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Article

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Multisensory Brand Experiences in Digital Media

Sensations based on touch, taste, and smell can add new dimensions to the digital experience. This article discusses why a multisensory approach will in future be necessary for marketing brands in digital media and provides a short overview of the multisensory processing of the brain and the latest trends in multisensory technologies.

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Successful digital branding is not an isolated concern, but rather part of the overall brand management: visitors of a website should experience digital brand offerings in the same way they experience the brand in television, radio, and print, and this should come as close to the real-world experience as possible. While it takes a lot of work to deliver a multisensory experience of brands in digital media, it can be done, by making sure the environment addresses each of the five senses.

Sight is especially important: 83% of what we perceive from our surroundings is visual (see Table1) (Pauen 2007; Bream 2004; Linxweiler 2004). The visual impression of a brand heavily determines its brand image, as any example of a luxury brand shows. The disproportionately strong effects of sight explain why pictures and images are so valuable in digital media – from the beginning, digital media have relied on visuals, e.g. buttons and graphics (Herbst/Musiolik 2015).

Images are quickly noticed, activate the neural network and trigger associations in a very short time. Thus, many other sensory impressions can be deduced from the visual impression and the already stored experiences (Herbst/Musiolik 2015, 2016). Sight can also trigger other sensory impressions. When someone looks at an apple he knows (better: remembers) how it tastes, how it smells, how it feels. In this case, the brain uses the visual signals and processes them in such a way that an image of reality arises. Thus it is possible to activate different senses with certain visual stimuli, but the other senses also have enormous potential since they can also trigger multisensory experiences. Imagine, for example, the sound of opening a bottle of beer (Herbst/Musiolik 2015). How does it feel in your hand? How does the first sip taste? Now imagine how it feels to touch the thorn of a rose with your finger. This will also elicit a number of associations. How is this possible?

Our Brain Constructs Neural Networks

We store experiences as neural networks (cell assemblies). Such a network consists of nerve cells (neurons) connected to one another as Hebb described as early as in 1949: "Our brain, driven by efficiency, does not place information like a computer, but organizes the world in so-called neural networks (neurons) that are connected to one another" (Hebb 1949). These neural networks are the building blocks of our memory; without them we could not meaningfully arrange, store and retrieve the huge amount of information that flows into us every second.

Neural networks are responsible for the fact that a stimulus triggers certain complex patterns: when thinking of a brand, not only one association arises, but many at once. If this happens repeatedly, this whole network is strengthened. If a certain ex-

citation pattern is well-paved by frequent repetition, this group of nerve cells will always be more easily activated. As a result of the brand experience and the associated learning process, a neural network of the brand is created, with all the multisensory associations, experiences, ideas, and memories. In this context, concentrated impressions are important, which support the establishment of permanent associations by targeted and frequent repetition offline and online. Such storage networks are also called patterns or schematics, i.e. complex, bundled knowledge. The alpine world, for example, consists of the impressions of thin air, the sounds of cow bells in the pastures, the smell of pine forests, the sensation of picking a wildflower. Tropical themes, in turn, are conveyed by humid air, palm trees, white sand, waves, and coconut flavor (Herbst/Musiolik 2015; Esch 2001; Paivio 1986; Kroeber-Riel 1996; Larkin/Simon 1987, p. 72 ff.).

The multisensory network of a brand consists of all the possible sensory impressions (multisensory holistics) received via:

- **Sight:** pictures, backgrounds, structures,
- **Sound:** brand acoustics, brand acoustics logo, music, other sounds (e.g., the sound of a BMW car door shutting), language,
- **Smell:** leather, flowers, food,
- **Touch:** surfaces, landscapes, wind,
- **Taste:** hot, cold, spicy, mild, savory.

The more familiar we are with a brand network, the easier it is to activate it – and this from more diverse perspectives and with fewer signs. One trigger suffices to set off the whole network:

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Table 1: The Information We Receive Via Our Senses

Sight	83%	Eyes
Sound	11%	Ears
Smell	3.5%	Nose
Touch	1.5%	Skin/movement
Taste	1%	Tongue

Source: Herbst/Musioliik 2015.

a look at the BMW logo, for example, activates our entire body of BMW knowledge, feelings, and experiences. Fragments of sensory information are enough to create a complete impression that comes from our own mind (Herbst/Musioliik 2015; Gordon 2003; Engelkamp 1991; Fuster 2002).

From all the above, it becomes clear that images suffice to trigger the consumer's schematic and thus generate multisensory experiences. However, due to the overabundance of images in the modern digital world competition for the consumer's attention has become fierce. Thus it would be desirable to generate a realistic multisensory experience in digital media. This requires devices that can reflect the brand by reproducing smell, taste, and touch sensations, in addition to sight and hearing. The following section deals

Management Summary

Promoting brands should not be limited to using sight and sound but should be expanded to the use of touch, smell, and taste as well. The main challenge in doing so is to transfer and regenerate multisensory sensations, especially touch, taste, and smell, at remote points. Improving the recently invented digital technologies related to touch, taste, and smell will provide the key for successful multisensory brand promotion in future.

Main Propositions

1. Technologies that can reproduce touch, taste, and smell will define the future of brand marketing.
2. Digital taste and smell actuation technologies can address the limitations of chemically based systems.
3. This will lead to a paradigm shift towards a multisensory internet in future.

with these technologies and describes how they can be used to enable true multisensory experiences in digital media.

Technically Generated Multisensory Experiences

At the next stage of the internet, humans will not only communicate emotions with sight and sound but also with touch, taste, and smell. Humans will want to share these stimuli digitally, as they currently do with video- and audio-based media on the internet.

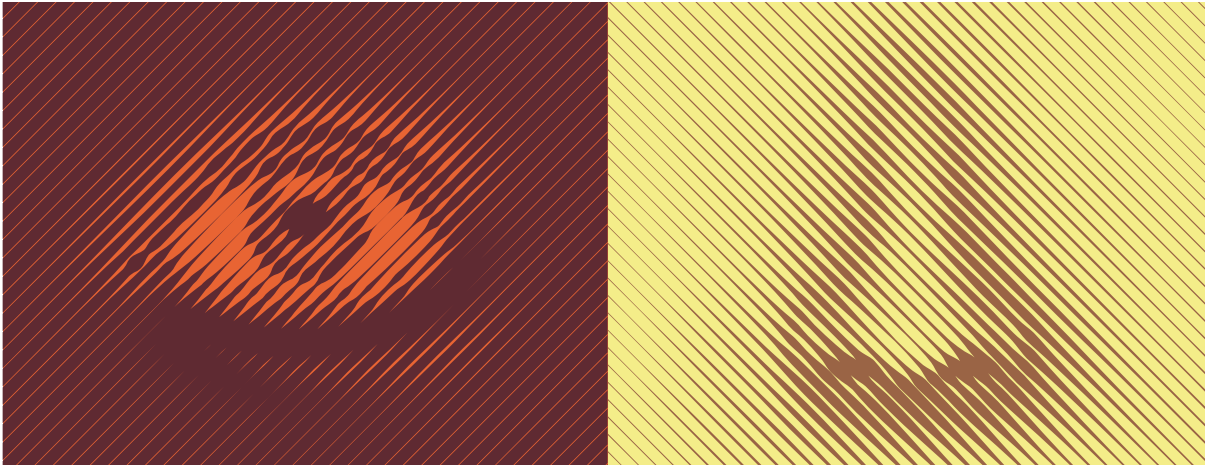
Haptic sensations are generally of two kinds: kinesthetic and tactile. Over the last couple of decades a number of haptic rendering technologies has been developed by both industry and academia. The most widely used haptic technologies are piezoelectric actuators, solenoids, linear resonant actuators, magnetic repulsive forces, electrovibration, and ultrasound. These technologies are frequently used to render haptic sensations in devices such as mobile phones, game pads, touch gloves, and touch screens. Therefore, it is safe to say that there are multiple commercially viable technologies which can be used to deliver haptic experiences.

However, more time will be required for the internet, multimedia, and end user devices to adapt and deliver complex multisensory experiences. So far, the senses of smell and taste have received minimal consideration in digital communication. In the field of multisensory communication, however, the digitization of smell and taste sensations would be of great benefit. To provide true multisensory experiences, new technologies that can reproduce taste and smell sensations are required.

There are two basic ways to deliver experiences of taste and smell: by chemically based stimulation and by digital technologies. The following sections will provide a summary of the latest developments in these fields.

Experiences of Smell and Taste Using Chemical Approaches

Scientific research related to smell has been carried out since the 19th century. An olfactometer is a device that can generate and deliver different smells in an accurate and controlled manner based on a protocol set by the experimenter. In 1888, the Dutch scientist Hendrik Zwaardemaker developed the first olfactometer (Heilig 1962) for his smell experiments. Since then, olfactometers have been used to stimulate multisensory experiences in academia. The authors of the present paper have developed a low-cost laboratory olfactometer that can be used to deliver eight different smells (Karunanayaka et al. 2017).



On the other hand, devices known as gustometers (Platig et al. 1988) are used to deliver a certain concentration and volume of a taste stimulus to the tongue over a specified period. These devices are often used in academic research for delivering taste sensations.

Both olfactometers and gustometers can be used to accurately stimulate a limited number of smell and taste sensations. These devices are available for purchase off-the-shelf but often come with an expensive price tag.

One of the earliest technological solutions that delivered multisensory food eating experiences was the Food Simulator. It used chemical and mechanical linkages to simulate sensations of food uptake by providing flavoring chemicals, biting forces, chewing sounds, and vibrations to the user (Kortum 2008). Another taste device that used chemicals to stimulate the sense of taste was called TasteScreen (Maynes-Aminzade 2005). This device could be attached to the top of the user's computer screen and held 20 different chemical flavoring cartridges to mix and spray toward the screen. By licking the computer screen, the user could taste the image shown on the computer screen.

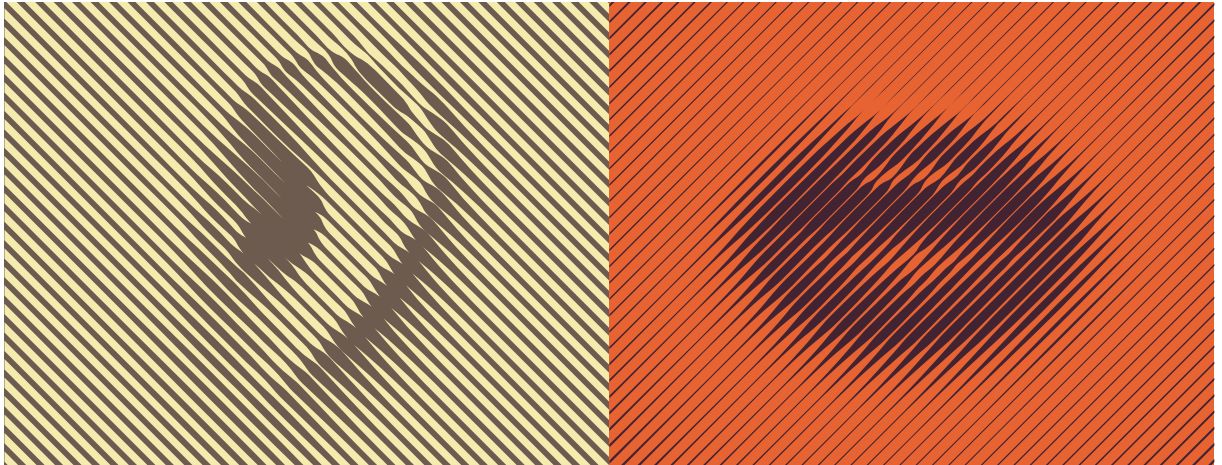
Narumi et al. (2010a) presented an artificial gustatory display based on cross-modal interactions. They utilized a wireless LED module connected to the base of a plastic cup to superimpose virtual colors on a drink. The Tag Candy and Meta Cookie systems by Narumi et al. (2010b) utilize augmented reality with other sensory inputs to produce different flavor sensations. The Tag Candy utilizes vibration and hearing via bone conductivity to deliver several sensations as a user enjoys a regular lollipop tied to the system. The Meta Cookie system utilizes smell and visual information to provide different taste sensations to the user while eating a cookie.

Scantee (Scantee 2018) is a mobile scent actuation device which plugs into the 3.5 mm audio jack of an iOS or Android device and can be carried along. It is the world's first phone attachment that can produce smell or fragrance by using smart phone applications. The scent is released from a removable reservoir by using an ultrasonic motor. This device can release only one aroma at a time and the user must hold the device close to the nose. The scent release is triggered through touchscreen input or via an incoming text message or social network notification.

Experiences of Smell and Taste Using Digital Approaches

To provide taste sensations using a purely digital approach, Ranasinghe and colleagues proposed a device in 2011 which was called the 'Electric Taste Machine' (Ranasinghe et al. 2011). When the user places the apparatus on top of the tongue, it delivers a weak electric current in a controllable manner (from 20 μ F to 200 μ F and from 50 Hz to 1 KHz) producing various taste sensations. Different kinds of stimulation pulses produce different taste sensations: constant-current stimulation produces strong metallic and electric taste sensations, 20 Hz stimulation evokes sour, salty, metallic, and electric sensations, while 94% duty cycle stimulation induces sour, metallic and electric taste sensations. Other taste sensations such as sweet, bitter, umami, fatty (oily), mint, carbonation, chemical, and spicy were also reported (Cheok/Karunanayaka 2018).

On the other hand, the device 'Thermal Taste Interface' produces taste sensations on the tongue purely by modifying the temperature of the surface of the tongue (from 25 °C to 40 °C while heating and from 25 °C to 10 °C while cooling



down). During the heating process it is possible to produce sensations of sweetness, fatty/oiliness, electric taste, and warmth. Similarly, cooling the tongue produces mint taste, pleasantness, and coldness. When using this device together with a drink, it is possible to enhance the intensity of sweetness (Karunanayaka et al. 2018).

In order to digitize smell sensations without using any chemicals, Hariri et al. (2016) proposed a new user interface called 'Electric Smell Machine'. This device can stimulate the olfactory receptors in the nose by using weak electrical pulses. For this purpose two silver electrodes of the device are placed into the nasal concha. Stimulations at 1 mA and 70 Hz/10 Hz induced smell sensations such as fragrant, chemical, and sweet (Cheok/Karunanayaka 2018).

Practical Usefulness and Affordability of the Chemical and Digital Stimulation Approaches

Today, many people prefer to shop online owing to limited time and energy. Online shopping is primarily based on vi-

sual information only (the design, size and color of the product). In various instances it would be helpful to provide an additional sensory cue, such as smell, to attract the attention of customers, especially when buying perfumes and food products. A combination of smell and taste during online shopping might also increase the percentage of internet users buying food online. Currently, by just looking at food images, consumers can only use their recollections of the taste of certain foods. In future, we might be able to smell and taste the food items before we order them.

When comparing chemical vs. digital taste and smell actuation systems, each category has their advantages and disadvantages in terms of usefulness, cost, and technology readiness. Olfactometers and gustometers are the best practically available solutions on the market that can be used directly to deliver multisensory experiences with the ability to switch between different smells and tastes and to support longer hours of operation. However, the main disadvantage of those technologies is the high price. For example, an olfactometer with at least eight channels costs more than \$ 10.000 and a gustometer costs more than \$ 5.000 (Knosys 2018). As regards low-end solutions that can be used occasionally, Scentee has provided a low-cost solution. When they launched their product, the first listed unit price was \$ 20. Their most sophisticated version, Scentee Machina Quattro (Scentee Machina 2018) which is equipped with four Scentee diffusers, costs about \$ 398. Cyrano (Cyrano 2018) and Aroma Shooter (Aroma Shooter 2018) are similar kinds of implementations which are sold at around \$ 150 and \$ 1800, respectively.

However, chemically based smell and taste delivery systems are complex, expensive to use, and need routine main-

Lessons Learned

1. In future, our internet communication and online experiences will become multisensory.
2. Future digital multisensory devices will help humans to share multisensory experiences over the internet.
3. A multisensory internet may serve as a platform for strong multisensory brand marketing.

tenance for smooth operation. Also, it is difficult to control the stimulation area over time and to maintain the desired concentration over time. Therefore, generating taste and smell sensations without using chemicals is becoming an important requirement.

The best possible long-term solution for this problem is to improve the digital taste and smell technologies and to make them ready for daily use. Thus it will be possible to solve the above-mentioned limitations and to provide the missing multisensory digital experiences for taste and smell. However, it might take another 10–20 years until these devices will become readily available for the general public to use in their daily life.

Ethical Principles for Digital Innovation

In the context of this article, it could be shown that meanwhile there are numerous digital innovations which confront

humans with the question whether options which are technically possible are also morally justifiable as well as socially beneficial. Thus, in recent years, various technologies have emerged that have the potential for the next "big thing", such as taste and smell technologies, which bridge the gap between physical and psychologically generated multisensory experiences. These technologies might be adapted for usage in fields such as retail, entertainment, tourism, security and health. It becomes clear that the innovations increasingly penetrate into all areas of human life and cause changes not only in business, but also in our social life.

The question then arises as to whether current principles of ethics can be applied to digital innovations or whether completely new principles are needed. Society, politics, economics, and science are facing great challenges in this respect and a general discourse is necessary to define values and standards for the development of a framework for action in the digital age without causing a backlog of innovation. 🚩

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