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Schifferstein, Hendrik NJ

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Supporting food design with consumer research: from inspiration and validation to participation and integration

Hendrik NJ Schifferstein

To increase practical relevance, scientific research on food design is slowly shifting toward studying real-life food situations, letting go of experimental control to allow creative freedom, and studying design considerations during the creative process. On the other hand, some chefs and food designers have started to develop collaborative activities with academic professionals and involve researchers in their work who can conduct sensory tests of their cooking efforts. Some design researchers try to obtain general principles of interest from the creation and evaluation of food prototypes, for example in digital gastronomy, while using playfulness to increase dining engagement, or while trying to promote healthier and more sustainable food practices. This mutual cross-fertilization can enrich research activities and refine design and culinary practices.

Address

Department of Human-Centered Design, Delft University of Technology,
The Netherlands

Corresponding author: Schifferstein, Hendrik NJ
(H.N.J.Schifferstein@tudelft.nl)

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Introduction

Scientific research and design practice often seem to be at odds with each other. Academic researchers try to understand the world, try to unravel mechanisms, and search for general knowledge, while designers try to develop products and services that consumers like to use in their everyday environment and that potential buyers find difficult to resist (e.g. [1]). To develop knowledge and tools that designers can use in their practice to develop successful food innovations, researchers must find

a way to bridge this apparent gap. Researchers need to develop an understanding of the field of design, become aware of the designers' challenges and needs in the different stages of a design process, and present their knowledge in a way that facilitates adoption and integration by the design professional. This paper gives an overview of various approaches that have been used to connect consumer research with the daily practice of creatives in the food realm and evaluates their (dis)advantages.

While a designer is looking for ways to materialize certain intentions, consumer researchers focus on understanding how users interpret and build on the information they perceive in products. Therefore, designers and researchers have different goals and follow a different stream of thought. This discrepancy generates several tensions. For instance, researchers will wonder whether insights obtained from consumer experiences with a particular product will be generalizable to other products and situations. On the other hand, designers may find some scientific insights obvious or too general and may miss a sense of direction from these findings. Furthermore, designers are confronted with different types of problems than researchers [2]. Design problems are typically complex and ill-defined. Often only a desired outcome is specified, but both the means needed (what) and the process or working principle that will lead to the desired end value (how) are unknown [3]. Proposing possible solutions may then be preferable over trying to analyze and solve the problem, as it is not possible to obtain all necessary information [4]. Hence, design usually begins with intuition (discovery) and ends with reason (justification) [2].

Although their education teaches designers how to make use of different types of tools and approaches to address ill-defined problems within a given time constraint [4], each design process can be shaped individually, including the development of the tools needed on the way [5,6]. In contrast to researchers, who often try to separate or control factors to study them and prefer to use standardized and validated measurement instruments, the strength of designers is to approach challenges holistically and flexibly: They link abstract insights and ideas to people's everyday lives and take the complexity of this everyday context into account, while having an eye for the accompanying products, stakeholders, processes, or nuances that may be relevant. Hence,

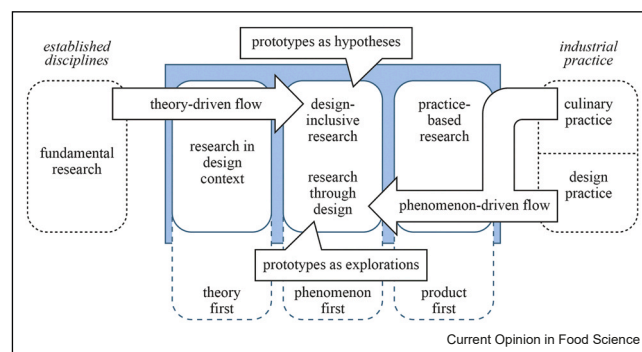
designers tend to think associatively, trying to include all aspects that may be relevant and exploring multiple routes simultaneously (a synthetical approach), while researchers tend to follow linear lines of arguments, trying to solve specific and isolated problems by determining what causes what and how this affects a possible outcome (an analytical approach) [7]. Because designers need to make many decisions during the development process, they cannot investigate all questions that come up in detail. Therefore, many studies or explorations they perform can be classified as quick-and-dirty, rather than robust scientific studies [8]. In many cases becoming inspired or getting a feel for matters may be more important for designers than obtaining findings that apply to large groups of customers. Sometimes a spark can create a good product for a niche market that may become very successful, without appealing to a large audience.

Designer intentions may also differ from the goals consumers try to achieve through consuming their products. Consumers may perceive or interpret product cues differently than intended, they can perceive different benefits, and consuming the product may satisfy different needs. This becomes evident in a recent study examining misalignments between designers' decisions and user wishes in food packaging design [9]. Hence, for consumer research to be effective in informing product design processes, the research should not only investigate consumer goals, but also the way in which they are related to perceived benefits and how such benefits may be derived from product features.

In addition to designers, several chefs are active as creatives in the field of food design. Training programs for chefs usually focus mainly on the acquisition of technical preparation skills, increasing their expertise knowledge on topics such as ingredient quality, mixing ratios, preparation methods, and cooking equipment, while evaluating the effects of such culinary determinants by tasting the end results of their endeavors [10,11]. In their professional life they use knowledge on their clientele to develop a personal vision of the menu to be offered [12]. Therefore, creative chefs typically build on their expertise to explore new possibilities to create new dishes, user experiences, and develop new preparation methods, which can provide guidance to other chefs and be an inspiration for scientists.

So, what does that imply for research on designing in the food realm? Despite these fundamental differences in approaches, scientific research and professional practices can benefit from and cross-fertilize each other, and Figure 1 indicates how initiatives from either side can develop into different types of design research [13,14]. Since many different aspects must be taken into account when creating a successful design, such as

Figure 1



Different types of design research in the food realm.
Adapted from Refs. [13,14]

the technical properties, how people interact with and perceive the product, how it fits into their daily lives, what makes the product profitable for a company, and how production, use and disposal affect the environment, the relevant disciplines in Figure 1 span many areas of science. If we zoom in on consumer research in the food area, it can involve ergonomics, product perception and experience, food choice, and anthropological studies, to name a few. Hence, researchers with many different backgrounds and interests can take a role in supporting food designers. Geographically, most research in this area is currently conducted in Europe, which can color the themes being addressed within the topic, but as many food challenges have a global impact, the relevance of food design is by no means limited to a single continent.

From 'research-in-context' to 'design-inclusive research'

Scientific studies in the food context with potential relevance for food design include controlled experimental studies on how the color, shape or orientation of the plate [15,16] affects the appreciation of a dish or how graphic design elements on food packages influence the perception of its content [17]. Over the years, researchers have increased the external validity of such studies by using more realistic choice tasks with correspondingly sophisticated statistical models [18,19], moving from laboratory studies to consumer testing in the home, restaurant or on-the-go environment [20,21], and by studying choice and purchase behavior in physical and online stores [22–25].

Of particular interest to food design is the creation and testing of realistic prototypes and finished products. But even in studies evaluating realistic prototypes (e.g. [26]), the characteristics of the creative process are often not reported. An exception was made by Michel, Velasco, Gatti, and Spence [27], who worked with a chef to show that aesthetic presentations derived from established

Figure 2



Realistic packaging design variants for a muesli bar, developed for an experiment on packaging perception by a professional graphic designer [21].

artworks could be used as inspiration to improve the appreciation for a dish. However, in the latter paper, we still miss the considerations the designer/chef uses during their process. Designers use a holistic approach to create coherent configurations of elements. How do such configurations come about, what aspects does the designer consider, and in what order?

Schifferstein, Lemke, and de Boer [28] used a factorial design to develop instructions for a graphic designer, rather than specifying combinations of packaging elements (Figure 2). Because the designer had artistic freedom to create packages, the study revealed several unanticipated barriers increasing its relevance for future design assignments. We noticed that realistic images of organs provoked disgust and did not support a healthy image, while cartoon-style images were acceptable. Furthermore, our designer observed that it was difficult to separate the effects of image content and style, because it can be difficult to find or recreate a single image in different styles. We also became aware of additional design consideration, such as how elements are grouped and balanced, and what aspects draw attention first, as this influences the main message consumers will derive [28]. In addition, packaging designers examine whether the package can attract attention from a distance, when it is displayed on supermarket shelves together with competitors [29].

To make theoretical concepts accessible to design practitioners, it can be helpful to develop tools that help bridge the gap between theory and practice. Lemke, Boon, and Schifferstein [30] provided 10 bridging concepts that describe ways in which disgust can be used to encourage or discourage specific consumer behaviors. Besides explaining the principle behind each concept and illustrating it with an example, the authors offer four lenses that provide dimensions on which to evaluate design ideas, raise points for discussion, and offer opportunities to fine-tune the design. In a similar vein,

Thompson-Bell, Martin, and Hobkinson [31] created a model for multisensory artistic practice and a taxonomy of cross-domain creative strategies — based on the affordances between the domains of food and music — with the objective to create new music to complement and enhance the characteristics of selected foods. Interestingly, the authors observed that some meanings associated with sensory impressions can activate political and social issues that provide an impetus for further deliberation.

From 'practice-based research' to 'research-through-design'

Research based on culinary practice and design practice starts out from the activities performed by chefs and food designers. Typical challenges are to make food products, interactions, or diets more convenient, pleasurable, healthy, and/or sustainable. Several world-renowned chefs [32–34] have created their own culinary laboratories in which they optimize their preparation methods, recipes and eating experiences. As chefs, they are masters in creating aesthetic experiences for their restaurants, but they also try to incorporate important societal themes (e.g. sustainability, slow food, worker conditions, and gender roles) [35–37].

A design practitioner does not have the researcher's luxury to focus on a single aspect. Instead, creating a design implies embracing the entire complexity of a certain situation and they may perform various types of research over the course of the design process. Input from researchers could help to optimize these studies, as inadequacies in the used research methods might result in unreliable outcomes or biased insights. Particularly tricky are concept tests, because the popularity of a new concept very much depends on whether participants can imagine the proposed situation well.

The use of traditional sensory and consumer research studies can help to support the design process,

Figure 3



Images of the Shitty Food project. Left: Using food-based elements to play the roles of food passing through the gastrointestinal tract. Right: Participants compare models they created of their feces with the Bristol Stool Chart, a standardized model doctors use to discuss stool characteristics with patients. Reprinted with permission from Ref. [58].

particularly in the culinary field [38–40]. For instance, Westling, Wennström, and Öström [41] set out to create a basic recipe that would support the sensory qualities of gray peas. After an analysis of existing recipes, they used factorial combinations to create eight recipes and evaluated these in a sensory test. After selecting the most promising recipe, various chefs performed cooking elaborations using adapted recipes, different cooking methods, garnishes, and condiments in multiple real-life contexts. Based on consumer tests, a basic recipe was selected for minced gray peas preserving their pronounced flavor, and an understanding was generated of its appropriateness for different applications, which allowed further diversification and innovation paths.

Patois, Chen, Meiselman, Barraco and Giboreau [42] went beyond traditional paths to develop a recipe book for immunocompromised bone marrow transplant patients who need to avoid microbiological risks. First, the authors harmonized the recommendations from different parts of the world. After conducting patient interviews, health professionals came to the culinary school to explain the hygienic rules that chefs should respect. The chefs then created several easy recipes and worked closely together with researchers to ensure that all practical restrictions were considered. The final guidebook contains 22 recipes that attain a balance between enjoying home-made meals and following restrictions, both for everyday life and festive times. Given the increasingly aging populations in many countries, the attention for

food solutions for people with specific nutritional requirements or disabilities is likely to increase (e.g. [43,44]). Possibly, training chefs who can develop recipes for groups with specific nutritional needs may increase the contribution of gastronomy to the health sector and improve patients' meal quality [45]. Analogously, designing food solutions for people who operate under extreme circumstances, such as astronauts [46] or athletes [47] can benefit from designers' input.

To gather detailed situated and context-specific knowledge, designers have created their own research methods, where participants create artefacts that express their thoughts, feelings, and ideas [48]. These should help uncover people's tacit knowledge and their latent needs, allowing the designer to develop an image of their ideal future. Furthermore, presentation modes that support interpersonal engagement, such as personal anecdotes, collages, video highlights, scenarios, storyboards, and persona displays are used to enhance the designer's understanding and empathy for the users [49]. Some designers also give consumers an active role in the design process, an approach called participatory design or codesign [50].

When carried out in an investigative manner, design activities can also provide insight into universal principles if the exploratory process involves the creation of prototypes that are empirically evaluated. Consistent with the idea that proposing possible solutions is preferable to trying to analyze and understand a problem

[4], research-through-design uses different ways of acquiring knowledge, sensing intuitively, and the creative process of making to approach chaotic situations with stakeholders who have imprecise or conflicting intentions [51]. Thereby, it opens up new perspectives on a research topic, and may lead to unexpectedly rich responses [52,53].

A research-through-design approach is often used in projects where designers explore new technologies to create products or user interactions and study effects on what people think, value, and feel [54]. In the food realm, for instance, we find explorations that use digital technologies to create digital gastronomy [55,56]. Another line of research uses playfulness to engage participants and invite potential users to cocreate prototypes. This participatory approach to research-through-design has been used to investigate the potential role of play in creating more engaging gastronomic experiences [53], help children develop healthier eating patterns with more vegetables [57], support people in developing healthier relationships with their gut microbiome [58], and offer people the opportunity to create their own sustainable dishes and cutlery from bioplastics using local, easily obtainable ingredients [59].

For example, the Shitty Food project [58] assisted people struggling with intestinal disorders and their relatives with overcoming the taboo of talking about defecation and toilet habits. Patients and their family members engaged with their gut processing mechanisms by drawing their gut anatomy with food-based paints, performed gut mechanics by passing food through a set of simple objects representing different parts of the digestive system, or sculpted models of their own feces using different foods (Figure 3). Altogether, this created an intimate space for toilet stories and finding new ways to deal with gut health.

Conclusion

Two types of design research try to bridge the gap between food research and design: one originating from scientific research on design-relevant topics that starts to incorporate more input from designers and thereby becomes more design-relevant; and another path starting from food design and culinary practice, where research practices are becoming more sophisticated, and where the creation of solutions generates insights with general applicability.

While the two paths can theoretically be distinguished, be aware that some of the activities performed can be similar in practice. When both paths involve a collaboration between a researcher and a designer/chef, it can be difficult to determine in hindsight which approach has dominated the activities in the project. While it is

likely that one partner will take the initiative, during the collaboration the roles of the contributors can change, and the classification of a completed project can be a point of contention.

To develop new and relevant design knowledge, it matters to balance divergence (invention, exploration, and discovery of new possibilities) with convergence (testing, finding which options are reliable and preferable). The practice-led exploration is typically stronger on the former, while the science-led investigation is stronger on the latter. Between these two extremes, the two come together and this cross-fertilization, through cooperation and mutual adoption of good practices, is likely to enrich research approaches and refine design and culinary practices.

Data Availability

No data were used for the research described in the article.

Declaration of Competing Interest

The authors declare no conflict of interest.

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