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Intersections between Design and Science in the Mediterranean Food Landscape

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Keywords

Design and Science, Food Design, Cultural Landscapes, Mediterranean Diet, Design Experimentation.

Abstract

Over the last few decades, design has become part of the realm of food in an increasingly incisive way, with the designing of both functional and communicative products at the service of nutrition as well as of food itself.

Design for food, through the interpretative filter of contemporary sciences and interdisciplinary experiments, takes the opportunity to consider the future scenarios of nutrition along with the possibility of finding adequate solutions to the increasingly stringent needs for well-being, health, and sustainability.

In this perspective, the scientific literature underlines the benefits of the Mediterranean diet, whose antioxidant, anti-inflammatory, soothing properties, as well as the presence of vitamins, mineral salts, and fibers, constitute a precious heritage to be enhanced and translated into contemporary lifestyles, as they favor the prevention and reduction of various pathologies.

This important baggage of scientific knowledge opens up new and unexplored fields of design experimentation for the discipline of design that is able to guide, convey and modulate the values and potential benefits of Mediterranean food culture through the design of artefacts that can be imbedded into everyday life, becoming an instrument for the treatment of psycho-physical well-being.

1. Introduction

Over the last few decades, the discipline of design has entered the dimension of food in an increasingly incisive way, through the designing of functional and communicative products at the service of nutrition and foods themselves. What has played an important role in this context, is the development of the most advanced and complex declinations of food culture, that is linked to the international interest in the food sector as an important value for culture, health, and sustainability, aspects highlighted by the multiplication of initiatives dedicated to food and its future - e.g., Expo 2015, Feeding the planet, energy for life, held in Milan. Among the numerous scenarios studied, the most interesting ones are molecular cuisine, nutraceuticals, and Sci-Fi Food, in which futuristic perspectives of food models are prefigured on the basis of the current promises of science and studied through chemical/ physical components.

In this perspective, thanks to the interpretative filter of contemporary sciences, design for food takes the opportunity to reflect on future food scenarios, along with the possibility of finding adequate solutions to the increasingly stringent needs for well-being, health, and sustainability. Designers, through interdisciplinary experiments, explore alternatives to current food production, proposing new materials, new ways of living, cultivating, communicating, and transforming, taking advantage of the energy and natural resources used in the food sector as well as the use of innovative digital technologies, such as 3D printing and artificial intelligence (Beckley et al., 2017).

This vision is even more significant when considered within the context of the cultural and productive landscapes of the Mediterranean, in which food has always represented an identity value, recognised and appreciated throughout the world, due to the virtuous combination of conviviality, multisensory enjoyment, attention to detail and beneficial properties for health, as highlighted by the experiments carried out in the early 2000s on some of the main foods of the Mediterranean diet (Visioli et al., 2005). From a purely scientific point of view, the literature highlights how the Mediterranean diet, rich in fruit, vegetables, fish, olive oil, and poor in foods of animal origin, can protect against the risk of chronic and degenerative diseases, cardiovascular disorders, and cancer (Esposito et al., 2017), preserve brain health (Squillaro et al., 2018), along with other elements maintains cognitive abilities as well as prevent Alzheimer's and dementia in the elderly (Perrone et al., 2020).

In addition to being associated with a reduction in mortality and the risk of contracting chronic metabolic diseases, the Mediterranean diet also reduces the impact on the environment, reducing carbon emissions and water consumption, thanks to the elevated number of food resources of plant origin – higher in the Mediterranean than in Northern Europe – due to the biodiversity of plants and cultures.

2. The "Design for Mediterranean Food" Project

This important baggage of scientific knowledge opens up new and unexplored fields of experimentation for the discipline of design that can guide, convey and modulate the values and potential benefits of Mediterranean food culture through the designing of communicative products, tools, packaging, functional foods (Bogue, Collins & Troy, 2017), and accessories that are grafted into the frenzy and frugality of everyday life to be translated into lifestyles and tools for the treatment of psycho-physical well-being.

In this context, was carried out the *umbrella* project *Design for Mediterranean food*, started in 2010 within the Hybrid Design Lab¹ (HDL) at the Department of Architecture and Industrial Design (DADI) of the University of Campania Luigi Vanvitelli, which have benefited since 2017 of the collaboration with the Department of Advanced Medical and Surgical Sciences (DAMSS) of the same University².

The project includes several hybrid activities (Langella, 2007) involving interdisciplinary research between design and science, didactic activities conducted in Design courses (Santulli & Langella, 2010), and collaboration and consultancy activities with companies, in order to integrate these different dimensions to converge towards a very important theme for contemporary society. Some of the activities carried out in the project are financed by research funds or companies or conducted in collaboration with the Città della Scienza Museum in order to spread these activities in an international scientific context. The results of these activities are projects in which design expresses its different speculative and proactive attitudes, inducing correct eating habits through the design of communicative artefacts, accessories, tools, and processes.

Coordination: Carla Langella.

² The activities described were funded as university research on the theme: *Design and nutra-ceutical science* coordinated by Carla Langella, and subsequently formed a research area within the TRANSITION project funded with inter-university VALERE funds in 2019.

All the products that will be described below, and that are part of the *Design for Mediterranean food project*, share the same methodology that links design skills, technical/scientific knowledge, production processes, and user's participation (Langella, 2019). The methodological approach, which is based on the collaboration with scientists, is structured as follows:

- Analysis of the design problem, defined by the hybrid team of scientists and designers through an intersection between the emerging scientific matters, recognised by scientists, and the society emerging needs, observed by designers using interviews, observation or focus group.
- Definition of the type of users and involvement following a user centred approach (Holtzblatt, Wendell & Wood, 2004; Giacomin, 2014).
- State of art analysis (scientific scenario of reference and design cases study).
- Concept definition. In this phase, the importance of a hybrid (design and science) approach is essential in developing strategies to induce and facilitate healthy behaviours and lifestyles, based on the values of Mediterranean agrofood culture, which can help to prevent and reduce the effects of some diseases through synesthetic and pleasurable experiences.
- Definition of morphology, structure, materials, processes and using models. These complex choices are oriented by the main objective of facilitating the adoption of designed artifacts and the integration in the user's life through a pleasant and easy experience. This is important to improve the quality of the relationship between people

and food and therefore the user's quality of life and their awareness of the impact that daily choices can have on their wellbeing. In this phase, that is led by designers and scientists, users and companies are involved through meetings and interviews.

Prototyping and trial tests, and exhibition³.

In the project *Design for Mediterranean food* the design discipline expresses its persuasive attitude, capable of inducing people to make specific actions and choices while making these actions simpler, more pleasant, fun, exciting, persistent, and continuous. In addition to this potential, there is the attitude of design for communication to convey the most recent scientific knowledge on the relationship between food and health, making it more accessible and easily memorized so that people become more aware and therefore able to make their choices on the basis of scientific knowledge.

3. Design to Promote Correct Eating Habits

Even if everyone is aware of the benefits of the daily consumption of fruit and vegetables, it is still relatively low in the most industrialized societies. The reason of this resistance is due to the difficulty of transporting and eating this type of food outdoor – e.g., at work – an issue highlighted by the Italian National Institute of Statistic (ISTAT), which statistics underline that people who eat out prefer to take food that is easy to transport,

³ Most of the products are exhibited in international science exhibitions promoted by Città della Scienza such as *Diatom de-Science, Intersections between Design and Science* (2014), *Italy: the beauty of knowledge* (2018-2020), *Italy: the art of science* (2021), *Futuro Remoto* (2017-2020).

that does not rise, that can be eaten with the hands, at room temperature, and without the need for additional tools. The consequence of this trend is the reduction in food quality. A possible answer to this problem is the *Dia_paper*⁴ project, one of the results of the research activities carried out within the HDL, whose aim is to facilitate the transport of fruit to consume out of home, reducing the risk of ruining it thanks to a single-fruit packaging with an origami morphology that protects its content. The project is realized in a special paper obtained experimentally by including diatomaceous powder⁵ in the cellulose in an increasing percentage, allowing to obtain a porous structure characterized by progressive gradients of moisture absorption and substances responsible for the rotting of fresh fruit, such as ethylene (Lee et al., 2015; Wei et al., 2020) (Fig. 1). Another reason for the low consumption of fruit and vegetables is distraction. People tend to forget to eat before-mentioned foods or drink water as if they are secondary actions to the basic meal consumed frantically. In these cases, design, through the creation of apps, communication tools, and products, can act as a reminder to eat fruit and vegetables. The Sensory Dishes⁶ collection aims to induce people to consume fruit and vegetables by evoking the colours, textures, and shapes of nature in a multisensory way, correlating the taste experiences to the psycho-physical benefits induced, aimed at the rediscovery of the body's needs (Lyman, 2012;

Méndez-Balbuena et al., 2015).

Design by Mara Rossi; Coordination: Carla Langella.

Residual fossil diatom.

Design by Valeria Papa and Maria Bellanca; Coordination: Carla Langella.



Figure 1. Mara Rossi, *Dia_paper*, experimental single-fruit packaging obtained by including diatomaceous earth powder in the cellulose, 2014. Coordination: Carla Langella.



Figure 2. Valeria Papa and Maria Bellanca, Sensory Dishes, 2021. Coordination: Carla Langella.

This is possible thanks to the work done on the surface of the plates that, for example, is coloured and textured like an orange, to associate a multisensory stimulus to the experience. Infact scientific studies reveal that there is a correspondence between food, colours, and the body's needs. The intention of the project is to change the way of relating to food through a pleasant experience that is based on user's unconscious memory, and whose results are energetic and beneficial effects, both on body and mood, due to the consumption of fruit and vegetables (AlAmmar et al., 2020; Rooney et al., 2013) (Fig. 2).

As in the previous case, the Fresh_it⁷ fruit bowls aim to facilitate and encourage the consumption of fruit and vegetables by integrating different containers that simplify the washing, drying and consumption phases of this type of food. The work carried out on the surface, through the use of holes and grooves, not only allows the different containers in the kit to be stacked, but also the collection of excess washing water. The intention behind this project is to align the design of a product with the lifestyle of its users, through a single set of containers that simplifies and speeds up the washing, preparation, and consumption of a specific category of food (Fig. 3).

The relevance of the projects discussed in this section is the attempt to reverse a currently rampant lifestyle that sees a reduction in the consumption of foods such as fruit and vegetables both at home and away from home.

Design by Giovanna Montano; Digital design support: Gabriele Pontillo; Coordinator: Carla Langella.



Figure 3. Giovanna Montano, *Fresh_it*, 2021. Coordination: Carla Langella; Digital design support: Gabriele Pontillo.

In order to do this, it is considered that the development of products that can be an incentive towards a healthy diet, adapting their consumption to the lifestyle of the users, is a strategic choice in terms of their well-being and health.

These aspects are linked to those more closely related to therapeutic agenda for chronic, degenerative, or cancerous diseases, which impose very strict dietary regimes in the already difficult life of patients, characterized by a prevalence of vegetables and whole foods, as well as specific methods of preparation, conservation, and consumption. This leads to a series of psychological, cultural, economic, social, and anthropological problems that can be addressed through the tools of *design for food* (Zampollo & Peacock, 2016; Batat & Addis, 2021; Massari, 2021) and *design for all* (Aslaksen et al., 1997; Bendixem & Benktzon, 2015; Persson et al., 2015), which allow

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the creation of artefacts that make medical indications more acceptable and adoptable. In this perspective, the intention of the projects developed at the HDL is to respond to needs such as the assimilation of antioxidant nutrients or reducing the intake of fats and sugars, both for pathological and borderline situations (stress, depression, old age), in order to rebalance body awareness, the ability to perceive, feel and modulate external sensory and multisensory stimuli, based on the most recent neuro-physiological mappings.

To do this, particular attention is paid to the design of nutraceutical foods, tools that simplify and speed up the preparation of meals, as well as accessories for the transport and consumption of meals themselves.

An example of what has been stated is the *BomBum*⁸ project (Fig. 4), whose purpose is to improve and simplify the preparation of healthy food at home, thanks to a multi-component measuring and moulding spoon that allows individual foods to be dosed into spherical snacks. The aim of the project is to become a useful tool for users who, for health or wellness reasons, need to take a certain amount of certain types of food – e.g. polyphenols – generally available as supplements in pill form, drinks, etc. With *BomBum*, the user can shape the snack autonomously by creating a multi-textured structure consisting of a more solid and compact outer shell, and an inner core of nutraceutical liquids or seeds (Hussain et al., 2021) that are injected into the shell through a small internal piston with different injection sections.

⁸ Design by Chiara Bottari, Benedetta Cuomo, Margherita Cuomo, Rossella Di Maro; Digital design support: Gabriele Pontillo; Coordination: Carla Langella.

BomBum consists of three main elements, the handle, designed to suit both left and right-handed users, with a cavity through which the syringe for injecting the liquid texture passes. The handle is attached to the hemisphere, which can be used as a spoon during preparation, and once this stage is complete the upper part of the hemisphere is used to shape the snack shell. Both halves, detached from the shell and hooked together, form the packaging of the snack. The relevance of this project lies in the possibility of enclosing in a single object the preparation, conformation, transport and consumption of a highly functional food, as it is customised to the specific needs of a user.

4. New Digital Technologies for Food Design

Among the products developed during the study, there are also systems of products and services for the tasting of foods of excellence of Mediterranean culture aimed at valorising the ancient and rooted production traditions in a contemporary key, which highlight the nutritional values, achieved through innovative digital technologies, such as 3D printing and artificial intelligence.

The *Sunder*⁹ project is based on the valorisation of the Sorrento IGP walnut and its derivatives, through a kit that aims to provide a synesthetic experience that integrates taste (Cardello & Schutz, 2003) and touch to amplify the qualities of the walnut, to favour its consumption (Ni et al., 2021) as well as reactivating the local micro-economy, while averting the risk of the disappearance of walnut trees.

⁹ Design by Cinzia Gervasio, Claudia Improda, Simone Martucci, Vincenza Pellegrino, Alessia Schettino; Digital design support: Gabriele Pontillo; Coordination: Carla Langella.





Figure 4. Chiara Bottari, Benedetta Cuomo, Margherita Cuomo, Rossella Di Maro, BomBum, multi-component measuring and moulding spoon for healthy homemade food. Coordination: Carla Langella; Digital design support: Gabriele Pontillo.



Figure 5. Cinzia Gervasio, Claudia Improda, Simone Martucci, Vincenza Pellegrino, Alessia Schettino, Sunder, nut tasting kit, 2021. Coordination: Carla Langella; Digital design support: Gabriele Pontillo.

The intention of this project is to trigger the curiosity of the user through gestures that can enhance the experience and convey the strong identity of this type of food. In this case, an integral part of the methodology applied is bio-inspiration; the kit designed includes different components for the study of each of which was inspired by nature: the nut-opener, for example, is bio-inspired to the structure of the beak of the *Haematopus ostralegus* which uses the beak to open oysters, while the tool used to extract the nut from the shell is inspired by the skeleton of the *Pedicellaria echinoidea*. Other components of the kit are a small hook, a fork, and a straw to taste the walnut liqueur.

The next stages of the project described above involve conducting perception and usability tests. With regard to its production, the material chosen for all the accessories is zirconium oxide, a ceramic material already used in the production of utensils for food use (Fig. 5).

The description of the Sunder project shows how additive technologies can be used to rapidly produce an object that can be analysed and evaluated from various points of view. Nevertheless, the use of 3D printing is not limited to the production of accessories, but also of food, as it allows the development of functional foods, custom-designed in terms of both ingredients and configuration according to the nutritional needs of the individual – prevention of allergens, animal products, religious restrictions, weight control, hypersensitivity –, characterised by complex and elaborate geometries and textures.

Through 3D food-printing, it is, therefore, possible to enrich the nutritional composition of food, in which precious alternative raw materials – such as insects, algae, seed husks, animal proteins grown in the laboratory or proteins of plant origin – are introduced, and at the same time, shape the food products on specific consumer needs, maintaining visually appealing shapes and ethically sustainable production (Lupton & Turner, 2016). A reality in the Campania region that deals at an experimental level with the additive production of food is Stampa3DSud, which through this technology has developed nutraceutical products through foods such as carrots and potatoes, inspired by the geometries of nature, such as the nautilus, and the ramifications of corals (Fig. 6).



Figure 6. Stampa3DSud, 3D printed food experiments, 2021.

Even if it is mainly applied to the military and space sectors, as well as gourmet cuisine and food for the elderly, the development of health and wellness products can become a reason for the use of 3D printing in food for expanded distribution. Digital gastronomy introduces issues related to culinary experiences that go beyond simple taste, investing all the aspects

of gastronomy (Van Bommel & Spicer, 2011). 3D food-printing, therefore, allows consumers to "continue eating experiences" – visual, material, nutritional, etc. – and enjoy food while the meals are being prepared and consumed.

Nevertheless, there is still a long way to go in this area, in terms of both experimentation and production, from the point of view of aesthetics, acceptability and commercialisation of 3D printed food.

5. Design for Awareness of the Relationship between Food and Health

The results of the *Design for Mediterranean food* study consist not only of products but also of visual artefacts, the aim of which is to improve the quality of the relationship between food and people, informing users about the food choices that facilitate healthy behaviours and lifestyles.

An analysis of current scientific literature highlights how the relationship between food and health is consolidated for different age groups, cultural backgrounds, and health states (AlAmmar et al., 2020). This relationship becomes even more evident when comparing users suffering from diseases such as Neurofibromatosis type 1, diabetes, obesity, as well as psychological pathologies such as depression.

In line with what was previously stated, there is the awareness that healthy diets, such as the Mediterranean diet, make it possible to prevent the risks associated with chronic diseases: for example, scientists study *dietary patterns*, who rather than looking at individual nutrients or foods, propose an analysis of the food model which, in a more predictive way, can quantify the *extended* benefit that food combinations, such as

those of the Mediterranean diet, can have on individuals (Del Chierico et al., 2014).

Communication design, and in particular information design, therefore acquire a central role concerning the possibility of conveying information and disseminating knowledge among heterogeneous groups of users, thanks to the visual translation of data that allow improving food choices and portions, triggering an improvement in the state of mind and health, while also preventing some pathological conditions. The project activity described in the current paragraph was carried out thanks to the collaboration with the Department of Advanced Medical and Surgical Sciences of the University of Campania Luigi Vanvitelli, and in particular with the research group coordinated by Prof. Mariarosa Anna Beatrice Melone, who made it possible to acquire the necessary scientific information as well as experiment with visual forms and graphic layouts that could best convey easily decodable information. Thanks to the methodology described in the previous paragraphs, and to an approach based on the convergence between the rigour imposed in the treatment of technical/scientific data, and their visual and at the same time narrative translation for a better dissemination of the contents (Star & Griesmer, 1989), two different types of products were created: one dedicated to digital use via the web, the other conceived as a printed leaflet. The infographics created for the web were designed to be used as a dissemination product on the most popular social networks. Created using a mixed graphic-photographic technique, this visualization aims to relate the number of different foods that satisfy the daily requirement of vitamin C, D, polyphenols, and omega3.



Figure 7. Roberta Angari, Food infographics, quantitative infographic on foods containing specific nutrients, 2021.



Figure 8. Roberta Angari, Portions and proportions, guide to the ideal proportions for a healthy lifestyle, 2021.

The project is characterised by the amazement of the user in understanding how very different quantities can give the same amount of vitamins or nutrients needed by the body (Fig. 7). The printed leaflet is meant to be a guide to the ideal portions of food, which allow maintaining a healthy lifestyle. The hierarchy of information that is articulated between the outside and the inside makes it immediately clear how making healthy meals is one of the most important first steps to take not only for physical fitness but above all health. Few rules such as drinking a lot, reducing the consumption of oils, eating lots of seasonal fruit and vegetables and many colours, as well as dedicating a part of the meal to carbohydrates and proteins, guarantee the creation of a balanced meal, optimal for daily needs (Fig. 8).

6. Conclusions

The projects and experiences carried out in the *Design for Mediterranean Food* project, and the scenario described in the contribution, show how design plays an increasingly important role in the creation of artefacts that translate scientific information into everyday action, especially when this action has an impact on the health and well-being of users. This is well described on the one hand by the relevant scientific literature, and on the other hand, albeit in an experimental way, by the projects listed, whose intent is to create experiences around food, emphasising how the consumption of healthy and Mediterranean foods is fundamental to increase the degree of involvement and evolution of users' daily practices. In fact, as stated in the previous paragraph, the Mediterranean diet constitutes a precious reference for the design of future

food landscapes, oriented towards health and widespread well-being, sustainability, and enjoyment.

In addition, a healthier approach to food selection, preparation and consumption, has a further positive impact on users, helping to rebalance the hormonal structure, strengthening the feeling of psycho-physical well-being, as well as preventing and treating some pathological conditions.

As a conclusion, the last but not least aspect is that both, from a product and communication design point of view, design is able to convey values and information, making them an integral part of users' daily lives. This, thanks to the methodology used and described above, constitutes a significant feature of the projects described, as it allows the humanisation of technical objects, through the design of sensorial experiences and the active participation of users, to converge with the rigour required when confronting with the design of an artefact that translates technical/scientific information. This last theme, which is well linked to the issues more closely related to the field of information design, is actually much broader and scalable, mainly if contextualised with the design of artefacts, whether tangible or intangible, related to health and well-being.

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The introductory paragraph and conclusions, were jointly written by the three authors.

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Using participatory action research she aims to explore the ways in which tacit knowledge can emerge, be understood and leveraged to better design relational services for sustainable futures. This exploration will pivot on the ways of knowing that emerge from the process of design, craft and co-creation as well as on the indigenous practices at the local level. Her research aims to enable the emergence of a new design epistemology, based on concepts like post-humanism as well as on feminist and indigenous theoretical frameworks. This will be accomplished with small groups of people, within which co-creation will occur, following processes of participatory design.

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Since 2006 she founded and coordinates the Hybrid Design Lab (www.hybriddesignlab.org), the design laboratory dedicated to mutual relations between design and science with particular attention to the experimentation of biomimicry in design and the integration of designers in the development processes of new materials to which the specific Designer in lab project is dedicated.

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