

Scent Marketing: Making Olfactory Advertising Pervasive

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Abstract: please provide an abstract here

1 Purpose

Like other media-based business, the advertising industry is increasingly confronted with the problem of information overload. Penetrating this *information bulk* and reaching customers with advertising messages becomes correspondingly difficult. An important issue for advertisers is finding new methods of persuading consumers to purchase their goods and services. The first that come to mind in connection with the word *advertising* are posters, newspaper ads, commercials on TV or radio, etc., that is, visual and auditory media. However the advertising industry does also use consumption-raising instruments like scents to manipulate consumer behavior by unconsciously raising emotions and consequently manipulating purchase decisions. The marketing expert Martin Lindstrom writes on his website:

“Did you know that currently 83% of all commercial communication appeals only to one sense – our eyes. That leaves a paltry 17% to cater for the other four senses. This is extraordinary given that 75% of our day-to-day emotions are influenced by what we smell, and the fact that there’s a 65% chance of a mood change when exposed to a positive sound. This is a long way of saying that the importance of our senses has been completely overlooked in the brand-building business... until now.”

Smell-supported advertising is called *scent marketing* (Bartzos, 2008), and relies on the neuropsychological effects of olfactory stimuli - emotionalization and recall by smell. The area of research analyzing the neuropsychological effects of advertising and commercial activities on the consumer is referred to as *neuro-*

economics. The term *scent marketing* came up in 2002, and defines a subarea of neuroeconomic research and should be distinguished from *scent advertising* defining perfume advertisements. Designing fragrances and installing scent-dispensing systems for scent marketing purposes is called *air design*.

Olfactory perception allows a distinctly subliminal communication between human beings and their environment, through a direct connection of the olfactory system to our emotional center. Pam Scholder Ellen, marketing professor of Georgia State University states:

“With all of the other senses, you think before you respond, but with scent, your brain responds before you think.” (Vlahos, 2007)

In the mid-nineties, psychologists examined the effect of scents on purchase behavior and confirmed that perfumed sales rooms contribute to increase sales (Stöhr, 1998). Therefore, marketing experts did not hesitate to use the olfactory communication channel as a medium for subliminal messages (Emsenhuber, 2010).

Scent marketing is implemented in various shops, hotels or recreational facilities and has affected consumer's behavior for nearly 20 years, and with considerable impact: However, this is not always positive. Scents are interpreted very subjectively and can quickly annoy people. In cases where consciously perceive olfactory advertising messages, they sometimes fear injurious effects on their health (Herz, 2007). Fearing miasma and the beguiling of people are known reactions to smell and can be found through the ages. It is necessary to avoid such reactions by respecting people's preferences and individualizing olfactory advertising messages, this requires the implementation of more intelligent and pervasive Scent Marketing systems.

2 The Historical Background Of Scent Marketing

Scent marketing is not merely "a child" of the 90's and was already used in ancient days. The first scent marketers to use were scent traders who sold fragrant goods like fresh bread, fish, cheese or flowers. These products disseminated their smell throughout the market square and lured people to the various different stands. This raises the question of non-fragrant products can be sold? These can be scented with perfume, for example. In the ancient world people used perfume to sell themselves, such as prostitutes, or their estate like their house or their slaves. However, the relevance of smell, perfume and olfactory perception has varies according to the historical with and culture, as the analysis and investigations of historians and philosophers demonstrate. For instance Alain Corbin speaks of an "*olfactory revolution*" in the 18th century, which was influenced by the French Revolution and a new standing of hygiene. Today's scent marketing is intensifying

the relevance of olfactory perception and is compelling us to learn about the perception of odors once more. A brief retrospective review of the historical and cultural background of scent marketing is revealing:

Human perception was already of interest to ancient philosophers, but olfaction was neglected until the last decade. Why do the senses of sight and hearing gain so much more attention nowadays and why did researchers fail to the sense of smell until the last decade?

Walter Benjamin considered changes in the social relevance of perception, as people's adaption to new technical media (Kloock & Spahr, 2000). Accordingly, the hegemony of visual and acoustic perception is due to the rise of telegraphy, photography, film, radio and television. However, as Paech (1999) wrote in her article *Das Aroma des Kinos*, after the first cinemas had opened their doors, the first experiments with *scent movies* were also conducted. These pioneering efforts demonstrated the beginnings of new media on the one hand and resistance on the other hand, involving psychological effects, which would be discovered only a hundred years later.

In evolutionary terms, the sense of smell is the first form of perception, as demonstrated by German researchers who identified the reaction of sperm cells to the aroma of lily of the valley (Hatt & Dee, 2008) and the fact that the olfactory bulb is situated within the oldest part of our brain (Dennis, 2004). In prehistoric times when visual and acoustic amplifiers did not exist, perceiving odors was crucial to survival. Studies on indigenous peoples and feral children indicate the relevance of olfactory perception far from civilization (Hatt & Dee, 2008). With respect to contemporary history, a decreasing impact of smell corresponds to increasing civilization.

Ancient advanced civilizations like those of Mediterranean area or in the Middle East invented perfume. Ancient people used scents to render homage to gods. Hygiene and sanitation were an important part of cohabitation and bad body odors were considered unacceptable. Accordingly, higher castes, which could afford these luxury fluids and scenting themselves and their home with perfumes. Body odor came to indicate class differences and was a symbol of social distinction as a consequence.

Scent also found its way into religions like Christianity or Buddhism as a spiritual instrument. In both religions, incense occupied a central position in communicating with god in both persuasions. Generally, Asian cultures have a special relationship to smell and especially to body odor. On the one hand, Asian people have almost no own body odor (Classen et al., 1994), On the other hand, hygiene and fragrances play an important role in their social coexistence and led to the development of a bathing tradition. In the early Middle Ages crusaders brought this tradition to Europe and consequently introduced the installation of bathhouses. Increasing plague epidemics and sexually deviant behavior in these bathhouses supported the church's opinion that personal hygiene makes people sick and encourages degenerate behavior. Accordingly, bathhouses were closed and bad smells were a daily occurrence.

A lack of understanding of personal hygiene existed for several centuries. In *The Foul and the Fragrant*, Corbin (1988) describes the olfactory situation in the 18th century in France. Before the French Revolution, baroque society not only suffered from political instability and excessiveness, but also from unbearable sanitary conditions and diseases. Because of their ignorance, scientists ascribed the spread of disease to the malodor in the air and appealed for an improvement of public hygiene. As protection against miasma, people used a plethora of perfumes and scented powders, which contributed both to olfactory excesses and to the development of capitals of perfume like Grasse. It's is therefore surprising that Süskind (2006) chose that period of time and that location for his bestselling novel *Perfume*. Only such an environment could constitute the perfect background for an olfactory genius like the character Jean-Baptiste Grenouille. Ultimately, the olfactory situation was so unbearable that philosophers of the Enlightenment had also stressed the importance of personal hygiene. With the French Revolution, says Corbin, there was also an "*Olfactory Revolution*". The installation of sewerage systems and another manifestations of hygiene also manifested the prominence of smell. People became more sensitive to miasma, but also to fragrance and began to prefer light scents (Stafford, 1993). Enlightenment philosophers again raised the issue of a hierarchy of senses and labeled the sense of smell as unworthy of mention. Smells were undesirable and olfactory perception was classified as animalistic and *ignoble* (Jütte & Lynn, 2004). The invisibility, immeasurability and subliminal perception of smell were the main reasons why scientists abandoned the concept of olfaction.

As already mentioned, Asia occupies a special position in the cultural history of smell. Smells, body odor and personal hygiene play an important role in the traditions, medicine and daily life in the Far East. This has its roots in an early understanding of hygiene and awareness that scents have a healing effect. In contrast to Western cultures, the peoples of Eastern Asia preserve their ability to smell and do not ignore olfactory incentives to date. They regard smells and the sense of smell as a natural part of their daily lives and there are no inhibitions in this context.

A comparison of civilized cultures shows how Enlightenment philosophers effectively influenced the perception of smells in the Western world. The olfactory Revolution led to an increasing disapproval of smells until they became a real taboo in European societies and an unsuitable topic for discussion. Only good old perfume *survived* the era of "*deodorization*" (Corbin, 1988). The commercial launch of Chanel No. 5, the first perfume consisting of artificially produced fragrances, initiated another olfactory revolution, because perfume was no longer a luxury good and was now achievable to everyone. Being scented no longer constituted a social class distinction. However, this was not the last milestone in the cultural history of smell. Indeed, it would seem we are going through a third olfactory revolution right now. Scientific success in olfactory research, such as the decoding of the first olfactory receptor by Linda Buck and Richard Axel (Hatt & Dee, 2008), discussions about olfactory disturbance caused by cigarette smoke and biogas plants (Umweltbundesamt, 2006), the development of the first smell re-

corder and smelling mobile phones in Japan (Corbin, 1988), and the increasing use of scents for marketing purposes, indicate a new relevance of odor.

3 The Sense Of Smell

Without the special characteristics of olfactory perception, scent marketing would not work. Smell differs from other perceptions in the ability of the perceiver to respond and recall without thinking. Olfactory stimuli are almost instinctively processed in the human brain, in contrast to other sensual impressions (Dennis, 2004). Over the last few years, the mystery of smell could be unraveled more and more and will surely keep researchers busy the next years. The following discussion provides an overview of current research results, which constitute only the beginnings of olfactory research.

Skepticism about the significance of smell in social and cultural history is rooted in a lack of understanding of the smelling process. As the cultural history of olfaction reveals, there has never been a rational explanation of smelling. People were ashamed of this animalistic behavior, which was led by that incomprehension of the sense of smell. However, scents were always much sought-after for their emotionalizing and overwhelming effect. Since the end of the 20th century, researchers, especially neurologists, psychologists and biochemists have attempted to explode the myth of olfaction.

The neurological olfactory center is situated in the earliest part of the human brain to form and a foetus's nose already develops at between 11 and 15 weeks (Wilson & Stevenson, 2006). Olfactory perception also includes the sense of taste, because tasting without smelling is almost impossible, a familiar effect of colds. Therefore, the perception of aromas can be defined as just one sense.

In comparison to other senses, smelling assumes a special position within the modalities of perception. The process of perceiving volatile components is characterized by spontaneous recall, inevitableness, unfiltration, unconsciousness and emotionality. As researchers have found out over the last few years, primarily neurological factors account for these characteristics, which give customers the potential to perceive highly emotionalizing advertising messages.

However one problem remains: The interpretation of odors can be very subjective and related to individual emotions. The recognition of odors is based on a learning process starting in the embryonic phase (Rouby, 2002) and entails perceiving odors and saving them in combination with memories, incidents and emotions, forever stored in the long-term memory. Perceiving a known odor is essentially an odor-related memory recall. Accordingly, the sense of smell should constitute a perfect interface with the human brain, eternally depositing information and recalling it by means of "re-perception".

Perceiving a smell starts with a biochemical process based on a lock and key principle at the upper end of the human nose. The olfactory epithelium is located

there and consists of about ten million olfactory receptors, which are sensitive to about 350 different volatile components. In 2006, Linda Buck and Richard Axel were awarded the Nobel Prize for decoding the first olfactory receptor. Meanwhile, another three receptors or sensory neurons have been decoded (Hatt & Dee, 2008)(Rasche et al., 2010). In comparison, a dog's epithelium consists of about 220 million receptors. If an odorant molecule docks to the right receptor, an impulse is sent to the olfactory nerve, also called an olfactory bulb, which is the connector to different cerebral areas. The discovery of these neuronal connections explains the extraordinary characteristics of olfaction.

Evolutionarily and neurologically, the sense of smell is our fundamental instinct and also bears this functionality today. Odors can yield information about good or bad food, toxicity, or whether something is burning. Generally, we use this functionality every day and can identify at least 16 different scents. Specialists as perfumers or gourmets train their olfactory tool and can isolate up to 1000 fragrances. Yet, the Sense of Smell Institute determined that the average human being could potentially recognize approximately 10,000 different odors (Bradford & Desrochers, 2009). This aptitude shows that we don't usually use our sense of smell to its full capacity.

Perceiving odors occurs spontaneously and is only avoidable by stopping breathing. This unavoidable nature is caused, on the one hand, by a lack of an *olfactory palpebral* and on the other hand, by the direct connection between the olfactory epithelium and long-term memory. Olfactory signals are processed without any filtering by our brain. Any perceived odor is saved in the long-term memory, in combination with the current smell situation, which includes locations, plants, persons, emotions, etc. Smelling such odors promptly recalls that particular situation, including various details. Researchers refer to this phenomenon as an "*olfactory memory*" or the "*Proust Phenomenon*", which obtained its name from Marcel Proust's explanations of sensual impressions in his work *In Search of Lost Time* (Herz, 2004).

We are always exposed to smells, but often they are too diffuse for conscious perception and we perceive them subliminally, which is a kind of protection measure. Odors can cause positive as well as negative emotional reactions, which are due to close links between the olfactory and the limbic system, our emotion center. How the perceiver is emotionalized depends on his or her memorized impressions. The combination of inevitability of perceiving odors and the emotionalization could be dangerous relating to psychological effects. The human olfactory system is equipped, more so than other senses with a habituation function. It rapidly habituates if the same smell is present for a longer time. Accordingly, it is almost impossible to identify one's own body odor or that of close relatives. Also, a constant environmental odor is no longer perceptible by habitants; only foreigners such as tourists or visitors will notice it (Deshmukh & Bhalla, 2003). The intensive emotionalizing effects of smells are the determining factors for a faster olfactory than visual or auditory habituation. The nostrils can not be closed instinctively, in contrast to eyelids. Olfactory habituation can serve as a protective

mechanism that keeps us from having to constantly bear smells, which we can not escape and which could otherwise cause emotional harm.

The perception of pheromones another subliminal perception of volatile components is. Both humans and animals exude pheromones sensed by the vomeronasal or Jacobson organ, so as to cause instinctive reactions within their species, which is also called olfactory communication. Most recently, there was a debate on whether humans have such an organ and generally communicate via pheromones (Watson, 2000). Through numerous tests, scientists have now established that the human species is capable of perceiving and reacting to pheromones. After the discovery of the human Jacobson organ at the internal nasal septum, the first human pheromone was also extracted (Sturmheit, 2008). The sex steroid Androstenone, which could previously only be isolated from the saliva of boars, can in fact be found even in the male armpit sweat and urine (Brand & Jacquot, 2007). Another argument supporting the existence of vomeronasal communication is the ability of women to identify whether a man correlates genetically to her own DNA by checking his body odor, including pheromonal information (Watson, 2000). Pheromones also play a role when mothers recognize their babies through smelling its body odor (Watson, 2000). However it is also known that pheromones of other species can influence humans. Perfume components like civet or musk are animal scents, which contain sexual pheromones from the male civet cat and musk deer. Women find a small amount of such animal scents appealing, but do not instinctively react to them (Watson, 2000).

By understanding the human smelling process, the psychological effects of special fragrances can also be explained. An area of expertise concerned with these effects is Aroma-Chology ®, a term created by the Sense of Smell Institute (Warren & Molnar, 2010). This scientific group accumulates established knowledge of olfactory perception and deals with the relevance of smell to behavior, emotions and mood.

Food designers were among the first to explicitly apply fragrances for sales-promotion. The food industry relies on color-odor associations to inform consumers about the taste and smell of products. Heinrich Frieling, a color psychologist and expert for color associations, explains how colors influence consumption and why different sensory stimuli can complement another (Frieling, 2005). Table 1 shows colors and the associated odors or tastes used for food packaging and advertising. The tasting process is actually a smelling process, because the olfactory epithelium determines flavors through the internal channel to the pharynx. Tasting and smelling are almost the same perception process, an important fact for food producers. Color-taste and color-odor associations are derived from individual experiences affected by general factors like nature, culture and habitat. Therefore, it would be counterproductive to produce, for example blue sweets in the shape of a bear with orange flavor. However, such associations can diverge in different cultures, which forces producers to adapt their products according to the market in question. Air designers are also geared to color-odor associations and the aroma therapeutic effect of fragrances, when they develop perfumes for scent marketing.

Table 1: Color-odor associations according to Frieling, (2005)

Colour	Odour
PINK	sweet, mild
LAVENDER	sweet, unerotic
MAGENTA	heavy, narcotic, charmingly, sweet
INDIGO	scentless
BLUE	scentless
MINT	juicy, fresh to salty
GREEN	fresh, fragrant, perfume with green fragrance
OLIVE	musty
LIME GREEN	sour, dry, fresh, bitter
YELLOW	perfume, flower
ORANGE	hearty
RED	sweet hefty, hot
GOLD	sweet, good, stunning
OCHER	sourly, neutral
BROWN	aroma, musty
WHITE	scentless
GREY	bad

An exceptional quality of olfactory perception is a direct connection between our smelling system and the hypothalamus, a neurological area, which controls the autonomic nervous system. This connection facilitates an influence on the viscera by perceiving odors and is the reason why aromatherapy really works and why some scents can affect consumer well-being.

Physiological and psychological research are increasingly expanding into the field of sense of smell and accordingly developing from a scientific background for scent marketing and the unique impacts of smell on human behavior. However, this research is in its infancy and many elements of the smell phenomenon remain unexplained.

4 Scent Marketing

Scent marketing relies on the neuropsychological processing of olfactory stimuli in the human brain. It utilizes the effects of smell on human behavior and the Proust Phenomenon. The creation of a pleasant atmosphere for clients is a general objective of scent marketing. The aim is to ensure that customer remain in stores as long as possible and enjoy the ambiance, so that they buy more products and

consume more (Michell et al., 1995) (Hirt, 2009). However improving store atmosphere is not the only aim of scent marketing. Bradford and Desrochers (2010) differentiate between three forms of scent marketing, depending on how scents are used: the *marketer scent*, the *product scent* and the *ambient scent*. Marketer scents are used for product or service promotion and form part of a promotion campaign. If the scent itself is the product, as with perfumes or air fresheners, Bradford and Desrochers refer to it as product scent. They refer to the original purpose of scent marketing, as an enhancement of the retail environment, as ambient scent.

It seems likely that product scents are only a form of scent marketing, when used in the form of marketer or ambient scents, or to promote themselves as product. For example, EPAMEDIA, a European public space advertising company, equipped some of their illuminated panels with move-detecting perfume dispensers as olfactory support for perfume advertisements (Michell et al., 1995) (Hirt, 2009). Therefore, scent marketing generally means supporting the sale of products and services with odors.

Ambient scent was an early form of scent marketing. Decades or even centuries ago, bakeries, coffee houses and restaurants often worked unintentionally with scents as attractants. Their chimneys and ventilation systems released enough aromas that made people's mouths water. Today, such shops work systematically with synthetic fragrances in order to provoke similar reactions.

Improving the ambience of essentially negative locations like hospitals or dental practices is another form of ambient scent. It is a social impact of the western world that people become uneasy when they smell chlorine-camphor and phenol, which give disinfectants their typical smell. In order to cope with this pattern, dentists sometimes attempt to improve the atmosphere of their practice by using a so-called *doctor's fragrance* intended to put patients at ease (Lehrner et al., 2005).

A logo or corporate scent is a variation of marketer scent. Customers will hopefully perceive these shopping scenarios as pleasant and relaxed, which is due to the already mentioned Proust phenomenon. Customers use the recall of autobiographic memories as described in Herz (2004). This effect entails the idea of using fragrances as part of the corporate identity of stores, hotels and service chains. Each time a client perceives the unique perfume of the chain, he or she will recall the shop, the situation and the pleasant atmosphere (Morris & Ratneshwar, 2000). In 2006, hotel chains like Weston, Sheraton, Omni, Four Points and Hyatt incorporated special fragrances as part of their brand image (Higgins, 2006).

As history shows, the scent of goods plays a relevant role in the sales process. Not only must food aroma meet one's expectations, other products are also liable to smell-related associations and connotations. For example, new cars do not smell of plastic and metal as one might expect. They are sprayed with an oil or leather fragrance, which is more appealing and familiar to drivers. However the RAC Foundation established that these odors can lead drivers, especially old men, to over-estimate their own capabilities, because they feel younger and more energetic, leading them to take more risks when driving (Nicholson et al., 2005). Nonetheless, some producers experiment with such associations and perfume their

products with unexpected aromas, in order to achieve a unique selling proposition or to cheer up their customers. Products like scented writing utensils, socks, CDs, USB-sticks, papers, etc. have already been introduced into the market.

Marketing strategies often include promotional events, such as advertising platforms and presentations of provider individuality. Event managers use the latest entertainment forms to compete for visitors and publicity. Thus, scents also capture the attention of event management and it is not surprising that there is a new occupation called “*Aroma Jockey*”, with the aim of lifting the audience’s spirit through *compositions of fragrance* (Emotion, 2008). The aroma jockey sets fragrances free, rather like a disk jockey plays songs. Affecting moods changes by using special fragrances may also assist in social interchanges, like meetings or classroom situations (Higgins, 2006). Researchers have noted that some fragrances contribute to improving the ability to think and enhance powers of retention (Herz et al., 2004). This effect can also be used for marketing purposes.

All these forms of scent marketing have a common problem - they treat all clients the same. Each person who enters a shop is confronted with the same fragrance, often exuded mindlessly from electronic dispensers, which evaporate one scent in fixed intervals and do not respond to individual preferences. Currently, scent marketing is inflexible and not adapted to custom tastes as formed by their culture and individual experiences. Therefore, scents can affect customer behavior in the wrong way, with dysfunctional consequences. There is no guarantee that each individual correctly understands a scent-borne, olfactory message.

5 The Olfactory Medium - Transmitting Information Through Smell

Like pictures or music, smell conveys information, which can be transmitted from sender to receiver; we can communicate via smell and therefore, it is a medium (Emsenhuber, 2010). As explained above, olfactory perception allows a very special form of communication, which is almost impossible to compare with other interaction modalities. No other sensory stimuli are so impossible to ignore and perceived unconsciously so. No other information affects our moods more intensively than odors. Odors can have a special meaning and invisibly and spontaneously transmit information, which other media cannot. Odors can bear information like emotions, warnings or memories, and also genetic information through body odor or pheromones.

The communication process through a medium can be formulated as a communication model, as in Shannon and Weaver (Fig. 1) (Herczeg, 2006). According to Shannon’s information theory, each message requires syntax, semantics and pragmatics, in a word: a language, which is spoken by both the sender and receiver. However, there is no unique olfactory language. Syntax, semantics and

pragmatics vary, depending on culture and individual experience, but also on profession such as perfumer, food designer or wine steward.

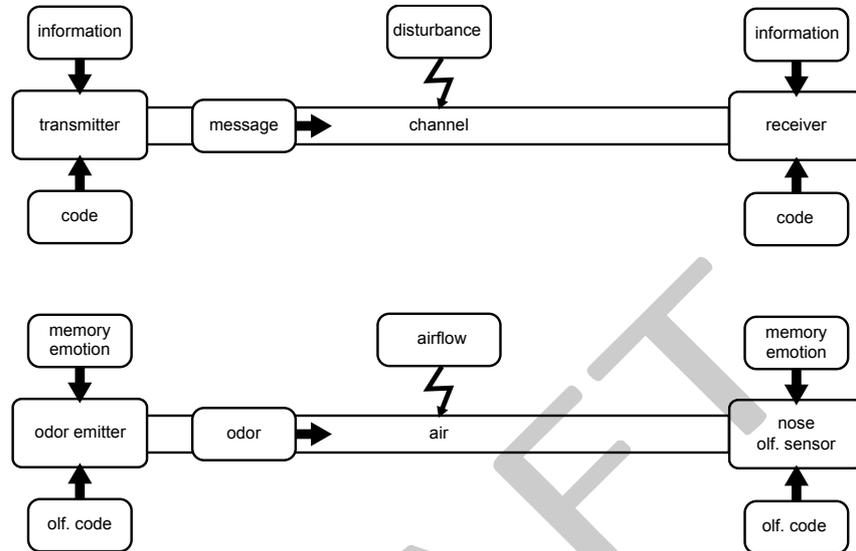


Fig. 1. Communication model by Shannon and Weaver

According to Shannon's paradigm, a scent dispenser (the transmitter) and consumer (the receiver) should have the same understanding of the dispensed scent (the message). In order to ensure that in retail environments, where there is a high fluctuation of people and consequently a rapid change in tastes and olfactory languages, scent marketing systems must adapt dispensed scents to individual preferences as quickly as possible. In short, they need to detect consumers' olfactory language, before disposing their olfactory message - they have to become *smart*.

6 Olfactory Technologies and Interaction within Pervasive Environments

General scent diffusers like scent candles, fragrance lights or other kinds of air fresheners work mechanically, without electricity. However, in the last few years, more and more electric scent gadgets were developed and tend to replace the analog models. Additionally to smell-sending devices, chemists are developing smell-detecting systems and *e-noses*. Devices that disseminate odors or detect volatile components can be categorized as *olfactory technology*. These components can act as *olfactory displays or sensors*, as human-computer interfaces and allow a bidirectional communication between them via smell. Thus, the technology for making scent marketing smart already exists, but the implementation stage still needs

to occur. The following section provides of current olfactory technology for sending and sensing and how it is used.

6.1 Sending and Sensing Olfactory Information

Most scenting systems in sales rooms are integrated in to the air conditioning, but there are also heat-based standalone devices. The first commercially available air design systems could not adjust their running time, fragrance or scent volume; they ran continuously and led to a suboptimal flood of fragrances. Modern systems offer both time and volume adjustment, as well as the option of changing between various fragrances (Fig. 2).

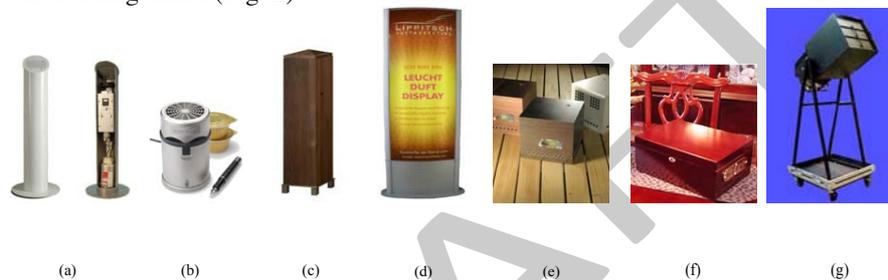


Fig. 2: (a–d) heat-based systems from Aromea, (e) ventilation-based aroma cubes from Sensorama, (f, g) EnviroScent

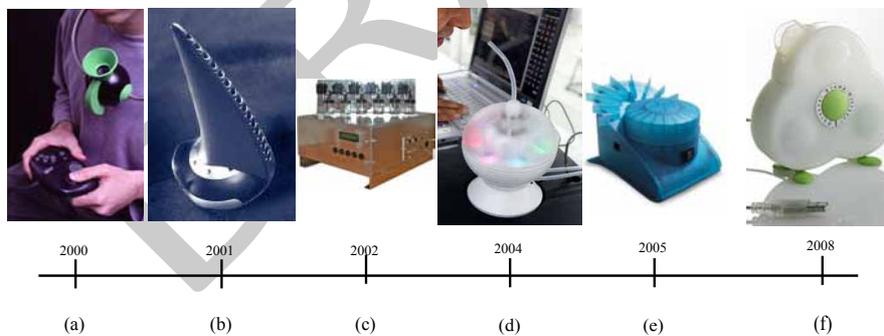


Fig. 3: (a) AromaJet Pinoke, (b) DigiScent iSmell, (c) FH Hagenberg SmellBox, (d) NTT Com Aroma Geur, (e) TriSenx Scent Dome, (f) Osmooze Personal Diffuser

Not only advertising takes advantage of odors, olfactory communication is receiving more and more attention in human-computer interaction. Today, digitally controlled odor diffusers are not only applied for advertising purposes, they are increasingly used as ambient indicators, such as an olfactory display in HCI-systems (Fig. 3.) For instance, Keye (2001) describes an ambient olfactory reminder system. The integration of an augmented reality application, with an odor

machine for improving on the reality experience, is presented in Emsenhuber, (2006). NTT Com (2007) developed a smell machine called *Aroma Geur*, laying the foundation for the first olfactory emails in 2004. This device was also used to create an ambient smell when listening to Tokio FM. In 2005, TriSenx (2005) launched their *ScentDome* to enable websites to emit scents. The special smoothness of olfactory interaction spaces was the central subject of the *Space-of-Scent* project (Haque Design and Research, 2007).

For the telecommunication industry, smell has been introduced successfully as a new sensory modality for interactions between human and mobile devices. The first “smelling” mobile phones were placed on the market in 2008 (Fig. 4). The Sony Ericsson SO701i is scented with an aromatherapy fragrance to enhance relaxation during stressful phone calls. In order to satisfy different preferences, the mobile phone is available with 8 different fragrances, which can also be useful for advertising purposes and tagging personal items like mobile phones with corporate scents. The Hyundai MP280 integrates an individual refillable scent diffuser, which acts as *smelling tone*. Samsung (2006) and Motorola (2007) also hold patents for smell phones. German inventors have already patented a mobile phone with a smell chip, which can send and receive *smell messages* (Inside-Handy, 2008). These mobile devices could be the future of mobile advertising – they offer a new method of sending not only informative, but also emotional advertising messages.

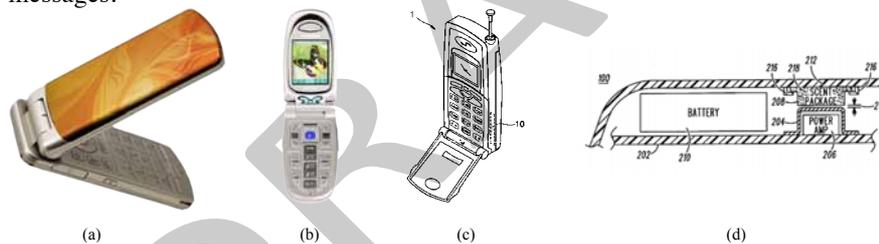


Fig. 4. (a) Sony Ericsson SO701i, (b) Hyundai MP280, (c) Samsung, (d) Motorola Smell-o-Phone

Odor diffusing facilities provide odors for static as well as mobile smart installations. Current scent marketing systems treat customers’ homogeneously individual preferences into account. Making such systems intelligent responds to these preferences as well as to the consumers’ psychological state, as aroma therapists do. The combination of emotion recognition, referred to Picard (1997) as *emotional computing*, and the use of smart olfactory technology can be a powerful advertising instrument.

Not only is the output of olfactory information an increasingly subject important for information technology research, but also the use of volatile substances as input for digital communication is becoming increasingly useful. Gas sensor arrays and electronic noses are especially useful for forensic investigations, for the detection of explosives, and for medical science as a means of diagnosing diseases

like cancer. Today, they are used increasingly to control digital systems. For instance, the Japanese *Hanahana*-installation can manipulate flower-animations with ten different perfumes. Wyszynski et al. (2005) have even sent a recorded odor by email and reproduced it for the receiver.

Researchers of the Austrian Konrad-Lorenz-Institute are currently developing a system for recognizing individuals by their body odor, which reflects the identity like a fingerprint (Penn et al., 2007). Body odor is the volatile state of sweat whose components are influenced genetically. Emotions like fear can also manipulate the sweat composition and contribute to the production of cold sweat (Chen et al., 2006). Ackerl et al. (2002) ascribe this manipulation to a release of fear pheromones. According to this theory, body odor has the potential to become a new data source for intelligent systems, enabling them to recognize individuals, as well as their emotions. It can be expected that in future, human pheromones will be measurable as animal pheromones are now (Sauer et al., 1992).

Sensing odors could be a useful instrument to enable advertisers to find out more about their clients, especially their emotional states. Other useful elements include individual odor preferences, which could be examined by identifying their body odor or personal perfume. The development of body odor detection and analysis through gas sensors and artificial noses, is a current challenge for scientists.

7 Olfactory Zones of Interaction

The recognition and manipulation of emotions are basic instruments of advertising. The olfactory information channel allows both the detection of emotions by body odor analysis and the stimulation of emotions by means of aroma therapeutic scents or pheromones. In the near future, smart advertising systems may be able to react to individual emotional states and manipulate them at the same time. Such bidirectional communication via odor would function within unconventional zones of interaction.

Generally, we can define smells as ambient media, because of their subliminality and inertia. Therefore, olfactory interaction operates in the ambient interaction zone (Ambient Media, Ishii & Ullmer, 1997). However, communication via odor operates within an unconventional ambient zone of interaction. Each smell-emitting human being or object is surrounded by a distinct vapor, constituting an olfactory aura, defined as *Olfactory Interaction Zone* (Emsenhuber & Ferscha, 2009). This zone can be extended dynamically from a square meter size to a square kilometer scale. Consumers are often able to detect the aromas of nearby bakeries or restaurants over several meters leading them from the street to their salesroom as an *olfactory direction sign*. Within an olfactory interaction zone, the information priority is defined by the intensity of an odor and the odor itself. As an example, the odor of fresh bread is not so important as that of smoke.

Raab (2001) was concerned with the current sociology of odor. He renders this unconscious communication modality explicit and defines interaction zones for olfactory interaction between humans, based on Erving Goffman's territories of the self (Fig. 5.).

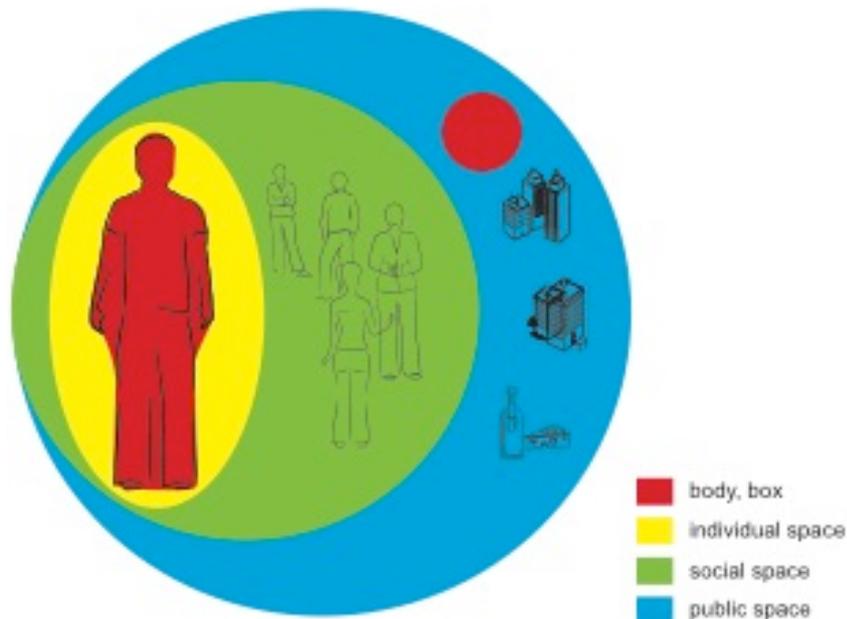


Fig. 5: Olfactory Zones of Human-to-Human Interaction according to Raab and Goffmann

The body defines the individual odor and is a source of the most familiar fragrance. An individual's personal space encloses the body and varies in impact depending on olfactory sympathy. The unpleasant body odors of interaction partners can maximize the extensions of personal space and pleasant ones can minimize it. Special smells constitute a social identity, an affiliation to a social group, which defines the social space. Smells associated with regions, localities or goods define the public space as interaction zone. Such smells are more acceptable than *foreign* ones in the personal space, because they entail a communal territory, apart from the box territory. They form a private territory in public space, which is occupied by an individual and its individual fragrance, such as a table in a restaurant or a seat in a train.

Raab's olfactory interaction territories are comparable with interaction zones used in HCI, apart from the fact that one interaction partner is replaced by an intelligent computer system. Therefore, Raab's territories of interaction constitute another principle for olfactory interaction zones in Human-Computer Interaction. An olfactory communication process can only be acceptable for a person, if the computer sends smell information without violating the human interaction territo-

ries. This needs to be kept in mind when planning scent marketing concepts and developing Scent Marketing systems.

8 Make Scent Marketing Pervasive

The current use of odors in human-computer systems, especially for scent marketing purposes, is based on the psychological knowledge of olfactory perception on the one hand, but also enters unfamiliar territories. There has not yet been sufficient psychological investigation to analyze the full range of mental effects of olfactory stimuli. However, in the near future, we have to content not only with visual and acoustic information overload, but also with olfactory information overload. Given that we suffer from excessive visual and acoustic impressions every day, nobody knows what mental damage numerous waves of fragrance could cause. Olfactory information overload could lead to two different scenarios: Scenario A describes a complete habituation of olfactory perception and a complete loss of our sense of smell. Scenario B would constitute another olfactory revolution, as in the 18th century, when miasma became overwhelming and intolerable (Corbin, 1988). In order to avoid such scenarios, users of the *smelling* medium must dose olfactory information very carefully, which requires respect for individual preferences and sensibility.

The highly subjective interpretation of olfactory stimuli requires an adaption of olfactory messages to the individual. Therefore, olfactory systems must *know* such preferences - they need to become more intelligent, or *smart*. Room-scenting product lines like Brise Sense & Spray or AirWick FreshMatic are the first sensor-controlled mass-market scent diffusers. Fragrance and intensity can be adjusted individually by hand. In public spaces, especially for scent marketing, such systems need more flexibility, because fragrance and its intensity must be autonomously adapted to people's preferences or moods. In the near future, smart scent marketing systems may be able to react to individual emotional states and manipulate them with aroma-therapeutic scents. Mobile *smelling* devices like smell phones offer a further possibility for mobile advertising – they offer a new method of sending not only textual, but also more emotional smelling advertising messages.

Whereas digital scent diffusers have already been brought to market, the development of gas sensors and artificial noses is still a topic of fundamental research. Especially for HCI-systems, there are not useful gas-sensing interfaces yet. Various interviewed computer scientists pointed to this aspect as a reason why smell is seldom used for Human-Computer Interaction (Emsenhuber, 2010).

A second problem is the social acceptance of such systems. At present, consumers are often unaware of these scents, which should potentially affect their mood. Maybe they cannot perceive them, because they are not trained to perceive

smell, or they ignore them because they do not recognize odors as relevant information. Therefore, scent marketing is currently a productive advertising tool, which unknowingly effects customer behavior. Whether or not this is ethically acceptable, is discussed by Bradford and Desrochers (2009). They argue that only an objective ambient scent, which can be recognized by the consumer, is ethically acceptable. A covert objective ambient scent “*is developed to motivate an action or influence consumer behavior below the consumer’s absolute threshold of consciousness*”. Therefore, the consumer cannot avoid the manipulation, as would be possible in the case of listening or not listening to shopping mall music. Bradford and Desrochers (2009) refer to Brehm (1966), who described consumers’ negative reactions to the loss of freedom to make a choice, as “*psychological reactance*”. Raab’s olfactory interaction zones could support the social acceptance of olfactory scent marketing systems. Also, a technological system has to respect olfactory borders and personal spaces. An HCI-system should not cross these borders by, for example emitting a flood of fragrances.

The Shannon-Weaver model implies that both sender and receiver need to have the same knowledge about the meaning of a message in a digital communication process. This meaning, code or language is a connotation of information to a word, number, picture, sound or smell and must be conveyed within such systems. In human-to-human interaction spoken languages are restricted to countries or culture groups. Olfactory languages like the aroma classifications of perfumers or the terms used by oenophiles, and also the meaning of smells within indigenous groups, are even more localized. Therefore, scent marketing systems need to know the user’s cultural affiliation and his or her individual olfactory preferences. The future challenge for computer scientists and other developers or designers of scent marketing systems will be the spontaneous detection of individual preferences and the individualization of olfactory advertising messages.

Today, we can detect user preferences in different ways. Especially online marketing works with user profiles, such as Amazon, Facebook or Google. These user profiles include precisely individual such preferences, which can also be used for scent marketing and the adaption of scents to customer taste. Mobile devices like mobile phones or gadgets with a digital ID, facilitate identification of customers and their preferences, wherever and whoever they are. However, this can lead to a violation of privacy. Therefore, users need to agree with the process and accept it. Alternatively marketers can take the next step and allow customers to design their own individual shopping environment by means of a customizable preference profile saved on their mobile device, which, for instance contains color, sound and scent preferences.

Another way to individualize scent marketing is changing by scents, depending on customers’ current emotional states and using the aroma-therapeutic effect of scents. Thus, shops and public places can adapt their shopping environments to that what people currently need and not that what they want. Depending on the general mood, they can calm people down or awake them up by using special scents like lavender or coffee aroma (Herz, 2009).

Sensing odors can also support advertising, which can be a useful instrument for finding out more information about people, especially about their emotional states, such as fear. Individual odor preferences, which could be examined by identifying body odor or personal perfume, are valuable data for pervasive advertising systems. Such preferences can refer to color preferences via color-odor associations, which could be useful for e. g. fashion style suggestions in fashion stores, to give but one example.

Reacting to one person and adapting olfactory marketing messages to his or her taste should not be a problem for scent marketers. After all, every day perfumery employers, who scent each customer with different perfumes, do just this. But how can crowds be handled, how can a mass of people with different tastes be satisfied by that one *right* scent? As already mentioned, smell is a very inert medium, and cannot be changed in milliseconds, not even in a few seconds. It takes minutes to exchange olfactory messages. Therefore, pervasive scent marketing systems need to manage the preferences of people and groups, especially demographic groups, in order to satisfy the majority.

Current olfactory technology allows only a restricted form of intelligent scent marketing. Depending on how fast olfactory technology will be improved scent marketing can become more and more pervasive. However, first of all smell has to be accepted as serious communication channel for developing pervasive scent marketing systems.

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