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## **Designing Food Experiences: A Multi-Sensory Approach**

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### **Abstract**

Food experiences extend beyond the eating of food. They may involve fantasizing about food, perceiving the venue where you buy or consume it, seeing or smelling the food from a distance, touching its package or container, the tools you use to prepare and cook, the cutlery you use to eat a dish, the way you dispose of the leftovers, and so on. In each of these stages, multiple sensory impressions conveyed by the senses of touch, audition, smell, vision and taste contribute to the overall experience. This section presents a structured design approach in which all sensory modalities are aligned to contribute to the same product expression over multiple stages of consumer interactions. The approach is illustrated through a graduation project aiming to enhance the experience of homemade cooking while using a kitchen appliance.

### **Keywords**

multisensory; design approach; food; experience; expression; engaging; kitchen appliance

### **Introduction**

To become successful in highly saturated consumer markets, products need to offer more than just good quality and an appealing look. They need to distinguish themselves from their competitors; somehow, they need to be special if they want to attract additional consumer attention. There are several ways in which products can be special, and producers may walk multiple paths simultaneously to support their product. For instance, a product may have an important story to tell, because it is produced in a special way and does not burden the local natural environment, because it is made in a very traditional way which uses authentic, historic utensils, because it contains local ingredients that provide special health benefits, because it is produced using the latest, state-of-the-art technology, or because its consumption is part of a local ritual that has been celebrated for a long time.

In this section, we provide a different approach that supports food purchase and consumption: we try to create intuitive, interesting and engaging food experiences by actively involving multiple sensory systems and we look for ways in which designers can enhance the aesthetic experience of consuming a food product. This asks for a broad perspective on product design in which the physical food may function as the centrepiece, but for which several supporting elements may be recruited in shaping the intended consumer experience, involving considerations of how the food is prepared and presented (e.g., cooking utensils, packaging, spatial arrangement, tableware) and the context in which it is consumed (e.g., on the street, at a particular occasion, in a restaurant).

Even though consuming food is a multisensory event by default (Schifferstein, 2006), a food experience goes beyond what happens between biting in a product, masticating, and swallowing it. An experience may already start when you think about a product, imagine eating it or start fantasizing about it (Desmet & Hekkert, 2007). First contact may involve

smelling the product or seeing it from a distance. This may activate memories about other experiences with similar products. It can give information about whether the food is ripe, and raises expectations about whether it will taste sweet, sour, or bitter. Perhaps you touch the package, which may feel firm, soft, crispy, rigid, heavy. All these sensations may be linked intuitively with specific product characteristics, and thus may enhance or decrease various aspects. Subsequently, when you open the package your experience is affected by the ease with which you access the food, the tools you use to prepare and cook the product, the way in which the product is presented, the cutlery that you use to consume the food, and the location where you happen to be: the number of people, the temperature, the lighting, the softness of your seat, the sounds you hear, and so on (Spence & Piqueras-Fiszman, 2014).

Each sensory modality is sensitive to a different type of energy and is stimulated by different product properties. As a consequence, the modalities usually provide a multitude of pieces of product information, which may or may not overlap (Schifferstein & Spence, 2008). Consumers tend to prefer products for which different pieces of sensory information duplicate or complement one another (Bell, Holbrook, & Solomon, 1991; Veryzer & Hutchinson, 1998). In these cases, the product communicates a coherent message, which makes it easier to understand what the product is and how it can be used. The downside of coherence, however, is that for common products this predictability can evoke boredom. A limited degree of conflict between information perceived by the different senses may result in a surprise, which consumers may evaluate as pleasant (Ludden, Schifferstein, & Hekkert, 2008, 2009). However, a discrepancy will only have a beneficial effect if the product remains easily recognizable as a member of a specific category (Hekkert, Snelders, & van Wieringen, 2003). Especially for food products that are ingested, unexpected elements may easily evoke an aversive reaction, because they can directly affect the person's health (Schifferstein & Michaut, 2002). Hence, sensory discrepancies only have the potential to improve product evaluations when the product is well-known, the discrepancies are relatively small, and expected negative health effects are minimal. In contrast, by excluding unexpected elements the designer takes away potential sources of distress and opens up the possibility to enjoy the product more intensely. By explicitly paying attention to all the sensory modalities in the design process, the designer avoids conflicting and confusing messages, enriches the product experience and makes the interaction with the product automatic and more intuitive.

An iconic multisensory food design is the 'Mary Biscuit' designed by Stefano Giovannoni for Alessi (Figure 1). This biscuit-box seems to enhance the coziness of social visits. The majority of biscuit boxes are made from metal: they feel cold and may contain sharp edges; the sounds they make when they are opened are also sharp, and when the cover accidentally falls on the floor it can make a loud and unpleasant noise. Hence, through the senses of touch and audition, many biscuit tins communicate hostility and coldness rather than friendship and warmth. The 'Mary Biscuit' container, however, is different in that it is made out of plastic, and has only rounded edges, while its shape resembles that of a pillow. The box feels soft and warm to touch, it makes only soft noises when you open it or put it down, and the box itself seems to invite the user to cuddle it. In contrast to the metal box, which usually does not have a distinctive smell of its own, the cover of the 'Mary Biscuit' is impregnated with a vanilla-like odor that becomes apparent when the container is opened.

Because many cookies contain the flavor of vanilla anyway, the additional smell may enhance the experience of tasting a cookie. In addition, the smell might evoke nostalgic memories of family visits to one's grandmother and may, thereby, enhance the feeling of sharing an experience with intimate friends or relatives. Upon closer inspection, the 'Mary Biscuit' container uses the majority of a consumer's senses to communicate similarly, but also seemingly redundant, information to produce a pleasing, multisensory impression.



*Fig. 1. The 'Mary Biscuit' designed by Stefano Giovannoni (courtesy Alessi spa)*

A sensory approach to design requires the development of multiple designer capabilities, such as the development of sensory sensitivity, sensory communication abilities, and material expertise (Schifferstein & Desmet, 2008). In a multisensory project, designers need to make sure that all pieces of sensory information together sculpt a coherent whole. Hence, sensory food designers need to obtain expertise for each sensory modality (vision, touch, taste, smell, audition) separately and in conjunction.

In order to train such abilities, designers need to engage with objects, explore materials attentively, and share and discuss their nuanced experiences with others. Although scientists and practitioners have developed systems that help to classify, describe, analyze and assess sensory experiences (Schifferstein & Desmet, 2008), it is only through the development of personal sensory sensitivity and expertise that designers can fully employ the possibilities of

sensory exploration as a tool in the design process. In some cases, the results of sensory perception research can provide general insights on how consumers are likely to experience particular product attributes, but only careful personal explorations can give designers information at the detailed level needed for incorporation in their design ideas. Hence, Multi-Sensory Design also involves an appeal to the designer to let their personal sensory experiences guide the design process. The sensory awareness of materials that artisans acquire by using hand tools to shape a material intuitively helps to produce coherent end products: working with natural materials in a real-life context automatically produces a feeling of whether different product elements match or not. Therefore, traditional crafting skills and sensory exploration of different materials are invaluable ingredients for creating coherent designs (Chamberlain & Roddis, 2003; Sennett, 2008).

**The Multi-Sensory Design (MSD) approach**

The main challenge in Multi-Sensory Design (MSD) projects is to come up with an integrated, holistic vision on the experience you would like to evoke among potential end-users. Perceptual knowledge and the corresponding cognitive associations that are obtained through explorations in all sensory modalities are explicitly incorporated in the design process. Based on these explorations in separate sensory modalities, an integrated sensory concept is formed by evaluating and selecting the sensory elements that together contribute to a holistic expression. These insights are then used to select materials, to design the product properties, and to develop the working principles of the target product (Figure 2). The ultimate design challenge is to develop a product that provides users with an interesting, rich experience and is nevertheless perceived as a coherent whole. On the basis of the insights obtained during multiple student projects, we developed a design approach in eight steps that supports the process (Schifferstein, 2011; Sonneveld, Ludden, & Schifferstein, 2008).

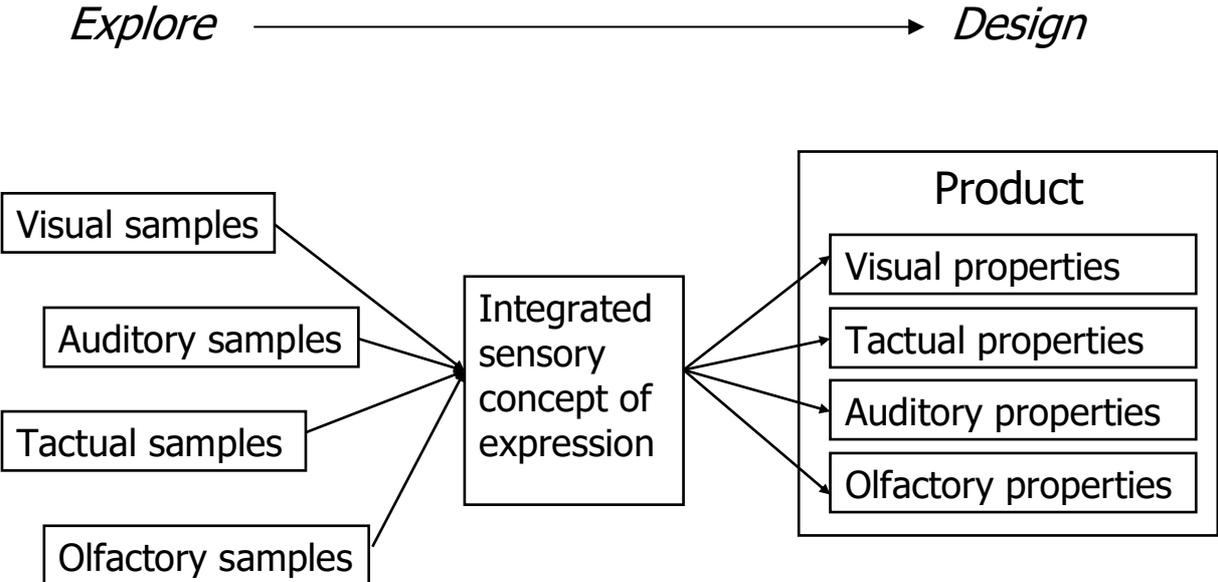


Fig.2. Framework for the Multi-Sensory Design approach (Schifferstein, 2011; Copyright ACM (2011), reprinted with permission).

*Below, we illustrate each stage of the process by referring to the outcomes obtained during the graduation project of Daniel Hagmeijer, performed at the Philips Research Laboratories in Eindhoven under supervision of Peggy Nachtigall and Jettie Hoonhout for his Master's degree in Design for Interaction at Delft University of Technology under supervision of Rick Schifferstein and Walter Aprile (Hagmeijer, 2010). The goal of his project was to create a user-friendly kitchen product in which the experience of "homemade cooking" was enhanced both in the product functionality and in the way the senses were stimulated during usage.*

### **1. Selecting the target expression**

Food producers may want to evoke specific experiences among their target user groups, and consumer research may serve as input for the product development process. If you know which kind effect you would like to achieve among your target users, you may intuitively derive the interaction qualities that are needed when people interact with your design, and this also partly defines the qualities of the object that you design (Hekkert & van Dijk, 2011). MSD takes the desired expression of the object (e.g., eagerness, cheerfulness, innocence, arrogance) as the starting point for the design process (Sonneveld et al., 2008).

In a business context, the target expression may be provided by the marketing department on the basis of consumer research. This research should be aimed at uncovering latent needs that are not yet met by current offerings on the market. Research methods that can be used at this stage are mostly qualitative, as they aim to get insights into processes that consumers are only partly aware of. Methods include making collages, filling in creative booklets, focus group discussions, and in-depth interviews. In addition, the analysis of big data sets on consumption patterns or consumer search behavior may reveal patterns that people are unaware of or are unwilling to report.

*The main goal of our example project was to find out what "homemade cooking" means to consumers, and how this meaning can be made experiential, by transforming these characteristics into product functionality and properties that stimulate the sensory modalities of vision, touch, audition, and smell. The student performed a qualitative study to obtain insight into the meaning of "homemade cooking": He gave six people a booklet with questions and tasks to be completed at home. In addition, participants joined a generative group session, during which they made a collage on the role of cooking in their lives and performed a sensory exploration of "homemade cooking".*

### **2. Conceptual exploration**

After the target expression has been selected, you need to develop an understanding of this expression. You may start by writing down all the associations that come to mind when thinking about this expression. Making a collage can support this process. What does the expression make you think of?

Participants in the example project reported that they like to be **in control** during cooking. Cooking should be done in a **clean** and **structured** environment. Kitchen tools should be **easy to use**. Cooks feel that homemade meals are **healthier** than what large companies provide. Also, meals may need to be **customized** to the dietary needs of individual household members. Dinner is also a **social event** where family members get together. Cooking tends to differ between weekdays when it is mainly seen as an **obligation**, and weekend days, when it is also a time to **relax** and **experiment** because people have more time and may invite friends or family for dinner. The cook who puts effort in preparing a meal would like to get **appreciation** from his or her family members (Figure 3).

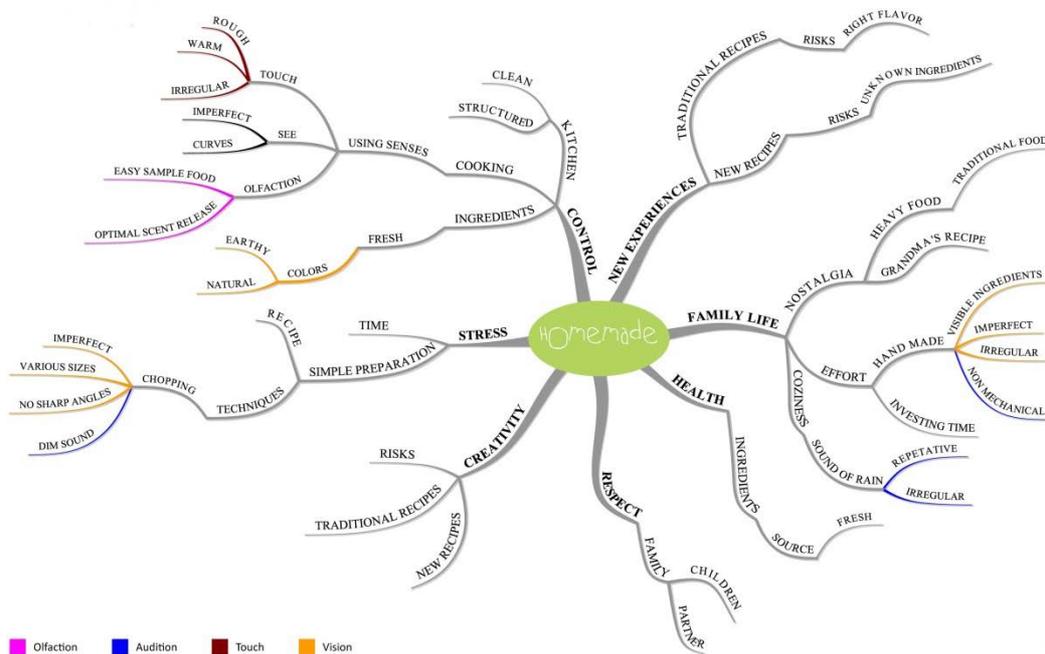


Fig 3. Associations for the concept “homemade” (Hagmeijer, 2010)

### 3. Sensory exploration

Subsequently, you collect samples that seem to evoke the target expression (Figure 1) for different sensory modalities (e.g., pictures, materials, fragrances, fabrics, computer sounds, foods, plants). How does the target expression feel, sound, smell, and look? While exploring the world, you should be curious about the sensory properties of objects, especially the ones people hardly ever seem to notice: In what ways can you pick up or manipulate an object? What sounds can it produce? How does it feel when you touch it in different ways? What does it smell like? Try to go beyond obvious choices: objects that look tough may feel quite elegant! Please try to use different types of movements to explore objects and close your eyes during the explorations, as this may distract you.

Participants indicated that “homemade cooking” tends to look a bit **messy**: Ingredients are still clearly **distinguishable** in a dish and they are chopped in **uneven**

sizes. Thus the perfect homemade dish displays imperfection. Sounds that are associated with “homemade” include the sounds of **rain falling** on a tent, which is associated with the cozy atmosphere inside a house; the **rumbling** of someone opening a **wooden door**, which is associated with craftsmanship; and the **sizzling** of a frying pan. Tactile sensations that feel homemade include the feel of a **rough** surface with an **organic** shape; the **embossment** on a flattened egg carton; and a piece of textile with **texture variation** that feels like someone has embroidered it or finished the edges by hand. Homemade should typically smell like the **fresh food** ingredients. However, the smell exploration showed that some food smells are hard to classify as readymade or homemade. Nonetheless, in some instances, readymade dishes acquire an artificial or sour smell that indicates that they are not homemade.

#### 4. Sensory Analysis

In the next step, you try to bring all information from the sensory explorations together in a single overview. You try to describe and understand the relationships between the perceived sensory properties and product expression. Try to find out why certain material samples seem related to a specific expression and try to determine the physical properties that evoke the target expression (Figure 4). In this stage, reading about systematic research on how people perceive and describe their sensory perception qualities can help to structure your personal observations and to facilitate communication among all stakeholders involved in the project.

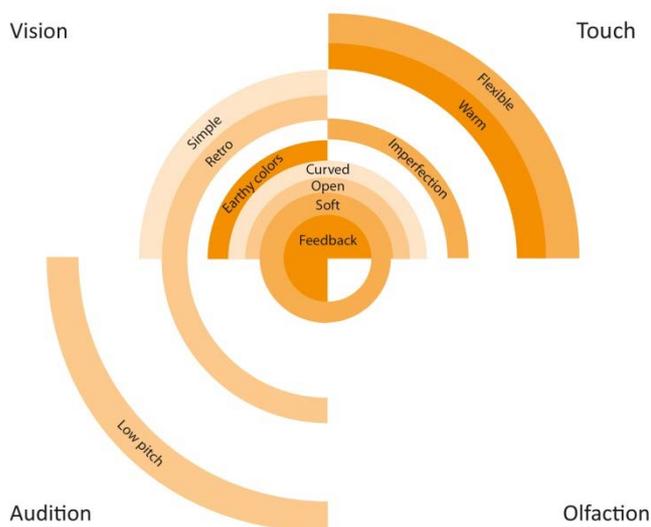


Fig. 4. Bringing together the sensory insights in a single map covering four senses (Hagmeijer, 2010).

#### 5. Mind map

The results of the previous stages serve as the starting point for a mind map. This mind map organizes the information that was acquired in the previous stages while trying to maintain the richness of the data. The target expression is displayed in the center of the map, where several outward branches connect it to the main concepts defining the core of the

expression. On their turn, these main concepts may be linked to other concepts, which may be linked to other concepts or sensory dimensions. From the center of the map to the periphery, the descriptors in the map become less conceptual, more concrete, and more sensory. New concepts may be added if links seem to be missing or if a set of concepts can be summarized under a new label. In the end, the mind map should indicate how a particular concept may be translated into perceivable product aspects that make the concept physically tangible.

If the final design involves a branded product, brand associations can be added to the mind map, to clarify how the design can contribute to the brand image. You may decide to modify or disregard some parts of the map in the design process if these conflict with the brand image (Nikolaidou, 2011).

The mind map is an essential step in the MSD approach because it creates an overview of all the information that was gathered in the previous steps. One of the important understandings that can be derived from the mind map is that a target expression may be achieved in multiple ways that can be mutually exclusive.

*In the “homemade cooking” project, we can distinguish between three branches that all support the design vision, either focusing on cooking together, enhancing the Dutch character, or emphasizing traditional values. Each of these topics branches out following multiple steps resulting in characteristics that are perceptible through the senses. In this case, it is not so hard to bring them all together and let the three branches together contribute and support an all-encompassing design (Figure 5).*

However, this is not necessarily the case in other projects. For instance, an expression like “elegance” may be related to flowing, uninterrupted movements, but also simple and straightforward solutions. Similarly, “natural” may evoke associations with green, firm and treelike structures, but also with blue, flowing waves. Integrating these different manifestations in a single design is unlikely to yield a unitary, coherent impression. Hence, in these cases, a materialization will depend on the choice that is made at this stage.

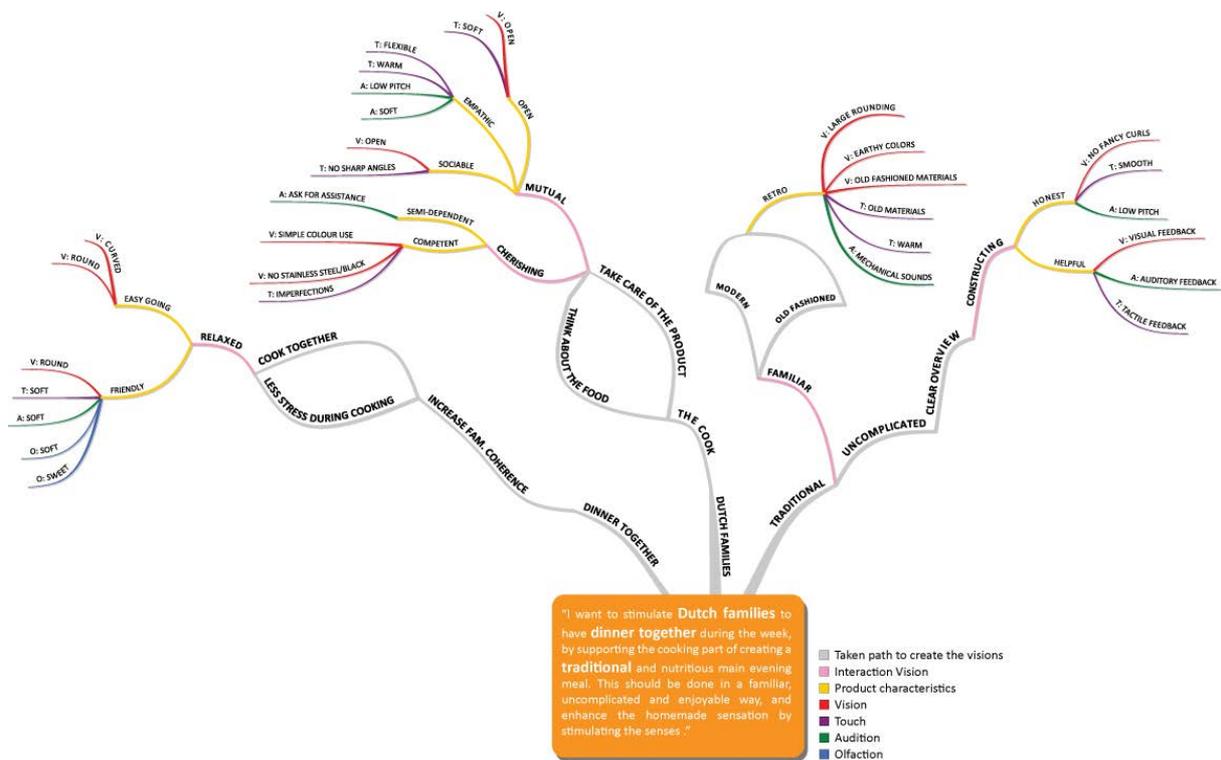


Fig. 5. Design vision, showing three topics that branch out into sensory stimuli that make the vision experiential and tangible (Hagmeijer, 2010)

To support and integrate the various steps transforming an experiential design vision into a materialization with a concrete set of sensory characteristics that support this vision, Camere, Schifferstein, and Bordegoni (2015) recently developed the Experience Map. This tool expands on the mind map by explicitly considering multiple conceptual levels in a single overview, and by using both words and images to represent them.

## 6. User-interaction scenario

By developing an interaction scenario, the time dimension is included in the design process. The scenario describes the actions users perform, the feedback they receive from the product, the instructions users receive, and so on. A scenario is usually set within a certain context, defining a typical user and an environment in which the interaction takes place. In the MSD approach, scenarios are used to identify all the sensory touch points during the encounter: Which senses are stimulated when you pick up the product, when you unwrap it, when you use it, or when you store it? What does this contribute to the overall expression?

## 7. Model making

Staying in touch with the physical counterparts of a specific product expression is a safeguard that enables you to develop an integrated user-product interaction that makes sense to prospective users and engages them. Actually, sensing a specific property often differs from one's expectations when trying to imagine it. In an MSD process, visual sketching and digital modeling should be left to a minimum, otherwise, visual impressions and cognitive reasoning will tend to dominate design choices. You should try to 'sketch' in all your senses, in order to assess the sensory aspects of your concepts. You can make collages

and explorative, physical models for the different senses, and assess their appropriateness in the proposed user context.

### 8. Multisensory presentation

The final design needs to be presented in a multisensory way if you want to communicate all the benefits of a Multi-Sensory Design; a set of slides will not suffice. If final prototypes are not yet available, you can show drawings, you can let the audience feel foam models, you can let them feel and smell materials, and you can play sound files. A storyboard can show the involvement of the various senses in the different stages of human-product interaction.

*In our example project, the search for a “homemade cooking” experience resulted in a two-person tabletop cooking device that can steam, grill and broil food (Figure 6). Each user has their own personal steamer and can place it on top of the cup in the center of the grill plate that can be filled with a low viscosity liquid like water, broth or wine. The steamer has small holes in the bottom to allow the steam to pass through. Grilling is done by putting food on a grill plate with raised ridges. For broiling the food is placed under this plate, where the heat radiates from under the grill plate.*



*Fig. 6. Concept of a two-person tabletop cooking device that can steam, grill and broil food and induces a “homemade cooking” experience among its users (Hagmeijer, 2010).*

*The cooking device stimulates the human senses and communicates “homemade cooking” in the following ways:*

- *Vision: The overall product aesthetics show a use of curves and earthy colors. The shape of the grill plate is kept as simple as possible while still retaining some curvature. The steamers show resemblance to old fashioned cooking pots. The curvature of these pots occurs throughout the design.*

- *Touch: Silicone surfaces are used for all elements the user touches during usage. This material feels soft and flexible and will only become slightly warm when the product is in use.*
- *Audition: The sounds are dampened using a soft, rubber-like material in the lids of the steamers and some parts at the bottom of the product. This material also stabilizes the tabletop and prevents it from shifting.*
- *Olfaction: The cooking smell will be the dominant smell during usage. We decided not to design any specific smell for the cooking device itself.*

After creating experiential prototypes, potential end-users may be asked to evaluate the proposed concepts to evaluate whether the product indeed is successful in fulfilling its primary functions and evokes the target experience. Quantitative research methods may be used to evaluate all the ins and outs of the concepts, so you can fine-tune the final design. This type of research should go beyond simple liking judgments, into more specific aspects on the sensory perception characteristics (e.g., how rough, sticky, soft the product is), the cognitive associations it evokes (e.g., whether the product is modern, natural, authentic), and the emotional associations it evokes (e.g., if it is surprising, relaxing, exciting). Typically, such judgments are obtained using questionnaires that ask participants to rate a number of adjectives on structured category scales or line scales (Schifferstein, 2009). This type of feedback can help to determine whether all the specified design goals are met and can provide the food designer with input on the effects of their manipulations on consumer impact.

## **Conclusion**

Consuming food products typically comprises a multisensory experience by definition, as this activity involves all the human sensory modalities. However, some elements of this experience may usually go unnoticed as they originate from the less obvious modalities. A multisensory approach to design may reveal the importance of such intricate sources of stimulation.

For instance, in the auditory domain think of the snap of the 'Kitkat' candybar (<https://www.nestle.com/brands/allbrands/kit-kat>), the distinctive crack of chocolate breaking as one bites into a 'Magnum' ice cream (<https://www.unilever.com/brands/food-and-drink/magnum.html>), the sound of the release of carbonation as a 'Schweppes' bottle is opened, or the characteristic pop of the 'Grolsch' swing-top cap beer bottle that all contribute to the consumption experiences. Such auditory inputs may be derived either from the food itself or from the packaging and tableware that support its consumption and all contribute to the brand experience. In similar ways, consumption environments might create additional sensory touchpoints.

When consumers buy fresh foods at a marketplace, they can use their senses to explore texture and smell, they can assess whether fruits are already ripe, and sometimes they can sample and try foods. There is no need for design to enhance the experience, as the foods and the environment can speak for themselves. In supermarkets, however, consumers are more restricted because fresh products may be wrapped in boxes or foil. Moreover, for many processed foods information is even confined to a name, a description, a brand logo,

and possibly a picture on a sealed package (Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). Hence, design can help companies communicate and support the intrinsic value of their food products among the vast number of competing products available in supermarkets. The MSD approach encourages packaging designers to explore different opportunities, for instance, among materials and the associated treatments they may enable or require. Packaging materials may feel warm or cold, heavy or light, smooth or rough, flexible or sturdy. They may look shiny or matte, transparent or opaque, flimsy or robust, and they may carry a smell or not. These qualities can all serve to communicate the properties of a food product, to support the brand proposition, and to enrich the cooking and eating experience (e.g., Nikolaidou, 2011).

As we show in our example project, the MSD approach can also be used to create durable products that support food preparation, consumption, and disposal. In this case, the approach supports the creation of durables that people can operate intuitively and that provide interesting and engaging user experiences. These products are likely to have a clear, distinct identity that distinguishes them from any competitors on the market (Lindstrom, 2005). Companies can use these sensory characteristics as unique selling points in their promotional campaigns. In addition, the products' rich sensory profiles will be difficult for competitors to imitate. By providing rich, satisfying experiences, users are likely to cherish these products, and continue to use them for a long period of time. In conclusion, because MSD has the potential to improve people's connection to food products during the purchase, make their cooking experience more intuitive and enjoyable, enrich their eating experience, and extend the usage time of durable kitchen tools, we hope that more designers will use this approach in their design practice.

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