge and Winkielman 2003).

We contribute to the literature on scent marketing by proposing that unconscious odor interpretation and meanings regulate consumers' responses and behaviors. Through a systematic review of empirical studies on olfaction, we i) discuss the current approaches to scent marketing; ii) propose a cognition-based framework to investigate the underlying mechanism (e.g., unconscious cognition) through which odors are mentally processed to influence consumers' behavioral, cognitive, and affective responses; and iii) develop a research agenda to encourage further studies on the cognitive processing of scents.

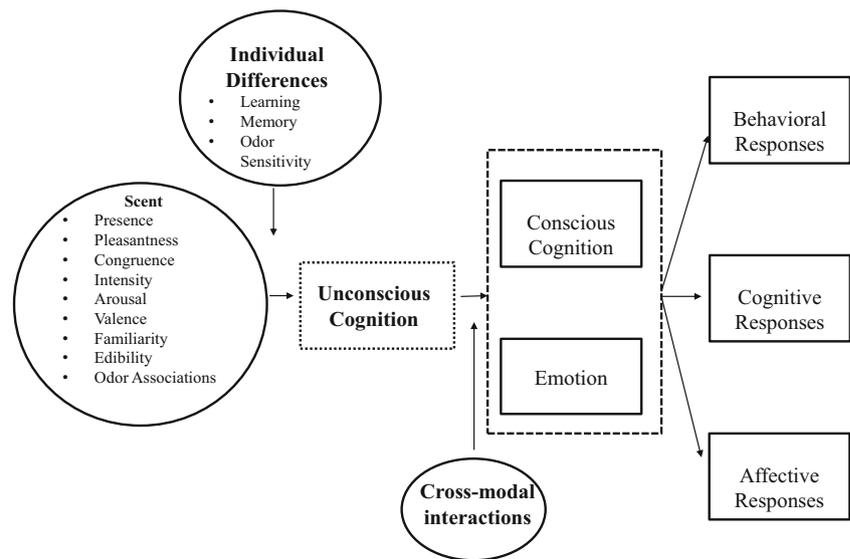
Systematic review and conceptual framework

The review process We conducted a systematic literature review of 55 empirical articles published from 1992 to 2019 in the fields of marketing, consumer behavior, and psychology. We accessed electronic databases relevant to those topics,

such as JSTOR, EBSCO, Emerald Insight, and the American Psychological Association's databases, which include a comprehensive collection of journals that specialize in publishing sensory research applied to the marketing and consumer behavior domains. For the search, we used the terms "scent," "product scent," "ambient scent," "smell," "odor," "odorant," "fragrance," AND "consumer behavior," "retailing," "marketing" in titles, abstracts, and keywords. We excluded from the analysis all articles that focused on olfactory imagery, chemical arguments, and odor recognition tasks since the focus was to review the empirical effects of scent on consumers' responses in retailing, advertising, and marketing in general. The search process ended with 10 theoretical and 55 empirical investigations containing 1 to 5 experimental manipulations of ambient or product scents. Hence, those 55 articles were sufficient to capture the most relevant empirical evidence on scent marketing research.

The theoretical framework The review first identified two approaches to scent marketing studies: emotion-based and cognition-based approaches. Most influential research on scent is conducted in environmental psychology, which has determined that pleasant scents induce consumers to approach the environment in which the scents exist (Mattila and Wirtz 2001; Spangenberg et al. 1996). Environmental psychology research on the effect of scent on consumer behavior has taken an emotional approach (Doucé and Janssens 2013; Mitchell et al. 1995), prioritizing the emotional processes of pleasure, arousal, and dominance as mediators of the relationship between smell perceptions and behaviors (Mattila and Wirtz 2001; Spangenberg et al. 2005). Recent empirical evidence has proposed that consumers' responses occur at the level of cognition, which demonstrates that odors influence individuals in the process of inference-drawing, judgment, thus determining product performances (Bone and Jantrania 1992). Most of our systematic review suggests that emotions and deliberate cognitions are essential for scent effects to arouse consumers' behavioral, cognitive, and emotional responses. However, our proposed Cognition-Based Framework for Scent Research (Fig. 1) addresses unconscious cognition as the key psychological process that activates odor interpretation, which, in turn, induces individuals' responses. To present the most important variables of our framework, we first present a detailed description of scent and its basic dimensions. Second, we discuss deliberate cognition and emotion as mediating psychological processes underlying the effect of odors on consumers' responses, as suggested in the traditional approach of environmental psychology. Third, we introduce the unconscious cognition of odors as the key automatic psychological mechanism through which odors activate mental concepts and meanings, which makes scent effects likely to occur. Individual differences and odor interactions with sensory cues in the surrounding environment are presented as moderators.

Fig. 1 A cognition-based framework for scent research



Finally, consumer outcomes, such as behavioral, cognitive, and affective reactions, are summarized.

Scent: dimensions and typology

Definition and basic dimensions Seminal studies have investigated product scent and ambient scent as perceived across two broad dimensions: i) the odorant, which refers to the chemical composition of the scent and elicits the perception of the scent (Hallem and Carlson 2006), and ii) the odor, which induces the subjective experience of the scent itself (Stevenson and Wilson 2007). Both physiological (e.g., the perception of chemical molecules) and psychological (e.g., the individual's perception of the odor) processes shape odor experiences. Nevertheless, individuals perceive odors across specific dimensions, such as *presence* (the existence of a particular odor in the surrounding environment), *pleasantness* (perceived affective quality of the scent), *congruence* (the appropriateness of the odor in a specific context or the coherence between the scent and the object of evaluation), *intensity* (degree of strength, force, or energy of the scent), *arousal* (how likely the scent is to evoke physiological responses and behaviors), and *valence* (varying from unpleasant to pleasant) (Spangenberg et al. 1996). Due to odor associations with individuals' episodic memories, learning, and past experiences, *familiarity* (Rabin and Cain 1984) and *edibility* (Gaillet et al. 2013) are also basic dimensions through which individuals perceive odors. *Valence* has been considered the most relevant dimension through which individuals perceive smells (Smeets and Dijksterhuis 2014), supporting the understanding of the major function of olfaction from an evolutionary perspective: It triggers approach and avoidance behaviors aimed at enhancing an individual's chances of survival. Those basic

dimensions of scent affect consumer responses, the process of which is mediated and moderated by variables that are described next.

Typology and categorization of scents It is well established that some odors are universally perceived as pleasant and others unpleasant across cultures. However, the perceived pleasantness of a scent depends primarily on scent composition as well as on individual differences in scent preferences, age, gender, and individual memory of past experiences (Gulas and Bloch 1995).

According to the aromatherapy literature, odors may carry *associations* with concepts, cross-modal perceptions, and behaviors. Some scents, for example, are recognized to have relaxing properties and create a more pleasurable environment, whereas others are more arousing and stimulating. Peppermint, for example, is commonly associated with sexual arousal and clear thinking, while cinnamon leads to focus and concentration. The aroma of lemon promotes calm and relaxation, while the aroma of lavender helps to control emotional stress. Poon and Grohmann (2014), for example, found that consumers' anxiety levels increased under conditions of low spatial density combined with an ambient scent associated with spaciousness.

Recent investigations have focused on those hedonic characteristics of odors that are directly related to knowledge and cognition instead of the basic dimensions through which individuals commonly perceive scents. Madzharov and colleagues (Madzharov et al. 2015) demonstrated that odors may carry semantic associations and differ in perceived temperature: Some odors (e.g., cinnamon and vanilla) are perceived as warm, while others are perceived as cool (e.g., peppermint). Herrmann and colleagues (Herrmann et al. 2013) demonstrated that different effects of ambient scents can be

ascribed to differences in scent composition (simple vs. complex), meaning that a scent may contain a single dimension (one fragrance) or several dimensions (more than one fragrance). Their experiments show that simple scents (e.g., lemon, orange) are more easily processed by individuals than complex scents (e.g., lemon-basil, orange-basil) and lead to increased amounts of money spent (Herrmann et al. 2013).

Odor perceptions might be associated with other sensory experiences, such as touch (Demattè et al. 2006), taste (De Araujo et al. 2003), specific events such as Christmas (Spangenberg et al. 2005), cleanliness (Holland et al. 2005), and gender (Krishna et al. 2010a). For example, Spangenberg et al. (2006) showed that when a scent is congruent with gender-based products it positively influences individuals' emotions and arousal, such that the masculine scent of rose maroc fits better with male clothing, while the feminine smell of vanilla is more appropriate with female clothing. Holland et al. (2005) demonstrated that the mere exposure to the scent of all-purpose cleaner caused participants to keep their direct environment cleaner during an eating task (eg., awareness checks showed that participants were unaware of this influence.) These results provide support for the idea that olfactory information, categorization, and cognitive processing create semantic associations with multimodal sensory cues and affect unrelated behaviors, even without an individual's conscious awareness.

Psychological processes

Emotional perspective As stated, findings from recent investigations contradict the notion that consumers primarily react to the environment emotionally (Chebat and Michon 2003; Cirrincione et al. 2014; Krishna et al. 2010a; Michon and Chebat 2004). Consumers' evaluations (Morrin and Chebat 2005), moods (Mitchell et al. 1995), and behaviors (Spangenberg et al. 1996) in response to odors instead seem to occur without significant shifts in mood or arousal. For example, while examining how ambient scents affect consumers' spatial perceptions in retail environments, Madzharov et al. (2015) provided evidence that scent can affect behavior through cognitive rather than affective routes. Chebat and Michon (2003) found that pleasure and arousal did not mediate the effects of environmental cues on perceptions and behaviors, and they suggested that the importance granted to emotions in the literature on atmospheric store environments may have been overstated. Michon and Chebat (2004), in examining how mall atmospherics (ambient odors and music) are processed through consumers' emotions and perceptions of their environment, concluded that some atmospheric cues are more likely to mediate shoppers' emotions while others stimulate cognitive processing: Music plays on emotions, and ambient odors play on cognition.

There is a debate in psychology regarding whether emotion is independent of thought (Zajonc and Markus 1984). Some studies suggest that for an emotion to occur, a change in mood or arousal is always needed (Zajonc and Markus 1984). In contrast, according to the cognitivist perspective, emotions arise under specific conditions in the cognitive appraisal of events and stimuli (Frijda et al. 1989) and may be independent of any experience of arousal (Frijda et al. 1989). The appraisal theory considers emotions to be the outcome of a cognitive process of appraisal. A stimulus (such as a scent) is cognitively appraised, and emotions occur as a result, so individuals cope with emotions in terms of both physiological and cognitive reactions. The perspective that affective responses to scents involve thoughts and reasoning may explain the contradictory results regarding the ability of odors to induce specific core emotions (Cirrincione et al. 2014; Michon and Chebat 2004; Spangenberg et al. 1996) for many reasons. First, the general arousal mechanism operates quickly and automatically, thus hindering individuals' identification of the source of their arousal and making it impossible for emotions to emerge (Schachter and Singer 1962). Second, odors are difficult to recognize (Chebat and Michon 2003) and label (Schab 1991), and they lack a conscious mental representation (Zucco 2003), making individuals' identification of the source of arousal even more difficult. Third, individuals appraise odors first through their affective valence (Smeets and Dijksterhuis 2014) and then through their associations and meanings (Rabin and Cain 1984). This evidence suggests that individuals' responses to olfactory stimuli, both emotional and cognitive, primarily involve odor interpretation, which consists of the system of existing knowledge, prior experiences, and memory for odors (Stevenson and Wilson 2007). Thus, we suggest that emotion itself may not be sufficient to arouse consumers' psychological responses.

Conscious (deliberate) cognition The act of smelling provides information and cognition that support individuals to experience the environment, helping them to assign meaning to physical and social phenomena (Holmes and McCormick 2010). Cognitive processes underlying the perception of odors and subsequent behaviors have been widely investigated (Biswas et al. 2014; Holland et al. 2005; Mitchell et al. 1995), mainly regarding the ability of odors to arouse conscious cognition, defined as cognitive processes of which individuals are aware during evaluative tasks involving memory, learning, and thinking (Dijksterhuis 2004). Exposure to odors may influence consumers' product choice (Biswas et al. 2014), haptic perceptions (Krishna et al. 2010a, b), decision-making (Mitchell et al. 1995), and purchase intentions for specific products (Spangenberg et al. 2006). In terms of memory, odors also contribute to improving product attribute recall (Lwin et al. 2010), olfactory and visual imagery (Lwin et al. 2010; Mitchell et al. 1995), memory for product

information (Krishna et al. 2010a, b), brand recall (Morris and Ratneshwar 2000), and ad recall more than pictorial and visual cues in commercials (Lwin and Morris 2012). According to Accessibility-Diagnosticity (A-D) theory, individuals access their attitudes toward an object by retrieving available cognitions, past experiences, and prior knowledge from their long-term memory or the surrounding environment (Feldman and Lynch 1988). Accessibility refers to information consciously accessed from the environment that is related to information previously stored in the long-term memory, which can have a great influence on consumers' inferences and judgments (Bone and Ellen 1999). Accessibility is high whenever a certain piece of information is easy for a consumer to retrieve. Diagnosticity refers to the degree to which the information is helpful in categorizing (i.e., clean/dirty; healthy/unhealthy) or interpreting the object or the environment. Diagnosticity is high whenever the information is low in ambiguity and the amount of other information available to the consumer is low. It is expected that an individual will rely more heavily on the more diagnostic information at the expense of the ambiguous information (Bone and Ellen 1999) to draw inferences and make judgments. Although odors are usually more ambiguous than images and sounds, they still function as diagnostic information about products and stores, activating mental representations and concepts (Chrea et al. 2005) and making already available cognition more accessible (Smeets and Dijksterhuis 2014). However, the cognitive processes of inference and judgment do not always occur at the level of consciousness but may instead operate automatically and unconsciously (Gaillet et al. 2013), as we explain below.

Unconscious cognition

People are constantly affected by information and inputs of which they are largely unaware. A visual ad, an odor in a store, or a haptic stimulus of a product may result in inferences, judgments, and even decisions that mostly do not involve deliberate rational thinking. With the term unconscious cognition, or unconscious information processing, we refer to those cognitive processes that occur outside an individual's conscious awareness (Dijksterhuis 2004) and are mostly activated by stimuli that are perceived at the subconscious level even before conscious cognition allows individuals to process and elaborate those stimuli. For example, brain areas that normally process certain stimuli are activated even when words are presented subliminally, as confirmed by studies employing functional magnetic resonance imaging (fMRI) (Naccache and Dehaene 2001), and pleasant food odors may subconsciously divert a person from pursuing an ongoing goal to start eating (Smeets and Dijksterhuis 2014).

Although understanding the distinction between conscious and unconscious cognition remains a priority in psychology

and neuroscience (Soto et al. 2019), it is both theoretically sounder and methodologically more plausible to examine the impact of implicit knowledge as operating along an implicit/explicit continuum, since most cognitive tasks, including perception, inference, judgment, and decision-making, result from the influence of both conscious and unconscious processes. However, while conscious cognition is activated only when an attribute or a stimulus is accessible or available, unconscious cognition operates continuously, since memories, past experiences, and thoughts that are deleted from the conscious are permanently stored at the subconscious level (Kihlstrom 1987). When relevant information is missing, individuals rely especially on their unconscious (the only available cognitions) to form their attitude toward something (Feldman and Lynch 1988). Odors influence the unconscious and differ from other senses in the direct connection between the two brain areas that control emotions and memories: the amygdala and hippocampus. The primary olfactory processing is related to the limbic, instead of the cortical system of the brain, contrary to visual perceptions, which are less ambiguous and more likely to be described and labeled precisely (Sommerville and Broom 1998). Visual perceptions, indeed, are recognized to better capture the attention (Smeets and Dijksterhuis 2014), possess multiple attributes for coding (e.g., size, shape, color), and produce a more concrete mental representation, than smells (Zucco 2003). Due to this ambiguity of odors to be consciously elaborated, mentally represented (Zucco 2003), and evocative (since they can be described only indirectly by metaphors or comparisons), the sense of smell is considered the most primitive of our senses and more likely to evoke automatic and unconscious responses as such responses are immediately connected to emotions (Engen 1987).

The unconscious activation of mental concepts aroused by odors has been addressed in studies investigating priming effects, which occur when the exposure to a stimulus affects the response to another, unrelated stimulus (Pauli et al. 1999). Although research on odor priming is still limited, preliminary evidence shows that the exposure to an odor outside the individual's conscious awareness may bias perception of verbal labels (Herz and von Clef 2001), visual cues (Seo et al. 2010), auditory and gustatory stimuli (Stevenson et al. 2012), and food choices (Hermans et al. 2005). Those studies have focused on odor meanings and semantic associations with sensory perceptions (Demattè et al. 2006) and concepts (Krishna et al. 2010a; Spangenberg et al. 2006) that arouse responses primarily unconsciously (e.g., are implicitly learned or previously experienced) and, afterward, are consciously elaborated to regulate consumers' responses. We propose in our framework that the perception of the odor primarily activates the unconscious cognition, which in turn engages individuals in conscious cognitive processes of odor interpretation and the emotional experience of the odor. Thus,

odor perceptions are regulated by both unconscious and conscious cognitive processes that jointly shape consumers' responses.

Individual differences

Several individual factors may moderate the relationship between scent and consumer responses, such as learning, memory, and odor sensitivity.

Learning and memory It is well established that olfactory stimuli are particularly capable of arousing emotions and supporting individuals in learning and retrieving episodic memories of their past emotional experiences (Herz and Engen 1996). This instills olfaction with a unique ability to influence mood, the acquisition of new information, and the use of information in many different contexts, all of which are important for learning and memory. Odors are equal to other cues for eliciting the content of memories, but they evoke memories that are more emotionally loaded than those elicited through other sensory modalities. Cognitive olfactory research has addressed a variety of factors, such as the duration of olfactory memory, the implicit memory of odors, and the odor-based context-dependent memory (Herz and Engen 1996). Regarding the duration of olfactory memory, some authors found that the rate of forgetting of olfactory representations is rather slow. Kärnekull and colleagues (Kärnekull et al. 2015), for example, investigated long-term olfactory forgetting as a function of the familiarity of the odor and odor identification, components that make the odor more meaningful and that ultimately result in better memory performance. The implicit (unconscious) memory for odors refers to situations in which the effects of prior experiences can be observed, although the participants are not instructed to relate their current performance to a learning episode, and the process can be disturbed by semantic knowledge. Degel et al. (2001) confirmed that being able to identify an odor by its correct name interferes with the retention and retrieval of an implicitly acquired and phenomenally unconscious memory of that odor. Odor-based context-dependent memory is grounded in the principle that odors encoded as part of a memory trace can facilitate memory of stored material when subsequently experienced. For example, in an education setting, a certain ambient odor enhanced retrieval of knowledge learned in that ambient environment (Herz and Engen 1996).

Odor sensitivity and processing style Humans have ordinary olfactory discrimination (Bushdid et al. 2014), which is strongly individually specific and may differ between individuals (Secundo et al. 2015). Age, for example, may affect odor identification and labeling (Larsson et al. 2004) and the perceived intensity of an odor (Hummel et al. 2003). Individual

differences also affect how odors are elaborated, and individuals process odors primarily through their valence. While some odors are universally felt to be pleasant and others unpleasant across cultures (Chrea et al. 2004), unpleasant scents are equally perceived independently of age (Konstantinidis et al. 2006). Genetic characteristics (Menashe et al. 2003), gender (Lundström et al. 2003), and culture (Chrea et al. 2004) also affect individuals' sensitivity to odors and olfactory performance. Gender plays a relevant role in determining individual differences in odor processing, as women are generally more sensitive to pheromones and odorants (Lundström et al. 2003) and more accurately identify olfactory information than men (Larsson et al. 2004). Odor processing also differs among individuals based on cognitive abilities: Proficiency in memory functions is positively related to odor identification performance (Larsson et al. 2004).

Cross-modal interactions (odors with other senses)

Perception is generally a multisensory process since most situations involve more than one sense. Cross-modal correspondences occur when attributes in one sensory modality consistently match those in another modality, and they may reflect a strategy by which the human brain can quickly and effectively deal with complex sensory inputs (Hanson-Vaux et al. 2012). Traditional research has explored the effect of odor correspondence with sensory stimuli in other modalities on subsequent judgments under the congruence hypothesis (i.e., it can be expected that the effect of ambient scents on product evaluations depends on how congruent the scents are with the product, given strong semantic connections) (Bosmans 2006). For example, consumers prefer coconut-scented sunscreen and lemon-scented household cleaner over the same products with incongruent odors (Bone and Jantrania 1992), and when the odor matches product category (e.g., chocolate odor with chocolate assortment; floral odor with flower arrangement), participants spend less time encoding product information (Mitchell et al. 1995). Individuals perceive the environment synesthetically (when stimulation in one sense induces an involuntary, unusual experience in either the same or a different sense) (Gallace and Spence 2006), and olfactory information has been shown to interact with visual (Lwin et al. 2016; Seo et al. 2010), haptic (Demattè et al. 2006), gustatory (De Araujo et al. 2003; Stevenson et al. 2012), and auditory inputs (Mattila and Wirtz 2001), giving rise to the multisensory experience of the stimuli in the surrounding environment.

Cross-modal interaction of odors with visual stimuli Studies suggest that odor-color associations are partly based on semantic knowledge (identity, familiarity, and category) of the source objects of the odors, showing the primordial influence

of experiences with explicitly identified odors (Li et al. 2007; Schifferstein and Blok 2002). Odor-color associations occur at the cognitive level of processing (Demattè et al. 2006), so odors may improve visual attention to semantically congruent objects (Seo et al. 2010) and colors (Demattè et al. 2006) and may bias odor detection (Gottfried and Dolan 2003). Goubet et al. (2018) reported that children's odor-color associations were primarily based on their prior knowledge of odors and on perceptual or semantic aspects of odor source objects. Using a visual stimulus, Gottfried and Dolan (2003) found that semantically congruent (as opposed to incongruent) pictorial images resulted in faster and more accurate odor detection. Ngo and colleagues (Ngo et al. 2011) found a widespread cross-modal association between odors and visual stimuli such as abstract symbols and shapes. For example, odors such as raspberry and vanilla were associated with rounded shapes, while bitter dark chocolate was associated with sharper shapes. The cross-modal interaction between olfactory and visual stimuli has also been explored in the context of print advertisement: Sniffing a scent while viewing an ad (e.g., olfactory-visual condition) improves visual attention to the advertised object when the object is semantically congruent with the odor compared with the visual-only condition (Lwin et al. 2016).

Cross-modal interaction of odors with haptic stimuli Odors may also interact with touch, modulating haptic perceptions of the softness of unrelated objects. For example, Demattè et al. (2006) showed that the pleasant odor of lemon (compared with an unpleasant animal-like odor) induces better judgment of the haptic qualities of fabric swatches (e.g., slight and soft). Similarly, Krishna and colleagues (Krishna et al. 2010a, b) demonstrated that when the smell is semantically related to haptic perceptions (texture and temperature) it leads to more favorable evaluations of the product (e.g., paper, gel-pack). The smell was semantically connected with the texture of the product along the dimension of odor hedonic qualities, such as gender-congruence and perceived temperature, so that consumers rated the smooth paper more positively in the presence of a feminine smell, while they rated the rough paper more positively in the presence of a masculine smell. Moreover, warm odors enhance warm gel-pack evaluations, while cold odors lead to more positive cold gel-pack evaluations (Krishna et al. 2010a, b). Lefebvre and Biswas (2019) showed that the presence of a warm ambient odor (e.g., cedar wood) versus a cool ambient odor (e.g., eucalyptus) influences perceived ambient temperature, which in turn alters food consumption behaviors. This is attributable to established implicit associations formed from the human body's innate physiological responses to changes in ambient temperature.

Cross-modal interaction of odors with gustatory stimuli Olfactory and gustatory systems are interconnected and activated in the same region of the brain. Guéguen and Petr

(2006) demonstrated that the pleasant odor of lavender, even when not congruent with all dishes served in a restaurant, had a positive effect on time and money spent in that restaurant. Gaillet and colleagues (Gaillet et al. 2013) showed that unconsciously perceived odors of foods with certain features influenced food choices: The scent of melon induced participants to more frequently choose starter-related food options, while pear scent induced more dessert-related food choices. In contrast to previous research that demonstrated general cross-modal effects (e.g., strawberry-scented solutions are rated as smelling stronger when colored red than when colorless), Biswas and Szocs (2019) demonstrated cross-modal compensation effects. For example, encountering a cue in one sensory modality (e.g., olfaction) can compensate (or satisfy) desires related to another sensory modality (e.g., gustatory). They demonstrated that exposure to indulgent food-related odors (e.g., cookie) stimulates food choices of healthy options, while the exposure to non-indulgent food-related odors (e.g., apple) induces consumers' choices of unhealthy food options.

Cross-modal interaction of odors with auditory stimuli

Several studies have demonstrated that matching an ambient scent with music style and tempo enhances approach behaviors, impulse buying, and satisfaction (Mattila and Wirtz 2001); cognitive processing and shoppers' evaluations of the mall environment (Michon and Chebat 2004); store attitudes and evaluations of the environment (Spangenberg et al. 2005), pleasure and time spent in the store (Morrison et al. 2011), and purchase decisions (Helmefalk and Hultén 2017). In studying odor-sound matches, Stevenson et al. (2012) demonstrated that individuals make consistent associations relying on both semantic and perceptual-cognitive mechanisms similar to odor associations with other senses (e.g., taste, vision, and touch). According to the semantic hypothesis, Seo and colleagues (Seo et al. 2011) demonstrated that sounds that are semantically congruent with odors (e.g., French fries odor combined with the sound of crispy chips) affect the pleasantness and perceived intensity of odors. In a study that provides support for the concept of a perceptual-cognitive mechanism underlying odor-sound correspondence, Crisinel and Spence (2011) showed that odors may be perceived to match certain pitches of sound and musical instruments.

Because odors are sometimes difficult to identify (Chebat and Michon 2003; Zucco 2003) (Chebat and Michon 2003), their interaction with other sensory stimuli may help individuals consistently process odors (Gallace and Spence 2006). However, research on cross-modal interactions of odors with other sensory cues is still limited. As the associations of odors with other senses occur at the cognitive level of processing, as demonstrated by Demattè et al. (2006), we believe that the interaction and processing of odors concurrently with other sensory inputs are of primary importance as moderators of

the cognitive processing underlying the effect of odor interpretation and behaviors.

Consumer responses to scent

Behavioral responses refer to individual actions and tendencies to behave in a certain way toward something. Environmental

psychology has demonstrated that pleasant odors lead to approach behaviors in retail settings (Adams and Doucé 2016; Spangenberg et al. 2006) and increase the amount of money spent (Bouzaabia 2014; Doucé and Janssens 2013; Vinitzky and Mazursky 2011), the time spent in the store (Morrison et al. 2011), and purchases of premium brands (Madzharov et al. 2015). Table 1 summarizes the evidence from previous research and highlights the important role of odors in regulating

Table 1 Behavioral responses of scent

Author	Response	Focus
Affective theories		
(SOR – environmental psychology, optimal stimulation theory)		
Adams and Doucé 2016	Behaviors toward the store	Retailing
Bouzaabia 2014	Time and money spent	Retailing
Chebat et al. 2009	Consumer spending	Retailing
Gueguén and Petr 2006	Time and money spent	Retailing
Helmefalk and Hultén 2017	Time spent on purchase	Retailing
Hirsch 1995	Money gambled	Retailing
Jacob et al. 2014	Amount of purchasing	Retailing
Mattila and Wirtz 2001	Approach behaviors, impulse buying	Retailing
Morrin and Chebat 2005	Dollar expenditures	Retailing
Morrison et al. 2011	Time and money spent	Retailing
Orth and Bourrain 2005	Exploratory tendencies, curiosity-motivated behavior	Retailing
Parsons 2009	Time spent in the store, purchase behavior	Retailing
Spangenberg et al. 2006	Time spent in the store, number of items purchased, amount of dollars spent	Retailing
Cognitive theories		
(Cross-modal interaction, synesthesia, priming, cognitive consistency theory, processing fluency)		
Biswas and Szocs 2019	Consumer preferences, food choice, number of items purchased	Decision-making, information processing
Doucé et al. 2013	Approach behaviors, search for information, buying behavior	Retailing
Gaillet et al. 2013	Reaction time scores, product choice	Information processing
Hall et al. 2010	Product choice	Decision-making, information processing
Herrmann et al. 2013	Time and Money spent	Retailing
Holland et al. 2005	Cleaning behavior, scent associations	Decision-making, information processing
Lwin et al. 2016	Ad evaluations, fixation time, fixation frequency, purchase intentions	Decision-making, information processing
Madzharov et al. 2015	Number of purchased items	Retailing
Schiffstein and Blok 2002	Sales of thematically congruent products	Retailing
Seo et al. 2010	Time spent examining products, time of eye fixation, number of eye fixations	Decision-making, information processing
Vinitzky and Mazursky 2011	Time spent in the shop, number of brands selected, number of brands purchased, total expenditure, level of telepresence, consumer attention focus, consumer challenge	

consumers' exploratory tendencies (Orth and Bourrain 2005), purchase decisions (Helmefalk and Hultén 2017), the number of items they purchase (Jacob et al. 2014; Schifferstein and Blok 2002), the amount of time spent examining products in the store (Seo et al. 2010), and consumers' general spending (Teller and Dennis 2012).

Cognitive responses involve individual reactions based on mental abilities related to knowledge, such as beliefs, thoughts, perceptions, and evaluations. Table 2 presents evidence from prior research that suggests a positive relationship between pleasant scent and cognitive responses, such as improved product quality perceptions (Chebat and Michon 2003), service satisfaction (Morrin and Chebat 2005), attitudes toward ads and brands (Bone and Ellen 1998), product judgments (Bone and Jantrania 1992), and analytical reasoning (Madzharov et al. 2018). Odor perceptions are also important in improving

evaluations of stores, merchandise (Michon et al. 2005; Spangenberg et al. 2006) and shopping malls (Doucé and Janssens 2013; Michon et al. 2005) and reducing perceptions of price (Spangenberg et al. 1996). More importantly, odors directly shape consumers' memories, restoring lost information (Morrin et al. 2011), increasing product attribute recall, and improving olfactory and visual imagery (Lwin et al. 2010).

Affective responses concern feelings, moods, and emotions that arise as a consequence of conscious or unconscious exposure to a stimulus. Previous studies have confirmed a positive relationship between odors and moods (Leenders et al. 2016; Mattila and Wirtz 2001; Spangenberg et al. 2006). For example, fruity and floral odors seem to induce calmness and reduce anxiety (Lehrner et al. 2000; Lehrner et al. 2005). Mood changes also mediate the effect of scent congruence on product judgments (Bosmans 2006), improve

Table 2 Cognitive responses of scent

Author	Response	Focus
Affective theories (SOR – environmental psychology)		
Adams and Doucé 2016	Store evaluations, product evaluations, intentions to revisit the store, word-of-mouth	Retailing
Bouzaabia 2014	Evaluations of the store environment, product and service quality	Retailing
Chebat and Michon 2003	Evaluations of the store environment, product and service quality	Retailing
Cirrincone et al. 2014	Memory for artworks	Decision-making, information processing
Doucé and Janssens 2013	Evaluations of the store environment and products, intentions to revisit the store	Retailing
Morrin and Ratneshwar 2000	Brand evaluation, recognition accuracy	Decision-making, information processing
Morrin and Ratneshwar 2003	Brand recall and brand recognition accuracy	Decision-making, information processing
Spangenberg et al. 1996	Evaluations of the store, purchase intentions for specific products, actual vs. perceived time spent	Retailing
Spangenberg et al. 2005	Evaluation of the store, attitudes toward the environment and the merchandise, intentions to visit the store	Retailing
Cognitive theories (Cross-modal interaction, synesthesia, priming, accessibility theory)		
Biswas et al. 2014	Product preferences, product choice	Decision-making, information processing
Bone and Jantrania 1992	Product judgment	Decision-making, information processing
Bosmans 2006	Brand evaluation, product evaluation	Decision-making, information processing
Demattè et al. 2006	Tactile perceptions	Decision-making, information processing
Hermans et al. 1998	Cognitive processing of verbal stimuli	Decision-making, information processing
Hermans et al. 2005	Product perceived quality, product attractiveness, purchase intentions	Decision-making, information processing
Krishna et al. 2010a, b	Memory for products, recall, cognitive processing	Decision-making, information processing
Lwin et al. 2010	Memory for verbal information	Decision-making, information processing
Madzharov et al. 2015	Social density perception, preference for prestige-focused advertising, tendency to buy premium brands	Decision-making, information processing
Madzharov et al. 2018	Analytical reasoning	Decision-making, information processing
Morrin et al. 2011	Retroactive inferences, brand recall	Decision-making, information processing
Pauli et al. 1999	Odor valence, interference effects	Decision-making, information processing

shopping experiences (Mattila and Wirtz 2001), and elicit more favorable feelings toward brands (Lwin and Morrin 2012). However, some studies have shown that the connection between odors and emotions is a matter of boundary conditions (temporal and contextual factors that set limitations on the propositions generated from a theoretical model, limiting its generalizability), such as the levels of retail density (Michon et al. 2005) and odor arousal (Cirrincione et al. 2014). The application of environmental psychology has not clarified the underlying mechanism through which odors regulate consumers' affective responses. It has not been demonstrated that emotions mediate the impact of scent on behaviors (Chebat and Michon 2003), on perceptions of service quality (Michon and Chebat 2004), or on affective evaluations of stores (Morrin and Chebat 2005). Table 3 summarizes the evidence from previous research about the relationship between scent and affective responses.

Research agenda

Our review reveals that the field of scent marketing has reached considerable scientific maturity from both the theoretical and methodological perspectives. We propose four areas of research and specific research questions (see Table 4, Q1-Q15) for each area, which may encourage future investigations.

Clarifying the role of arousal surrounding odor effects

The aforementioned systematic literature review suggests that research in scent marketing has prioritized the investigation of consumer responses from an emotional perspective. However, the evidence contradicts the notion that consumers primarily react to the environment emotionally. Their evaluations and behaviors in response to odors occur mostly independently of mood shifts. This may concern the way in which the SOR

Table 3 Affective responses of scent

Author	Response	Focus
Affective theories (SOR – environmental psychology)		
Bouzaabia 2014	Pleasure, stimulation	Retailing
Cirrincione et al. 2014	Arousal	Retailing
Doucé and Janssens 2013	Pleasure, arousal	Retailing
Gvili et al. 2018	Affective responses to advertisement, pleasure, arousal	Decision-making, information processing
Helmefalk and Hultén 2017	Consumer emotions, arousal, valence	Retailing
Leenders et al. 2016	Evaluations of the store, evaluations of the store environment, pleasure, arousal, dominance	Retailing
Lehmer et al. 2000	Level of calmness, moods, level of state anxiety	Service environment
Lehmer et al. 2005	State anxiety, current moods, alertness and calmness	Service environment
Michon et al. 2005	Consumers' moods, perception of the mall environment, perception of the product quality	Retailing
Morrin and Ratneshwar 2000	Pleasure, arousal, dominance	Decision-making, information processing
Poon and Grohmann 2014	Spatial perceptions, anxiety, spatial density, pleasure, arousal	Retailing
Spangenberg et al. 2005	Pleasure, arousal, dominance	Retailing
Teller and Dennis 2012	Pleasure, arousal, consumer spending	Retailing
Cognitive theories (Cross-modal interaction, synesthesia, priming, accessibility theory)		
Herz and von Clef 2001	Odor Priming	Decision-making, information processing
Krishna et al. 2010a, 2010b	Synesthesia, cross-modal interactions	Decision-making, information processing
Lwin and Morrin 2012	Synesthesia, cross-modal interaction	Decision-making, information processing
Mitchell et al. 1995	Cognitive processing accessibility, Static-Dynamic choice	Decision-making, information processing

Table 4 Research agenda

Subject	Proposed research questions for future research
Clarifying the role of Arousal surrounding odor effects	<p>(Q1) How do odors elicit more discrete emotions (e.g., excitement, disgust, fear) versus more general emotions (e.g., pleasure, arousal, dominance)?</p> <p>(Q2) Does the congruence between the arousal of the odor and other sources of arousal surrounding the environment influence scent effects on emotions and behaviors?</p> <p>(Q3) How does the interplay between the incidental arousal of the odor and the individuals' pre-existing moods drives consumers' responses to odors?</p> <p>(Q4) How does the interaction between odor-induced moods and cognitive processing affect consumers' responses to odors?</p> <p>(Q5) Which combination of arousal of the scent and the arousal level of other sensory inputs better evokes individuals' affect?</p> <p>(Q6) What is the effect of odors on mood changes after controlling for previous moods and their valence?</p> <p>(Q7) Is cognitive elaboration a boundary condition under which odors are effective to induce pleasant moods and arousal?</p>
Integrating Cognition to the Emotional approach of scent marketing	<p>(Q8) Why are certain odors perceived as diagnostic for the store environment but non diagnostic for specific products in the store?</p> <p>(Q9) Does the diagnosticity of odors work differently on choices and decision-making depending on the product category, product familiarity, and information processing style?</p> <p>(Q10) Does scent diagnosticity improve evaluations of products for which consumers have no strong preferences, compared with products already known by consumers?</p> <p>(Q11) Does scent diagnosticity affect product evaluations depending on whether the attribute of the scent is perceived as a more (vs. less) diagnostic attribute for the evaluation?</p> <p>(Q12) Does scent diagnosticity interact with consumers' information processing style?</p>
Assessing the unconscious cognitive mechanism underlying consumer's responses to scents	<p>(Q13) Does affective priming operate similarly for both positive and negative priming?</p> <p>(Q14) Are the cognitive mechanisms underlying the effect of odors on behavior affective (e.g., positive or negative perception of the prime) or semantic (e.g., the prime and the target share the same meaning)?</p> <p>(Q15) Does semantic priming occur independently of affective priming processes?</p>
Managing Cross-modal interactions between odors and other senses	<p>(Q16) To what extent are odors associated with other sensory cues based on the shared form and shape (e.g., perceptual processing) or based on their conceptual meaning (e.g., semantic processing)?</p> <p>(Q17) Are the cross-modal associations between odors and other sensory cues facilitated (vs. inhibited) when the two stimuli share the same (vs. differ on) hedonic valence?</p> <p>(Q18) Which sensory modality (e.g., vision, touch, audition, and taste) predominates to improve cross-modal associations with odors?</p>

model is conceptually applied to scent research. In contrast to other theories of emotions, the SOR model allows emotional states to be conceptualized in more general and bipolar terms (e.g., pleasure/displeasure, arousal/lack of arousal, dominance/submissiveness), inhibiting the investigation of a variety of discrete emotions (Bagozzi et al. 1999). The construct of general arousal as a basic emotion that regulates consumer responses does not capture the specific conditions of appraisal or the emotion-specific physiology necessary for the emotion to occur (Bagozzi et al. 1999).

Previous studies on the relationship between odors and emotions or moods have not found evidence of the effect of olfactory cues on general arousal (Chebat and Michon 2003; Cirrincione et al. 2014; Morrison et al. 2011), while other studies focusing on discrete, more specific emotional states, such as calm (Lehrner et al. 2005), anxiety (Poon and Grohmann 2014), and feelings for a specific brand (Lwin and Morrin 2012) have been more successful in confirming a positive relationship between odors and emotions. Arousal, as the basic emotional process underlying the perception of odors and consumers' responses, also has limitations regarding the methodological approaches and self-reported measures commonly employed to assess consumers' emotional experiences. We suggest that future research may challenge the conceptualization and operationalization of the arousal concept and prioritize the investigation of how odors elicit more discrete emotions (e.g., excitement, disgust, fear) than general emotions (e.g., pleasure, arousal, dominance) (Q1).

Empirical evidence suggests that boundary conditions are influential when consumers react to odors as a result of the experience of arousal (Morrin and Ratneshwar 2000; Spangenberg et al. 1996). Possible boundary conditions to be considered are the congruence between the arousal induced by the odor and other sources of arousal in the environment (Q2), the interplay between the incidental arousal induced by the odor and an individual's pre-existing mood (Q3), and the interaction between stimulus-induced moods and cognitive processing (Q4).

Several studies have demonstrated that the congruence of the thematic cues induced by memories and meaning (Kellaris, Cox and Cox 1993) is a necessary condition for achieving changes in mood (Spangenberg et al. 2005). Many studies have demonstrated that when two (or more) sensory stimuli are congruent on their level of arousal (high tempo music and arousing odor, for example) consumer emotions are enhanced (Mattila and Wirtz 2001; Morrison et al. 2011; Spangenberg et al. 2005). As such, we believe that the stimulation caused by odors alone may not be sufficient to induce arousal, so future research should clarify which combination of arousal caused by the scent and the arousal level caused by other sensory inputs better evokes individuals' emotions (Q5).

Theories of emotions observe that arousal may function as a regulating mechanism for goal attainment, coping responses,

action tendencies, and motivation (Oatley 1992) because emotions help individuals to correct discrepancies between current and desired states (Bagozzi et al. 1999). The exposure to olfactory stimuli may induce arousal that potentially elicits an emotion. However, the stimulus-evoked affect (e.g., olfactory-evoked arousal) may interact with pre-existing, incidental arousal (Yan et al. 2016), such that negative (vs. positive) pre-existing moods interacting with positive odor-perceived arousal induce individuals to reach a better mood (vs. maintaining their current mood). Future research should elucidate the effect of odors on mood changes after controlling for previous moods and their valence (Q6).

Effects induced by stimuli also interact with cognitive processing. In other words, positive moods lead to heuristic processing while negative moods induce more systematic processing of information (Bless et al. 1990). This may explain why a large number of previous studies on olfaction and emotions have produced mixed results on how odor perceptions affect stimulus-induced moods. Pleasant feelings (e.g., pleasure and arousal) contribute very little to determining greater perceptions of product quality and spending (Chebat and Michon 2003); arousal ratings diminish when individuals are engaged in effortful evaluation tasks (Mitchell et al. 1995) or in complex memory recall and recognition tasks (Morrin and Ratneshwar 2000). Counterintuitively, Cirrincione and colleagues (Cirrincione et al. 2014) found that self-reported ratings of arousal diminished due to the perceived ease of processing scent information when the information are congruent with the the object being evaluated (e.g., style of paintings). We suggest that cognitive elaboration may represent a boundary condition under which odors are effective in inducing pleasant moods and arousal (Q7).

Integrating cognition into the emotional approach of scent marketing

In order to approach the study of the effects of scents from a cognitivist perspective, as we suggest in this review, future investigations should explore the effects of scents according to the accessibility-diagnostics framework (Feldman and Lynch 1988). This may address scent marketing literature under which the conditions of information about scents can make some of the attributes or information regarding a product or an environment more salient, accessible, and diagnostic in order to facilitate the evaluation and decision-making processes. In the context of sensory marketing, the concept of cue diagnostics has been applied to study the effects of haptic perceptions on the evaluation of taste (Krishna and Morrin 2007). Even when haptic cues are nondiagnostic (not relevant) for evaluating product quality, haptic perceptions increased product evaluations and the willingness to pay in low- (versus high-) autotelic (e.g., consumers entered the shopping with no specific purpose in mind) consumers (Krishna and

Morrin 2007). Their study provided evidence that touching a firm (versus flimsy) plastic cup leads to a more positive evaluation of the water contained in the cup. Thus, even when an attribute is not relevant (diagnostic) to the evaluation of the product, it still affects product evaluations. Scent marketing studies have not explicitly examined the concept of scent diagnosticity. However, several studies have demonstrated that odors could make the elaboration process easier (Bosmans 2006) and the information more available (Morrin and Ratneshwar 2000) and could add compatible information that promotes consistent inferences about product performance and quality (Bone and Jantrania 1992). Conversely, when the scent adds no new relevant information to a product, it has a negative effect on judgment (Bone and Jantrania 1992). As previously suggested in a review conducted by Bone and Ellen (1999), the concept of diagnosticity may clarify why Spangenberg and colleagues (Spangenberg et al. 1996) found that a specific odor influenced evaluations of the store environment but not specific product judgments; that is, the scent has likely been perceived as diagnostic for the environment but not useful for evaluating any specific product in the store (Q8).

Future research should evaluate whether (Q9) the diagnosticity of odors works differently on choices and decision-making depending on the product category (e.g., scented versus unscented products), product familiarity (e.g., products for which consumers already have strong preferences versus new products), and information processing style (e.g., heuristic versus systematic processing styles).

Previous studies have demonstrated that the effect of scent on consumer responses may depend on product familiarity. A pleasant scent increases brand recall of unfamiliar brands more than of familiar brands (Morrin and Ratneshwar 2000). Accordingly, scent diagnosticity may have different effects on different products, depending on perceived product familiarity, such that (Q10) scent diagnosticity may improve evaluations of products for which consumers have no strong preferences (i.e., new, unfamiliar products) compared with products already known by consumers.

As the sense of smell interacts with other senses synesthetically, odors affect perceptions of other sensory modalities, such as temperature (Madzharov et al. 2015), social density (Poon and Grohmann 2014), and tactile perceptions (Demattè et al. 2006). Haptic perceptions affect evaluations of taste even when touch is a nondiagnostic attribute for product judgment (Krishna and Morrin 2007), and the attribute of the scent may be perceived as more relevant when evaluating unscented products (e.g., pencil, tissue) than scented ones (e.g., shampoo, fragrance). We suggest that further research should explore (Q11) how scent-perceived diagnosticity affects product evaluations depending on whether the attribute of the scent is perceived as a more (vs. less) diagnostic attribute for the evaluation.

The degree to which olfactory information is perceived as more diagnostic and less ambiguous may influence the style (automatic/controlled) of consumer information processing (Bone and Ellen 1999), so we encourage investigations on (Q12) whether the scent-perceived diagnosticity interacts with consumers' information processing style.

Assessing the unconscious cognitive mechanism underlying consumers' responses to scents

The effects of odors on evaluations and behaviors mostly occur without individuals' conscious awareness of the odors but not without an underlying cognitive processing mechanism. Few studies have explored the unconscious cognitive mechanism underlying consumers' responses to scents from the priming perspective. Preliminary results show that the incidental exposure to odors successfully affects the processing of unrelated information and stimuli, such as verbal labels (Herz and von Clef 2001), visual cues (Gottfried, O'Doherty, and Dolan 2003; Seo et al. 2010), auditory and gustatory stimuli (Stevenson et al. 2012), and unrelated behaviors (Holland et al. 2005). When the odor and the unrelated stimulus share the same valence (e.g., both are positive or negative), the stimulus is processed more quickly (Hermans et al. 1998) and evaluated more positively (Hermans et al. 2005). However, research applying the priming perspective has not clarified whether the positive effect of scent on behaviors occurs through affective or semantic priming processes. We encourage further research aimed at clarifying whether affective priming operates similarly for both positive and negative priming (Q13), whether the cognitive mechanism through which odors affect behaviors (Q14) is affective (e.g., positive or negative perception of the prime) or semantic (e.g., the prime and the target share the same meaning), and whether semantic priming occurs independently of affective priming processes (Q15).

The discussion of the embodied cognition aroused by smells and the cognitive mechanism underlying the relationship between the perceptions of odors and consumer responses may also address contributions to the methodology of scent research. Existing studies on the effect of scent on consumer behavior has employed almost exclusively the unintentional manipulation of odors in field and laboratory settings, supporting the idea that odors are not suitable for encoding in isolation (Smeets and Dijksterhuis 2014; Zucco 2003). Exploring the cognitive determinants of odor perceptions allows researchers to extend the methodological boundaries of scent studies and the benefit of innovative, intentional (i.e., cue-based) odor manipulations, contrary to traditional, unintentional odor manipulations (i.e., ambient odor not made salient to participants). The application of new approaches, such as accessibility-diagnosticity theories and priming paradigms, also call for alternative measures of odor effects. Thus,

we encourage researchers, according to the cognitive-based approaches, to collect more behavioral than self-reported measures, such as response time (RT) scores, which better represent cognition aroused by odor perceptions.

Managing cross-modal interactions between odors and other senses

Odors interacting with other senses may improve evaluations and bias subsequent judgments and perceptions (Demattè et al. 2006; Lwin et al. 2016). However, previous research has not clarified whether cross-modal interactions between odors and other sensory inputs occur at the perceptual or semantic level of processing. Further investigations should explore (Q16) to what extent odors are associated with other sensory cues based on their shared perceptual attributes (e.g., perceptual processing) or on their conceptual meaning (e.g., semantic processing).

Despite the importance of odor meaning, most research demonstrates that odors are primarily evaluated on their affective valence (Smeets and Dijksterhuis 2014) and that those positive evaluations of pleasant odors are easily transferred to unrelated objects and to stimuli in other modalities, such as verbal labels (Herz and von Clef 2001), visual stimuli (Seo et al. 2010), and gustatory cues (Stevenson et al. 2012). We suggest that future research should clarify (Q17) the extent to which cross-modal associations between odors and other sensory cues are facilitated (vs. inhibited) when the two stimuli share the same (vs. different) hedonic valence. Marketing and consumer behavior literature has primarily prioritized sight over the remaining four senses, perhaps because visual perceptions are recognized to better capture the attention (Smeets and Dijksterhuis 2014), possess multiple attributes for coding (e.g., size, shape, color), and produce a more concrete mental representation than smells (Zucco 2003). As senses differ at the level of coding and interpretation, future research on cross-modal interactions of olfaction with vision, touch, audition, and taste should focus on clarifying (Q18) which sensory modality predominates in improving cross-modal associations.

Final remarks

In this review of empirical studies on olfaction, we discussed the current approaches to scent marketing, developed a cognition-based framework for scent research, and proposed a research agenda to encourage further studies on the cognitive processing of scents. A better understanding of the cognitive approach to scent marketing has implications for management practices and public policies. First, an understanding of how odors are cognitively perceived and what meanings individuals attribute to scents may help address relevant issues in seasonal marketing tactics. Many companies develop ad

hoc seasonal marketing campaigns to improve sales and strengthen consumers' connections with their products, brands, and stores. Starbucks, for example, offers seasonal products and drinks that are available in stores only during a specific period of the year. For example, the Pumpkin Spice Latte is sold only during Halloween. Black Friday, back-to-school shopping season, and Christmas campaigns are all examples of the notion that every season offers managers the opportunity to better plan their marketing strategies. Those seasons may evoke memories through which individuals attribute meanings to odors. Thus, they may represent an easy-to-develop, low-cost tool to connect consumers with products and stores and to create a thematic, season-congruent holistic environment.

Second, odor meanings may have implications for public policies. Previous research has demonstrated that odor perceptions are strongly related to overeating and obesity and that exposure to certain food-related odors leads people, especially those who are overweight, to eat more (Wang et al. 2013). If, on the one hand, companies and managers use odors to trigger the desire to eat more and to improve sales and food consumption, further research could focus on whether olfactory cues can be equally effective, on the other hand, in reducing feelings of hunger and, combined with other public interventions such as nutrition programs, may help to limit overeating and facilitate weight reduction (Proserpio et al. 2019).

Finally, odor meanings and associations are also relevant in medical environments, the scents of which are associated with distressing experiences, anxiety, and sickness. Studies on olfaction as determinants of affective responses to medical environments have shown that certain odors (e.g., lavender, orange) help to reduce anxiety in the waiting rooms of dental offices (Lehrner et al. 2000; Lehrner et al. 2005), improving the overall patient experience. The development of a cognitive-based approach to scent studies does not necessarily solve the dilemma of whether the sense of smell is more an emotional or a cognitive sense.

Our cognition-based framework on the underlying mechanism (mediating process) of unconscious cognition in the effect of scent on consumers' behavioral, affective, and cognitive responses may help researchers to integrate cognition into the emotional approach applied in previous scent marketing studies, contributing to scent marketing literature in several ways. First, including cognition-based explanations of scent effects on consumer behavior allows researchers to address mixed or contradictory results concerning the interplay between olfactory perceptions and emotions, conceptualized as basic pleasure, arousal, and dominance in marketing. (This review provides evidence that emotions, for several reasons, are not sufficient to explain how consumers react to sensory stimuli and the surrounding environment.) Second, our framework exploits the notion that although odors are perceived across certain basic dimensions, such as pleasantness and

familiarity, they are also processed on the basis of their meanings and relevance to individuals, even unconsciously, suggesting that the sense of smell still works through its original and adaptive functions. Finally, a more systematic inclusion of the cognitive approach to scent permits researchers to focus more on the underlying mechanism through which odors are elaborated than on their effects, which allows a better understanding of consumer behavior.

The purpose of our review is not to diminish the theoretical importance of emotional approach to scent marketing studies. We, instead, wish to provide new insights on how to advance theory and practice that may improve the value of affective aspects of sensory attributes and their effect on consumption. Our review looks at the emotional processes arising from the perception of smells as the result of both, conscious and unconscious cognition. We believe that both approaches are of a great value to address the issue of the interplay between emotion and cognition in sensory studies. However, affective responses to smells may occur differently depending on the cognitive mechanism involved in the process of smell perceptions. While conscious cognition involves stimuli that are accessible and available at the time of perception, as usually happens with specific core emotions (e.g., interest and disgust), unconscious cognition may arouse outside of individuals' conscious awareness, as typically happens with more general emotions (e.g., pleasure and arousal), leading to affective responses that are more spontaneous and also difficult to recognize that still influence consumption. In the latter case, the individual does not necessarily attribute the source of her/his emotion to the odor. Therefore, depending on the nature of the cognitive processing, the emotional and conscious cognition components of our framework vary, influencing consumer (behavioral, cognitive, and affective) responses. We hope that our argument, based on recent literature, that scent affects consumer responses through cognitive rather than affective components, motivates future empirical research on scent marketing, since consumers constantly use their sense of smell even though they are not aware that they are doing so.

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