Packaging Design as a Graphic Interface between Traditional Communication and New Technologies

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Abstract

In recent years, new information and communication technologies have had a significant impact on the design field, also involving, in a relevant way, the design and marketing processes related to product packaging. The multiple roles assumed by packaging, from functional ones to visualization ones aimed at conveying the corporate brand and persuading the buyer, have been enriched with renewed nuances and unprecedented possibilities. The latter have profoundly redefined both the relationships with the product and those with the consumer. This article explores the new ways of communicating packaging and its transition from a simple graphic-formal artefact to an articulated graphic interface. Through the narration of recent experiences that testify its transfiguration towards advanced forms of communication of products/services, the authors investigate the possibilities offered by new technologies and the founding role of drawing in this specific field of design, in which applications are increasingly characterized by multidisciplinary approaches.

Keywords: packaging, brand, communication, visualization, usability.

Introduction

The relationship between content and package has become over the years, in the context of industrial production, one of the main elements of the designer's thinking. The theme of packaging represents a design problem that places the designer in search of solutions that are not only practical but also communicative. Although it fulfils the dimension of containing or protecting, the package itself becomes on the one hand an object with specific functions of use, on the other, a communication tool. Its visual, non-verbal component therefore takes it to the field of the science of communication through images, increasing its semantic value.
In the realization of a package, therefore, various inseparable components come into play, whose boundaries often appear blurred and indistinguishable. From materials to shape, from the stereotomic conception to ergonomics, from the visual communication of the surface to the conveyance of information relating to the content, packaging appears more and more like the crossroads between creativity and innovation. In this significant meeting point, the drawing, within the design process, takes on a crucial role.
Analysing packaging in its evolution, from the narrative to the communicative function, this article intends to investigate it as a graphic interface for communication. In this capacity, new technologies make it possible to reconsider the presentation methods of the package, allowing the implementation of broader communication strategies that have a decisive impact on consumer choice. In this context, the possibilities offered by representation in the structuring of the graphic, infographic or multimedia image make it possible to convey messages capable of go-

ing far beyond the product, making communication even more important than the content itself, or, according to the suggestion of Marshall McLuhan, the medium becomes the message itself [McLuhan 1964]. Therefore, in presenting relationships and transitions between product and packaging –meaning the latter as a means of communication, now of the brand, now of the product and the meta-values related or linked to it– some theoretical-methodological assumptions are exposed that allow to identify the functions of drawing in the methodological process of packaging conception, between design and marketing.

From the story of the brand to the communication of the system/service

Packaging is a tool that allows us to get in touch with the goods and products that surround us and is an integral part of that complex system of distinctive elements designed to represent a brand. It is often a communication artefact so significant that it identifies with it. An example of this is the Coca-Cola bottle, patented in 1915 by the Root Glass Company, on the initiative of the Coca-Cola Company which proposed the challenge of developing a bottle "so distinct that you would recognize it by feel in the dark or lying broken on the ground" [1]; as well as that of Campari Soda realized in 1932 when Davide Campari asked Fortunato Depero to design a single-dose bottle, which over time became not only an icon of the Italian aperitif [Annicchiarico 2022] but the representation of the values of a company that he believed in the partnership between contemporary art and communication (fig. 1).
Packaging design is therefore an activity that requires complex skills. The designer, starting from the needs of the users and considering the market logic and the company objectives, must ensure that empathy is generated between the consumer and the package/product, that is the relationship that binds the buyer to the brand, and that establish a lasting and persistent bond between them. This sale/purchase relationship is summarized in the 1960s by Jerome McCarthy in the 4Ps of the marketing mix [McCarthy 1960]. The American professor of Marketing Management describes the logic that governs the design of a product and its introduction and persistence on the market through four variables:

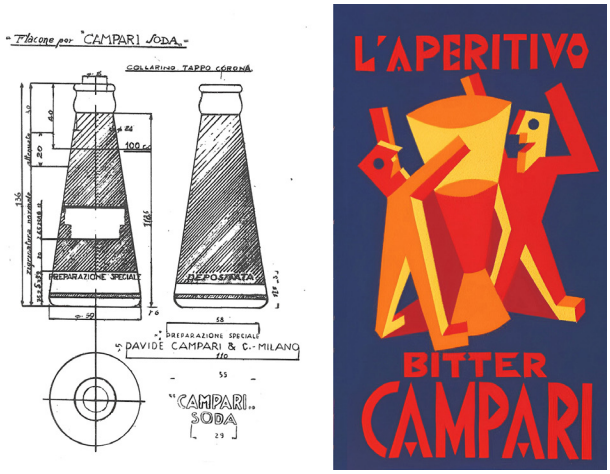

Fig. 1. Left: technical drawing for the executive production of the Campari Soda bottle, 1930s. A. Bordoni and Son glassworks. <https://www.campari.com/app/uploads/2022/03/THE-ART-JOURNAL-04-Campari-Soda-min.pdf> (accessed 9 August 2022). Right: Fortunato Depero, Bitter Campari, 1928.

- Product (the marketed good or service);
- Price (the price at which it is marketed);
- Placement (the physical or virtual place where it is marketed);
- Promotion (promotion activities designed to enhance the product).

In the early 1990s, Robert F. Lauterbon [Schultz et al. 1993], a forerunner of integrated communication, shifts the focus from a vision that favours the company to a customer-oriented one. At the 4Ps he adds the 4Cs. These, paying particular attention to the needs of the consumer and to the experiential value in the use of the product, ensure that the 4Ps evolve. Thereby:
- from Product to Consumer (to the needs of the consumer);
- from Price to Cost (at the price that the consumer expects to pay);
- from Placement to Convenience (to the most suitable form of distribution for the consumer);
- from Promotion to Communication (to communication capable of creating an empathic and emotional relationship with the customer).

In this development, new technologies play a crucial role.

They contribute to satisfying the needs of the consumer, because they can offer 'talking' devices, that is, capable of providing indications and guiding purchasing choices. The so-called enabling technologies transform the packaging from a mere container into a real communication and service vehicle. It becomes a device capable of informing and at the same time telling, creating a unique shopping experience for the user.
These technologies and 'Industry 4.0' were first mentioned in 2011 during the Hannover Fair when H. Kagermann, W.D. Lukas and W. Wahlster present a paper entitled *Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution* [Kagermann et al. 2011], then released in 2013 by the German government. This document explores the strategies for facing the markets of the new millennium competitively. The indications are implemented three years later in Italy by the National Industry 4.0 Plan [MiSE 2016] which speaks of 'Enabling Technologies', or rather those interconnected devices, tools and resources, capable of managing large amounts of data and capable of assigning to products and services an added value and intelligence that allows them to analyse information and make decisions independently (fig. 2).
The packaging sector is affected by these indications both in the automatic machine production field and in the production of packaging. Digital solutions that can make production systems more performing and flexible are adopted,

Fig. 2. National Industry 4.0 Plan. The enabling technologies [MiSE 2016].

suiting the production process to new sustainable materials and changing market needs. Similarly, the labels are equipped with added performance thanks to the use of NFC (Near Field Communication), RFId (Radio Frequency Identification), QR Code (Quick Response Code) and augmented reality [2], which improve the graphic interface, making clearer and more interactive communication with the consumer. These devices intercept a shared trend in the new millennium, that of product/service personalization. "Both the most recent studies and the observation of phenomena today give us an industrial system in which the boundary between manufacturing and services is increasingly thin, so much so that it is often difficult to identify the specific sector to which a single company belongs. Industry 4.0 will only accelerate this mix, thanks above all to the Internet of Things that allows you to create smart products which can be accompanied by more and more personalized services" [Prodi et al. 2017, XI]. The English researcher Kevin Ashton, the co-founder of the Auto-ID Center at MIT, speaks of the Internet of Things (IoT), of objects equipped with sensors and technologies connected to the Internet and capable of transferring information and data between them, in a conference at Procter & Gamble in 1999. It is a revolutionary technology through which the package goes beyond the classic functions, to become an integral part of a more complex system destined to no longer convey a product but a real service.

The design of the packaging to communicate aware and responsible information

The packaging of a product fulfils a series of functions: containing and preserving the product over time, transporting the content from the place of production to the space intended for sale, communicating the brand and at the same time informing about the intrinsic qualities of the product.
In the volume *Packaging Contro.Verso*, Valeria Bucchetti, visual designer and lecturer in Industrial Design, reads "critically the communicative dimensions that are condensed in packaging to identify spaces for experimentation, search for new forms of expression and language" [Bucchetti 2007, p. 7] and she investigates the ethical and social responsibility of the designer in design choices. Four areas of reflection emerge from this survey, two of which are relevant to the discussion below.

The first, called *Just enough*, is focused on the design of labelling capable of going beyond the representation of the brand, subverting and redefining the hierarchy of information that sees the attribution of greater weight to that information often relegated to marginal spaces, such as expiration date, calories, nutritional principles. In other words, 'just enough' is reported on the packaging for the consumer to understand the actual quality of the product.
In the second, defined as *New medium*, the packaging is proposed as a vehicle and tool to spread parallel stories that go beyond the intrinsic characteristics of the product itself, as happens in *Socially Active Packaging. The Case of Antipersonnel mines*, the project that "proposes to rethink tout court the packaging of the products, making them an active part in the promotion of the social message, through the redefinition of the form even before the graphic elaboration. The goal is to raise consumer awareness on the subject of antipersonnel mines, transforming the packaging of products traditionally sold in pairs –such as gloves, socks, and shoes– through the expedient of displacement. The product packages are split into two distinct packages, held together by gauze tape. The awareness message is interrupted on the surfaces of the two packs and becomes legible only by placing them side by side" [Bucchetti 2007, pp. 57-59] (figs. 3, 4). The same theme is tackled by Ettore Ciravegna and Umberto Tolino who design the pizza carton [Ciravegna, Tolino 2012]. This becomes a 'new medium' through which to sensitize the buyer on the seriousness of domestic accidents. The experiments conducted on the subject propose a communication made up of statistics, puns and pictograms capable of involving the buyer through elements that attract his attention (figs. 5, 6). As has been argued by Pine and Gilmore [Pine, Gilmore 2010], in the New Economy it is not enough to produce goods and services, but it is necessary to ensure that the customer has an experience in the act of consumption, which builds customer loyalty and attracts in an event that becomes memorable for him. Packaging, therefore, assumes a significant role in this perspective, becoming not only a wrapper but also a medium in the shopping experience.
Enabling technologies such as augmented reality, IoT technologies, NFC tags, and QR codes allow us to design packaging capable of generating, between user and product, new ways of interaction typical of experiential marketing. The sector that is drawing the most from

Fig. 3. Socially active packaging, the case of anti-personnel mines. Shoe packaging divided into two distinct boxes. <http://www.packagingdesignarchive.org/archive/pack_details/11421> (accessed 9 August 2022).

Fig. 4. Socially active packaging, the case of antipersonnel mines. Actions performed by the consumer to access the product and concept of the project From Bucchetti [Bucchetti 2007, pp. 58, 59].

Fig. 5. Che pizza… gli incidenti domestici. Cardboard pizza packaging project. From Ciravegna [Ciravegna 2012, p. 16].

these technologies is the food sector. The labels, mediating between bureaucratic and promotional aspects, due to their small size, are not always able to tell the potential and the history of the product.
The companies of the MMR (Mass Market Retailers) are therefore equipping the packaging with augmented reality, a technology that, through a mobile device, can add digital information to an artefact of communication that helps to expand knowledge.
On this theme, as part of the research activities carried out at the Academy of Fine Arts in Naples, a work entitled LabelAR [3] was developed which allowed experimenting with new possibilities linked to the shopping experience by extending the communication skills of labels, towards new virtual and interactive reading spaces, thanks to the use of auxiliary technologies such as augmented reality. The LabelAR project borrows as a case study the NCO Consortium of Social Cooperatives, which operates on assets confiscated from the Camorra and works to redevelop these territories, proposing activities such as educational farms and food and wine tourism. The studio investigates the theme of the social responsibility of the designer who, through the project, makes choices of meaning, attributing different values to the hierarchy of information and the system of graphic signs. Since the packaging must not only tell about the product but also about the social value of the

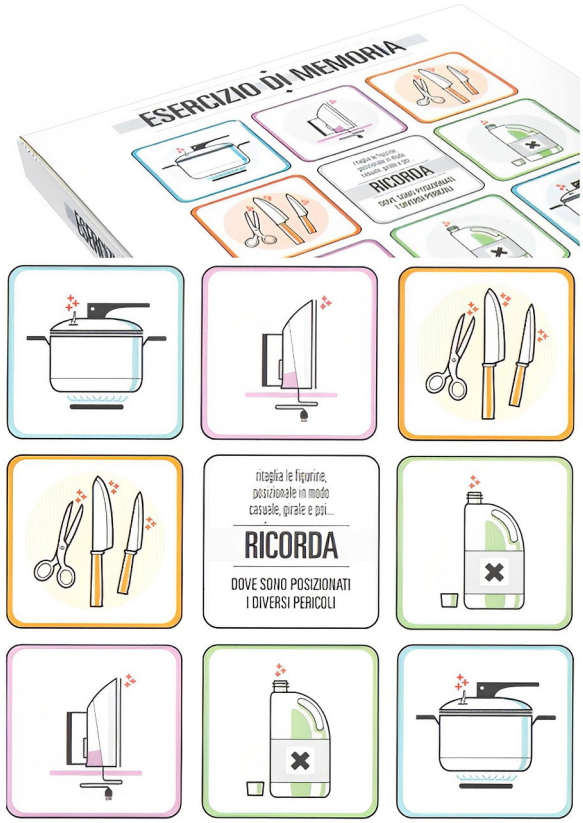

Fig. 6. Memory exercises. Project for the pizza carton that uses the memory game. From Ciravegna [Ciravegna 2012, p. 24].

company, the label on the back of the package contains a system of pictograms which, thanks to an augmented reality app, informs the consumer about how to consumption, cultivation and transformation techniques of products, origin, environmental sustainability and procedures for the disposal of the product, as well as the work of the Consortium. This 'augmented' information appears in the form of tabs on the screen of the mobile device when the latter frames the respective pictogram. To create greater empathy with the consumer, the basic indications are added to those regarding the method of

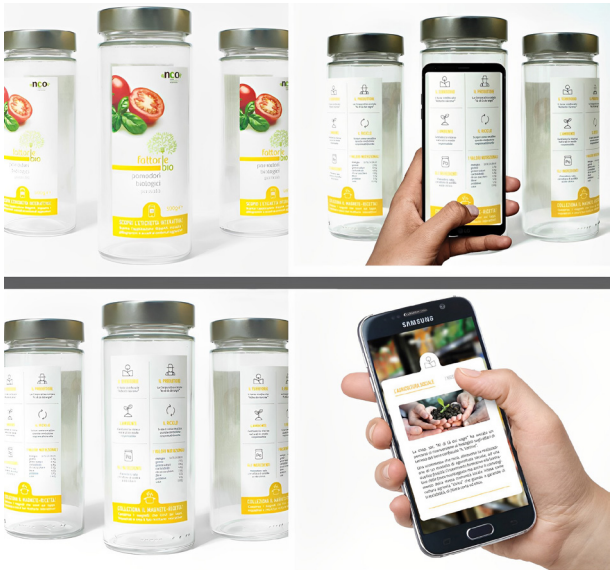

Fig. 7. LabelAR – Labels of glass jars and mobile application screen. Study relating to the Consortium of Social Cooperatives NCO. Author: M. Troiano [Troiano 2018].

Fig. 8. LabelAR – Information sheets obtained by framing the pictograms placed on the magnets. Author: M. Troiano [Troiano 2018].

preparation of the product, thanks to a recipe which can be accessed by scanning a magnet placed on the cap of the package. These magnets, acting as gadgets, become part of an ideal cookbook. The research has shown that these technologies orient communication in such a way that the customer can, according to his preferences and inclinations, search for the information that interests him most, choosing the level of detail that is most congenial to him (figs. 7, 8).Further experience in food product packaging was developed as part of the CD.PRO-CON project by the San Raffaele Roma Open University [4]. In particular, the research group has designed packaging for some products (legumes and dairy products) that the Agricultural Company Accadia Verde S.r.l. intends to place on the market. The packaging, aimed at providing the consumer with easily visible, clearly legible and possibly indelible product information, is characterized by experimentation that has combined design with new technologies. Neatec S.p.A., who participated in the research, has integrated, in the package project, an RFId tag system, a simple and cheap object but unique and difficult to duplicate, able to follow all the phases of the product's life and provide ample traceability/traceability of products and raw materials. In particular, through the use of NFC (Near-Field Communication) labels [5] applied to the product packaging, it was possible to provide the buyer in possession of a common smartphone with multiple pieces of information, ranging from the authenticity of the product to the nutritional and of the production chain, up to advice on consumption methods or recipes based on the product. A specific app puts the producer and the consumer in direct contact, who can receive automatic replies through a chatbot or by booking a telephone call with a producer operator (fig. 9).
The design of labels, using infographics and systems of iconic and conventionally shared signs such as pictograms, can provide 'custom-fit' data and information. These labelling implemented by the technology of the Internet of Things, open a new scenario that sees the packaging as part of a more complex system in which packaging becomes smart, to offer the consumer, as well as a product, a real assistance service. It is a technology that is being experimented especially in the medical field since through the connection between products it is possible to trace adherence to therapy and drug treatment.

Here are two emblematic examples that convey the proposed service, through a clear and readable user interface.
Phuture Med [6] is a case produced by the Palladio Group company created thanks to the printing of conductive inks that interact with the smartphone of the patient, the attending physician and a family member to check the correct intake of the medicine and monitor therapy (fig. 10). Water.IO [7] distributed by the Impacx company is a system that allows you to monitor water intake thanks to a bottle equipped with an 'intelligent' capsule that detects the opening and closing of the cap and the amount of water drunk. The device, thanks to a dedicated app, then sends the information to the personal device, to a platform and, if necessary, forwards the user with alerts or advice for taking the liquid.
We can note that, in this type of product, the design of the labels integrates with the design of the graphic interfaces used in the management of the service. A graphic interface, designed to ensure that the information is structured in a clear, legible and consistent way with the data shown on the label, must be associated with the design of a user experience based on the real needs and actual needs of the user, placing the user of the product at the centre of the design process.
Carlo Ratti, director of the Senseable City Lab [8], a research centre of the Massachusetts Institute of Technology, on the use of technology in reading products, raises new food for thought that goes beyond the use of devices. Ratti affirms that "technology is only a means and must serve to create relationships and exchange information that make us aware of our choices. Our task (as a designer) is to ensure that in the era of large-scale distribution, people know what they are buying. As in the old local markets" [Aliperti 2014]. These considerations shift the focus from technologies to sharing information relating to the purchased product. Carlo Ratti suggests a return to the purchasing methods of the past and hopes that in the future commercial spaces will be equipped with more immediate interfaces, without the need for personal devices to read the information on the product "the supermarket must instead offer a more intuitive, immediate experience: I put my hand close to the counter and the product tells its story. In this sense, I mean that we must first of all look to the past when it was still easy to get information on what was bought directly from producers, in local markets" [Aliperti 2014].

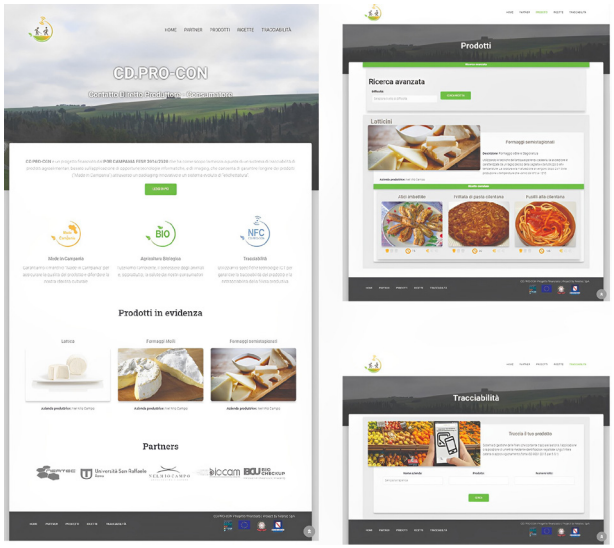

Fig. 9. CD.PRO-CON. Screenshot of the project portal with data linked to the mobile app. By Neatec S.p.A. <https://cdprocon.neatec.it/> (accessed 9 August 2022).

Drawing beyond form. Packaging as a research area between information visualization and usability

The impact of ICT on the creation of packaging has highlighted a significant design field in which the combination of form/function appears to be superseded by that of usability/interaction.
However, in the creation of such a device, usability and functionality must consider the image, as a medium for the marketing of the product and the vehicle of the brand, combining logic and aesthetics.
The role of representation in structuring graphic interfaces for the digital production of information intended for users remains crucial. As a surface for communication, the package takes on the character of material and cognitive space at once, in which form and ergonomics are re-evaluated in terms of visual fruition.
The growing diffusion of a large number of media for the visual communication of information has considerably revolutionized the field of representation by opening new research frontiers specifically related to

Fig. 10. PhutureMed, Packaging and app. Examples of application screens and the interaction of the blister with the app. By Palladio Group, 2015. <https://vimeo.com/1477309404> (accessed 9 August 2022).

visualization. As Vito Cardone observed "today's society, considered by all to be an information society, is above all a society of images. it is precisely the images that convey information, as evidenced by the fact that more than three-quarters of the information we receive reaches us visually. Of course, these are visual images in a broad sense now, no longer just graphic images. This involves a general effort of radical updating if we do not want to be swept away by scientific and technological evolution" [Cardone 2016, p. 19].

On the one hand, visualization can be read as a scientific research tool [Gillian 2012; Geroimenko et al. 2006], on the other hand, it seems to increasingly assume the role of a communication tool aimed at a wide audience of users, including non-specialized ones. The growing implementation of visual media has led to the recognition of new ways of representing, attributing scientific value to studies on visualization [Bertschi et al. 2015]. If visualization cannot be considered a new aspect in the graphic design of packaging, it can certainly be re-evaluated in light of new technologies [Johansson 2021]. The possibility of allowing the visual transmission of information, which transcends the label of the package and the product itself, through the conjugation of graphic elements and digital interfaces linked to mobile devices (such as smartphones), allows to balance attention between visual communication of the brand [9] and a series of additional information (fig. 11). The latter is dictated not only by legislative obligations, designed to guarantee the safety of the final consumer but also by the need to allow the consumer to make informed choices during the purchase phase. This implies that new technologies must be creatively integrated into the design process to affect decision-making [Shukla et al. 2022; Wang 2013].
The contribution of new technologies in this sector is certainly primary. It is possible to consider visualization as inclusive of analytical/visual thinking and communication as a sub-component of visualization itself. For this reason, the use of a correct representation of information and a precise structuring of the information visualization interfaces maintains a fundamental role.
But what are the major changes compared to traditional representation processes?
In the construction process of conventional visual communication, the message is a defined element and only the optimal presentation of the information on the surface of the envelope is required. In the new models, based on digital visualization, the message may not be completely predefined leaving the user the possibility to request and analyse information with the help of a system (generally an app) that allows him to retrieve and support his own specifications requests.
This use of the package is fundamentally based on the interaction within IT systems that allow the display of

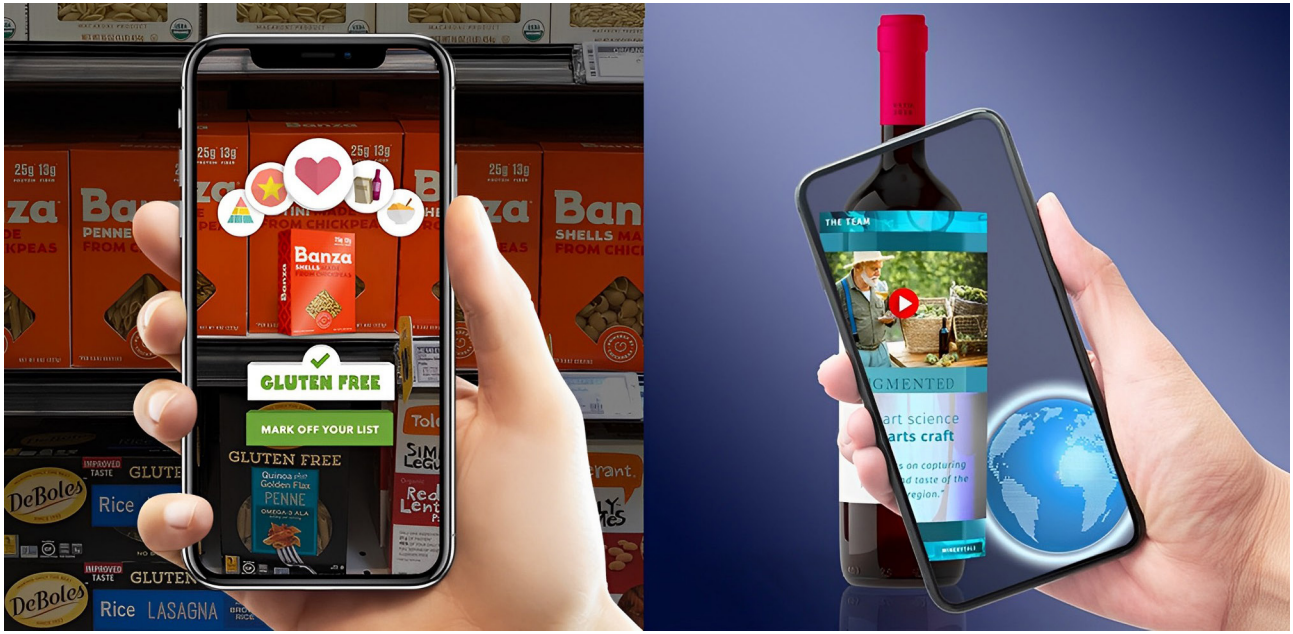

Fig. 11. Examples of visualization of product information in augmented reality. From Heller [Heller 2020].

information tailored to each type of user, with considerable advantages in terms of reading and communication times, convenience and versatility (fig. 12).
The general problem of the design of a package consists then, today, not only in the stereometric definition of a shape, in the use of graphics or geometric artefacts, images and textual information, but also in the development of graphic systems that can allow interactivity. Multimedia communication through a simple and easily accessible language must be able to allow consumers and producers to share information actively and to guide their choices attractively [10].
From a graphic point of view, this concept naturally requires new strategies. Compared to traditional systems of representation on paper, visualization through new media must take on a different role by embracing the issues related to web design, augmented reality and other multimedia techniques. Both those who define the representation and those who read it must share a new language. This, consisting of assemblies of images, videos, static and dynamic symbols, terminologies, icons etc., must be tested on all potential users.

Conclusions

Packaging design has currently reached important developments thanks to new information technologies. Together with the traditional forms of packaging, visualization is closely linked to the new digital media, embracing the problems related to the definition of new web-based representation systems and graphic interfaces. This type of digital representation involves not only designers and drafters but a variety of experts including computer scientists, designers and web designers. In fact, in addition to displaying a large amount of data, it is also necessary to carefully design the graphical user interfaces that allow

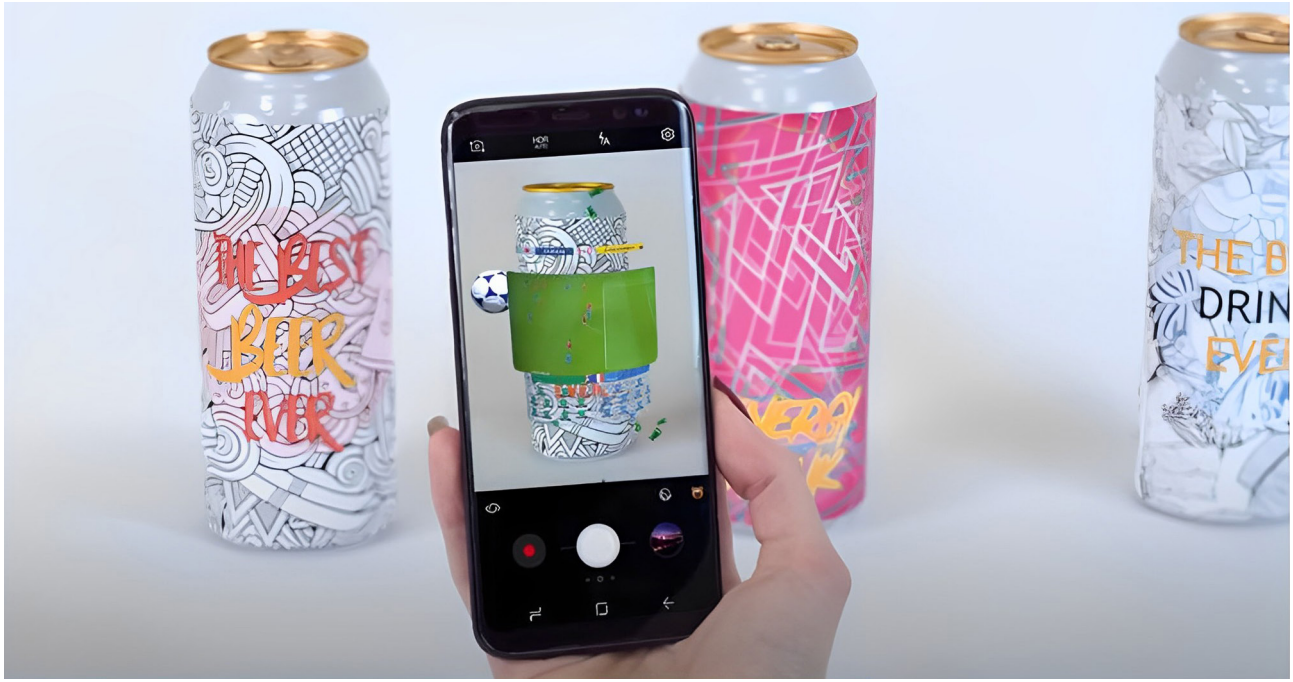

Fig. 12. Augmented Reality For Packaging. Use of AR technology in the food and beverage industry. By Skiwell Software, 2019. <https://www.youtube.com/watch?v=g4tnPETjgaw> (accessed 9 August 2022).

full interactivity and the ability to satisfy queries in real-time, on-demand or custom-made. This article, which provides a review of the current state of science on the conception of packaging as a graphical interface, identifies several open questions and fields of application of design not yet fully explored and at the same time research areas in which multidisciplinary approaches constitute elective choices.

Notes

[1] The expression takes up the creative brief of the competition that the administrators of the Coca-Cola Bottling Association launched on April 26, 1915, to some glass companies in the United States to develop a distinctive bottle for Coca-Cola. Taken from *The History of the Coca-Cola Contour Bottle The Creation of a Cultural Icon* available at the web page <https://www.coca-colacompany.com/company/history/the-history-of-the-coca-cola -contour-bottle> (accessed 9 August 2022).

[2] The introduction of AR augmented reality as a marketing tool, even regardless of packaging, has found recent and interesting applications by multinationals such as Amazon and Google, Ikea and Lego, just to name a few. The applications deployed (such as ARkit, Arcore etc.) are aimed at enhancing customer loyalty through strategies such as those 'unlock the brand' or 'try before you buy'.

[3] The cited work was developed in the context of a degree thesis on extended packaging. See M. Troiano [Troiano 2018].

[4] The CD.PRO-CON project Innovative *ICT systems and imaging for supply chain traceability, design packaging and health implications in a new agri-food company for direct contact between producer and consumer* financed by the Campania Region involved, in addition to San Raffaele

Roma Open University, also Biocam Scarl, the agricultural company Accadia Verde S.r.l., Bio Check Up S.r.l., Neatec S.p.A. Principal investigators of the project: F. Guadagni, L. Annunziato, M. Salvatore, A. Rullo. Responsible for the scientific activities related to the 'Design of new Production Processes: Packaging Design and Study of graphic communication' (OR1) S. Chiarenza.

[5] This is a specific type of RFId that is very reliable for small distances.

[6] The Palladio Group company has developed various research, conducted in collaboration with national research institutes and international companies, to support and monitor the patient during the therapeutic process. *The Phuture Med packaging* (2015) can be consulted at <https://player.vimeo.com/video/147730940?autoplay=1&loop=1&> (accessed 9 August 2022).

[7] The packging project is illustrated at the web address <https://impacx.io/water-io/> (accessed 9 August 2022).

[8] The *Senseable City Lab*, created with the aim of studying and anticipating social changes, is accessible at the address: <https://senseable.mit.edu/> (accessed 9 August 2022).

[9] This generally occurs due to precise marketing choices aimed at making the product more attractive on the market.

[10] It should also be considered that the advent of e-commerce is orienting producers towards virtual packaging strategies. The conception of packaging designed to generate sales of products for virtual stores will soon be considered, therefore, as a further challenge for the designer and those involved in representation.

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