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Communicating sustainability through packaging graphic design: associated sociodemographic factors

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***Abstract:** Although being increasingly valued and demanded by consumers, sustainability qualities regarding both product and packaging are not always transmitted effectively. In many packages we find contradictory messages because the texts, graphics and materials do not communicate the same about sustainability. To improve the communication of sustainability through the graphic elements of the packaging, this research seeks to determine which visual variables (color, fonts and images) better convey the concept of sustainability to consumers and if social-demographic factors (age and level of education) influence consumers' perception. The research is two-phased: first, semi-structured interviews with expert packaging graphic designers; and second, a survey of 544 consumers. The results state that color is the element that communicates better sustainability in packaging and that the graphic design that transmits a sustainable look is the one that bets on strategies that entail saving on resources: fewer inks and images, or backgrounds without dyeing. In turn, age and educational level influence the communication capacity that graphic design has to transmit a product's sustainability. The research conclusions constitute a guide to improving the communication of the concept of sustainability, achieving that the visual elements will connect with the structural and verbal elements of the packaging.*

***Keywords:** Design, Graphics, Packaging, Communication, Sustainability, Consumer*

Introduction

Concerns about environmental protection are not something new (Fiksel and Spitzley 1998; Thorpe 2010; Hellström and Olsson 2017), they were incorporated into the research field as well as into the practice of commercial and design as early as the 1960's and 1970's (Thorpe 2010). Later they continued developing and gaining pace in such a way that sustainable production and consumption became essential components of sustainable development and were included in the 21 Agenda, a pivotal document created as a result of the First Earth Summit (United Nations Conference on Environment and Development -UNCED- Rio de Janeiro, 1992). Thenceforth, sustainable consumption has become a common theme in both national and international politics (Thorpe 2010; Ma and Moultrie 2017; Futtrup et al. 2021), playing an essential role in commercial and social scenarios at the beginning of the XXI century (Boz, Korhonen and Sand 2020).

These political and professional efforts are the result of the growing consumer commitment to sustainability. This commitment affects consumer behavior not only in the process of purchasing goods, but also in the products they select (Pérez-Belis, Agost and Vergara 2018). In fact, the sustainable performance of the products and packages are increasingly a deciding factor in the choice of brand (Ma and Moultrie 2017).

However, evaluating the sustainability of a product is not easy even for corporations and designers (Fiksel and Spitzley 1998). Indeed, there is not a unique definition of sustainable packaging within the corporative sector and every company defines it in its own way (Boz, Korhonen and Sand 2020). From the point of view of consumers, this type of analysis is

practically impossible to carry out (Steenis et al. 2022), also considering that they do not normally have much time for this kind of evaluation at the point of sale, where they are exposed to more than 1000 different products per minute (Spence 2016). Therefore, buyers look for other elements that are more evident and easier for them to perceive as sustainable when making their assessment (Hellstrom and Olsson 2017; Steenis et al. 2017).

Packaging is one of these elements that consumers pay attention to determine whether a product is sustainable or not (Scott and Vigar-Ellis 2014) and becomes key to the process of transmitting the concept of sustainability (Hellstrom and Olsson 2017; Nemat et al. 2019); not only of the package but also of the product (Steenis et al. 2017). Nevertheless, the transmission of the concept by current packages/products is not always effective at all (Boz, Korhonen and Sand 2020; Granato, Fischer and van Trijp 2022). Very often there is no connection between the elements that make up the packaging, such as, for example, the visual features and the message the slogan wants to transmit (Magnier and Schoormans 2015; Seo and Scammon 2017), or the advertising claims made and the actual environmental performance of the product (Steenis et al. 2022). This lack of connection within the packaging elements can lead consumers to confusion and generate distrust toward certain goods (Boz, Korhonen and Sand 2020; Ketelsen, Janssen and Hamm 2020). Also, in these cases there is a higher risk of misinterpretation of the components that refer to sustainability in such a way that buyers could even perceive it as a greenwashing strategy (Magnier and Schoormans 2015).

Therefore, the ideal communication process for sustainability would be a packaging where all its components (structural, visual and verbal) are connected and transmit the same message about sustainability. In this way, packaging will provide more information to consumers (Magnier and Schoormans 2015; Seo and Scammon 2017), and consumers will grasp the concept of sustainability regardless of where they fix their gaze: the material, the graphics or the texts.

An analysis of previous research indicates that structural and verbal elements of the packaging (materials, ecological labels and slogans) as attributes of sustainability have been widely studied. Conversely, there is little research into graphic elements of the package and just a small number of studies include a deep analysis of how the aim of transmitting the concept of sustainability might be achieved apart from highlighting green or brown as ecological-related colors. In this sense, the novelty of this research lies in filling this gap by examining in greater depth the role of graphic elements in the transmission of the sustainability concept and thus determining which components and variables communicate this concept better.

The text is structured into three parts. The first section includes a review of the bibliography regarding the transmission of the idea of sustainability in present packages and which graphical variables are associated with it. The second part explains the two-phased methodology: a) semi-structured interviews of ten graphic designers that help us to define which graphical elements professionals of this sector associate with sustainable packages; b) a survey in which 544 consumers are asked to connect the idea of sustainability to different models of packages created on the basis of those answers given by the graphic designers interviewed during the first phase. The third part presents comments on the obtained results and the conclusions, mainly focused on explaining which graphic components of the packaging contribute better to communicate sustainability.

Literature review

Packaging and Sustainability Communication

The packaging as a sustainability transmitter is important for two main reasons. On the one hand is its immediate connection with the consumer's environmental conscience because of the direct and evident effect on the environment of both the production and disposal of packages (Steenis et al., 2017; Boz, Korhonen and Sand 2020). On the other, consumers are used to observing the design of the package, looking for visual clues that inform them about the attributes of the product (Magnier and Crié 2014; Magnier, Schoormans and Mugge 2016; Hellstrom and Olsson 2017). Thus, the package is a main pillar in the evaluation process of the product for their purchasing decision (Spack et al. 2012), especially in the case of fast-moving consumer goods (Magnier and Schoormans 2015), when there is a lack of information about the product (Magnier and Schoormans 2017), or when packaging implicitly provides the required information (Granato, Fischer and van Trijp 2022).

When communicating the concept of sustainability, three categories of attributes are involved: informative, graphical and structural (Bangsa and Schlegelmilch 2020; Boz, Korhonen and Sand 2020, 15) (Figure 1). In fact, consumers perceive that a packaging is sustainable if it transmits this concept implicitly or explicitly through its structure, its graphics or its informative texts (Magnier and Crié 2014).

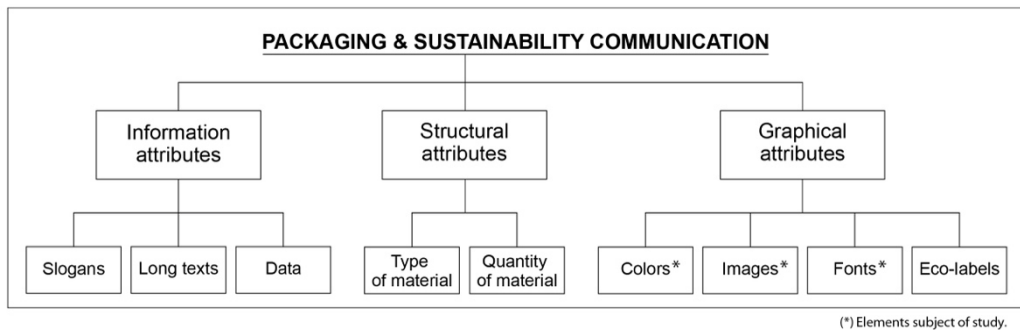


Figure 1: Packaging and Sustainability Communication Attributes.
 Source: Ampuero-Canellas, Gonzalez del-Río, and Tarazona-Belenguer 2023

As mentioned before, both the attention and time that consumers dedicate to evaluating packaging are limited, therefore they cannot perceive all the elements that come together to make up a container, but merely those that most stand out (Steenis et al. 2017). It seems that buyers pay more attention to the materials and the eco-labels at the beginning of the process but then they start considering other elements such as colors or images (Ketelsen, Janssen and Hamm 2020). In those cases where there are no verbal messages connected to sustainability, the materials and the graphic elements are the transmitters of the concept (Magnier and Schoormans 2015).

Verbal elements such as short slogans or more extensive text have the advantage that they transmit their messages more explicitly and directly (Magnier and Schoormans 2017; Granato, Fischer and van Trijp 2022). Also, they help to reinforce and make more noticeable those structural and graphical elements that transmit sustainability, especially in the case of new features that can be unknown to consumers (Magnier and Schoormans 2015, 54; Granato, Fischer and van Trijp 2022). Nevertheless, there are many consumers that do not spend much time reading the text printed on the packages, especially if they are too long, so verbal elements are not an efficient communicative tool in this case (Nemat et al. 2019).

Of all the structural elements, the material the package is made of is what better transmits the idea of sustainability (Magnier and Schoormans 2015; Scott and Vigar-Ellis 2014; Ketelsen, Janssen and Hamm 2020). An example is the fact those containers made of paper or cardboard

(Herbes, Beuthner and Ramme 2020); those manufactured with natural fibres (Magnier and Schoormans 2017); or those elaborated by using recycled cardboard (Thorpe 2010; Magnier, Schoormans and Mugge 2016) are considered more sustainable than plastic packaging. Some consumers also evaluate the quantity of material used to manufacture the package (Herbes, Beuthner and Ramme 2020), viewing those that use less material as more sustainable (Bangsa and Schlegelmilch 2020).

Unfortunately, the information about sustainability that consumers perceive through the material of the packages is sometimes wrong. In some cases, this could be due to a lack of more precise knowledge about the sustainability of the different materials because some advertising campaigns from the packaging industry (paper, plastic, glass or metal) have created inaccurate conceptions regarding their actual environmental impact (Boz, Korhonen and Sand 2020, 5). In some other cases, such as when consumers are confronted with an innovative material, it can be more complicated to know how sustainable it is just by seeing it and not having any explanatory text (Magnier and Schoormans 2015; Granato, Fischer and van Trijp 2022).

Regarding graphical elements, authors mention colors and imagery (Magnier and Schoormans 2017; Festila and Chrysochou 2018) as well as certification labels or eco-labels (Pérez-Belis, Agost and Vergara 2018; Agost Torres and Chulvi Ramos 2019; Annunziata, Mariani and Vecchio 2019) such as the green dot (Grüne Punkt), the FSC logo, or the Fairtrade logo. These labels inform of environmental awareness, respect for consumer health, social contribution, animal welfare, and local origin or production (Pérez-Belis, Agost and Vergara 2018), and usually, they are on the front of the packaging (Futtrup et al. 2021). However, it seems that young consumers only occasionally consult these labels when making a purchase (Annunziata, Mariani and Vecchio 2019). Also the rise in their usage generates packages with a large amount logos, which can be confusing for consumers and therefore fails in the communication process (Futtrup et al. 2021): buyers just do not see them or do not pay attention to them since there are too many of them.

Graphic Elements of Packaging and Sustainability Communication

Unlike the structural and verbal elements, graphic components have an underlying meaning that turns them into perfect transmitters to consumers in an indirect or implicit way (Festila and Chrysochou 2018) and have the advantage of being perceived quickly and unintentionally (Nemat et al. 2019). Perhaps because of this both graphics and colors are the most used components for communicating the idea of sustainability (Boz, Korhonen and Sand 2020) and even though their impact as regards the environment is minimum or non-existent, their effect in the evaluation of the package made by consumers is significant (Steenis et al. 2017), being more significant in those consumers who are not experts in environmental issues or having little sustainable orientation (Taufique et al. 2019).

Green and brown are the two colors that are mainly associated with this concept since both can be easily found in nature (Seo and Scammon 2017; Boz, Korhonen and Sand 2020; Herbes, Beuthner and Ramme 2020), as well as white (Magnier and Criè 2014; Sundar and Kellaris 2015). Among these three, green seems to be the most used for transmitting sustainability and this excess in its use can sometimes produce hesitation in consumers regarding the eco-friendly message the package is attempting to communicate (Granato, Fischer and van Trijp 2022).

Additionally, those containers in dull colors are considered more sustainable (Magnier and Criè 2014; Magnier, Schoormans and Mugge 2016), like those that preserve the undyed cardboard color (Steenis et al. 2017; Herbes, Beuthner and Ramme 2020); or those that use little ink for their labels (Scott and Vigar-Ellis 2014) or are just monochromatic (only one ink or color) (Magnier and Criè 2014).

As regards images, Taufique et al. (2019) discovered that consumers consider more eco-friendly packaging that incorporates nature-related pictures such as a tree or the sun. Moreover, consumers think that the icons most representative of sustainable and circular economy strategies are those that show the product or other existing and tangible objects, rejecting conceptual or abstract proposals (Agost Torres and Chulvi Ramos 2019).

Regarding the connection between fonts and communication of sustainable values, no research has been found that links the two elements. However, different research shows that, from the point of view of the shape of the letters and not the meaning of the text, fonts also condition the sensorial appraisal people make of the product (Celhay et al. 2015; Karnal et al. 2016; De Sousa et al. 2020); in the same way that there is a connection between the shape of the product and the flavor people presume it should have (Velasco et al. 2018). In this regard, De Sousa et al. (2020) and Velasco et al. (2018) found connections between the shape of the fonts used in the packaging of a coffee brand and the flavor attributed to the product in such a way that the idea of “sweet” flavors was better transmitted through rounded fonts while “acid” flavors through edgy fonts. Therefore, in the same way, there could be a relationship between typography and sustainability.

Having reviewed the literature, we move on to the objectives and questions raised by this research.

Firstly, regarding the two main graphic elements of packaging design (color, fonts and images), this research aims to determine whether the importance of these elements for the consumer’s perception of the idea of sustainability is the same for all three or if one of them is more relevant than the others.

- RQ1. Which graphic elements of a package (color, fonts, image) communicate the concept of sustainability better?

Secondly, authors like Magnier and Schoormans (2015) state that the communication of the idea of sustainability is better if the package has a “sustainable-look”. With this idea as a starting point, the second objective of this research is to establish which graphic variables related to the three graphic elements analyzed (color, fonts, image) adjust to a “sustainable-look” (as compared to conventional-looking packaging). Although many references related to color (the use of green for example) as a transmitter of sustainability have been found, there are few contributions concerning how this concept can be communicated through images or fonts.

- RQ2. Which graphic variables related to the color, fonts and images are connected to a “sustainable-look” packaging?

Thirdly, several research studies show that not everyone reacts the same way when confronted with the idea of sustainability (Bou-Mitri et al. 2020, 11). In this way, consumers with a lower educational level or higher age appear less interested in and aware of this topic (Sánchez-Bravo, Chambers and Noguera-Artiaga 2020). Therefore, we suggest that it is important to ascertain in this research if demographic variables of consumers influence the way they perceive the connection between the graphic elements of the package and the concept of sustainability.

- RQ3. Does age influence the perception of the idea of sustainability transmitted through the graphic elements of packaging?

- RQ4. Does educational level influence the perception of the idea of sustainability transmitted through the graphic elements of packaging?

Methodology

From the basis of the objectives set, we designed a two-phased research study: i) first, qualitative, to determine which graphical variables are key for a graphic designer to create

packaging that transmits sustainability; and ii) a second, quantitative, phase to determine whether there exists a connection or not between sustainability and graphic features in the packaging from consumer’s point of view.

Thus, the first phase includes semi-structured interviews, also used in the studies by Magnier and Schoormans (2015) and Herbes, Beuthner and Ramme (2020), in Convenience sampling is the most widely used sampling technique in research in this field according to Ketelsen, Janssen and Hamm (2020). Using this technique, ten expert packaging graphic designers from Spain were selected. Also, in selecting the interviewees, a specific diversity regarding age, gender, and seniority within the graphic design sector was considered and obtained, as shown in Table 1.

Table 1: Graphic Designers Profile

Age	25-35 years (40%); 36-45 years (20%); 46-55 years (40%)
Gender	Women (60%); Men (40%)
Design experience	5-10 years (40%); 11-20 years (30%); 21 years or more (30%)

Therefore, all interviews start with the reading of the definition of a sustainable product in order to ensure that the concept of sustainability is grasped by all participants in the same way, in its wider meaning and not only as a synonym for protecting the environment (Herbes, Beuthner and Ramme 2020, 267). Then, all graphic designers are asked to describe how they would design packaging for a sustainable product and to specify which colors, fonts and images he/she would use.

The answers obtained were first clustered into three main graphic variables (color, fonts and images). Next, the different topics covered by all respondents were identified, and points of intersection of their opinions were checked for. An abstract of the obtained views during this first phase is displayed in the first column of Figure 2.

DESIGNER’S ANSWERS + VARIABLES	
> COLOR	
One color.....	1
Nature-associated colors.....	2
Greens, blues and browns.....	2
Low saturation.....	3
Low brightness.....	3
Original material.....	5
> FONTS	
One font.....	6
No more than two font families.....	6
Bold for titles and regular for information texts.....	7
Light fonts less ink.....	7
Condensed fonts.....	7
Sans serif.....	8
Lowercase for information texts.....	8
Capital letters for titles.....	8
> IMAGE	
Vectorial illustration.....	9
Photography.....	9
One ink with various shades.....	10
Few colors.....	10
Low saturation.....	10
Soft and uniform tonality.....	10
Few or without images.....	11
Leaves, water, ground.....	12
Depending on the moto, an image that transmits it ..	12
Organic shapes.....	13
Geometrical and synthetic-organic shapes.....	13
Curves and straight lines.....	13
Manual strokes.....	13
Wouldn't add so many elements.....	14
Wouldn't fill that much.....	14

Figure 2: Relationship Between Graphic Designers' Responses and Consumer Survey Questions.
Source: Ampuero-Canellas, Gonzalez del-Rio, and Tarazona-Belenguier 2023

Taking designers’ answers as a reference (Fig.2), we designed a questionnaire that includes 32 packaging-designs. The use of fictitious packaging is common behavior in studies of this

type (Spack et al. 2012; Karnal et al. 2016; Steenis et al. 2017; Celhay et al. 2018). Orange juice was chosen as the product because it is easily identified by and connected to all the social strata the survey is intended for.

The different types of packaging are bundled into 14 questions (Fig.3). In each question one of the designed packaging types is in accordance with the opinion given by the experts regarding how a sustainable-product-packaging should be designed and the other one is not. For example: one package with a colored background and the other undyed (Question 5); one package includes images and the other does not (Question 11) or one package inserts many elements and the other few (Question 14). The correspondence between the answers of the designers and the questions in the survey can be observed in Figure 2.















Which of these products is more sustainable?			
V1 Number of colors 	V2 Tone 	V3 Brightness/Contrast 	V4 Positive / Negative 
V5 Background color 	V6 Number of fonts 	V7 Font thickness 	V8 Font shape 
V9 Image style 	V10 Image color 	V11 Image use 	V12 Image motif 
V13 Stroke type 	V14 Number of images 	Age Gender Educational level	

Figure 3: Relationship Between Graphic Designers' Responses and Consumer Survey Questions.
 Source: Ampuero-Canellas, Gonzalez del-Río, and Tarazona-Belenguer 2023

An analytical approach was chosen for the design of the packaging prototypes, considering the different elements and graphic variables separately and in an isolated way; instead of a

holistic approach where the general design of the packaging would be considered (Nemat et al., 2019). Therefore, the two or three packages shown in each question only differ in one specific graphic aspect while their other elements stay the same in order to analyse only the perception of one particular graphic aspect.

As with the interview with the graphic designers, this questionnaire starts with the definition of a sustainable product. Next the 14 questions related to the designed packages are presented and consumers are asked to identify which one they consider is the most sustainable or if both seem to be similar, in cases where participants do not perceive any difference. Finally, three classifying questions are included: gender, age and educational level. To reduce the bias for the position of the prototypes, we created two survey models where the order of the designs was changed, in accordance with Agost Torres and Chulvi Ramos (2019).

Using convenience sampling, the survey was delivered via WhatsApp, in accordance with the “snowball” sampling-technique, also used in the studies by Scott and Vigar-Ellis (2014); Magnier, Schoormans and Mugge (2016); or Annunziata, Mariani and Vecchio (2019). A total of 550 people from Spain answered the questionnaire. After data cleaning, 544 valid surveys were finally considered for this study. The profile of the respondents is shown in Table 2.

Table 2. Consumers Profile

<i>Age</i>	16-25 (24%); 26-35 (22%); 36-45 (27%); more 45 (27%)
<i>Gender</i>	Women (60%); Men (40%)
<i>Education level</i>	No studies/Elemental (10%); Middle (23%); Higher education (67%)

Data is processed through the statistics software Statgraphics. First a descriptive analysis analyzes how often each graphic feature is or is not associated with sustainability. Second, a Chi squared study establishes if there is any connection between any of the sociodemographic variables (age, educational level) and the perception of the graphic elements of the packaging associated with sustainability.

Results and discussion

An initial approach to the survey results (Figure 4) shows that graphic elements do transmit the concept of sustainability to some of the respondents but not in the same way. Thus, if we observe the numbers for the answer “can’t find a difference” obtained in each case, we can perceive the ability of that particular variable to transmit sustainability. Those variables where the answer “can’t find a difference” acquires a smaller percentage, such as V5-background color (19,00%), V11-image use (22,32%), V1-number of colors (26,38%) or V4-positive/negative (38,93%) seem to be taken into consideration for communicating sustainability while those variables that obtain a higher value, such as V12-image motif (69,93%), V6-numer of fonts (68,08%), or V14-number of elements (55,35%) or V13-stroke type (53,51%), would not be essential for transmitting the concept.

Global results (Value in %)

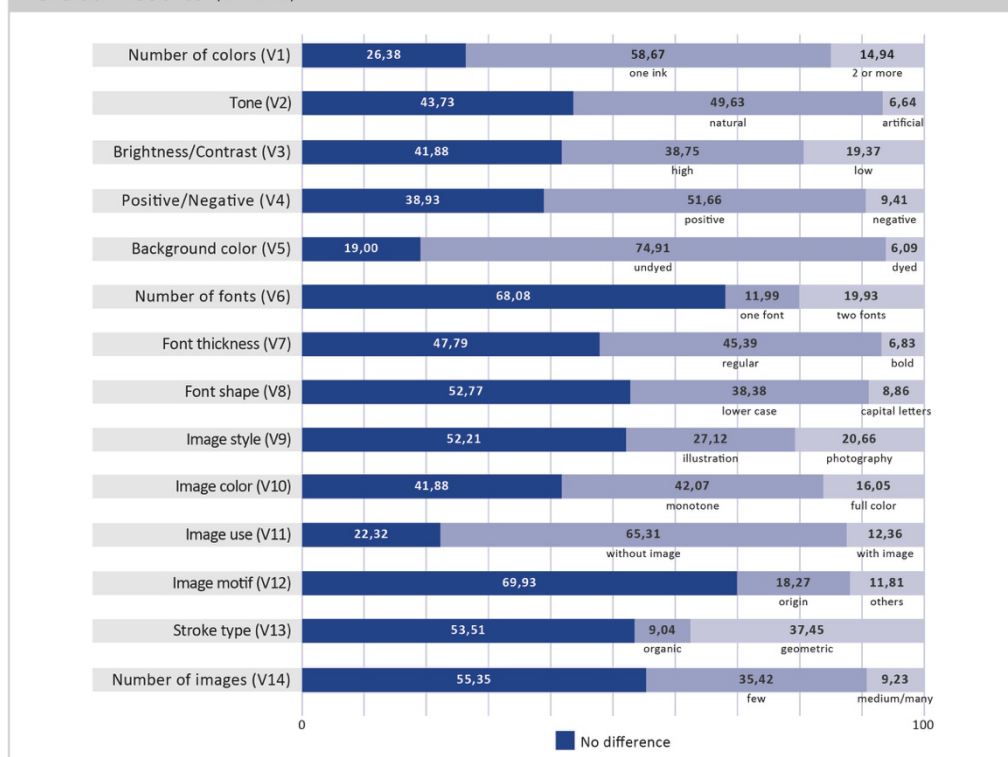


Figure 4: Frequency Analysis Results.

Source: Ampuero-Canellas, Gonzalez del-Rio, and Tarazona-Belenguer 2023

From the three graphic elements analyzed (color, fonts and image) and according to the first question of this research (RQ1), we observe that color is the component that better transmits sustainability because the answer “can’t find a difference” reaches a percentage lower than 45% in all variables related to it (V1, V2, V3, V4 and V5), from 19,00% regarding to V5-background color to 43,73% for V2-tone. Therefore, our results support the assertion of those authors that highlight the role of color as an important communicator of ideas and concepts (Sundar and Kellaris, 2015; Seo and Scammon, 2017; Lim et al., 2020).

Secondly, fonts are the graphic element that either communicates sustainability the least or consumers associate it with the sustainability of the product on a lower scale. It is precisely in those questions related to this variable where we find higher percentages for the answer “can’t find a difference”, all of them over 45%: V6-number of fonts (68,08%), V7-font thickness (47,79%) and V8-font shape (52,77%). The main reason for these lower sustainability-transmission abilities could be that the font is the least known graphic feature so consumers pay more attention to the linguistic factor (the meaning of those words that are being read) than to the formal factor (the shape of the letters). That’s why fonts would not be an efficient component for transmitting the values of sustainability at least through its formal definition. This result does not coincide with what has been found in the literature about the communicative power of typography in the field of design and packaging (Celhay et al. 2015; Karnal et al. 2016; Velasco et al. 2018; De Sousa et al. 2020).

Thirdly, we should mention image as the graphic element that transmits the idea of sustainability the second least. In this regard, from the six analyzed variables related to image, only two of them obtain a percentage of the answer “can’t find a difference” below 40%: V11-image use (22,32%) and V10-image color (41,88%).

After this first approach to the results, we come to analyze which variables of the three investigated graphic components (color, fonts and image) are strongly connected with the concept of sustainability. Therefore, we will try to outline from the consumer’s perspective the graphic variables associated with the sustainable-look of a product or a packaging (RQ2).

With regard to the five color-related variables examined, we can assert that the background color (V5) and the number of colors used (V1) are the 2 aspects most associated with sustainability. To be more specific, 74,91% of those surveyed think that a package with no background color is more sustainable than another that includes color and 58,67% consider that one-color packages are more sustainable than those that include two or more colors. These results agree with those obtained by Magnier and Criè (2014), Scott and Vigar-Ellis (2014), Steenis et al. (2017), Herbes, Beuthner and Ramme (2020).

On a smaller scale, the outcomes of the variables V4-positive/negative, V2-tone and V3-brightness/contrast also stand out. In such a way that, designs using a positive lay-out of color (V4), which means, dark images or texts over a white or light-color background; or the use of natural-toned colors related to the product (V2); or the presence of a high level of brightness and contrast (V3) are considered more sustainable showing percentages of 51,66%, 49,63% and 38,75% respectively.

It is easy to detect the connection between those results for V1-number of colors, V5-background color and V4-positive/negative and the environmental and economical dimensions of sustainability. From the options of packaging designs presented, those that use less ink/colors are consequently more sustainable and produce a lower environmental impact.

Regarding fonts (RQ4), even with its place as the least effective transmitter of sustainability, as we have previously shown, it is worth remarking that there is some consensus in the consideration that packaging that uses regular-thickness font (45,39%) or lower case (38,38%) appears to be more sustainable. The outcome for V7-font thickness could be attuned to those color-related variables mentioned above (V1, V5 and V4) since bold fonts require more ink and therefore is less sustainable from an environmental and economical perspective.

In the case of images, the results which stand out the most are those obtained for V1-image use, where packaging that does not include any image is considered more sustainable (65,31%), and the outcome for V10-image color, that shows how survey-participants better connect sustainability to monochromatic images (42,07%), which matches with the results for V1-number of colors and the study of Magnier and Criè (2014). To a lesser extent, we also observe the link between sustainability and the use of geometrical lines (37,45%) and a small number of images (35,42%).

From a more general perspective of these results, the graphic variables that consumers associate with a “sustainable-look” are showed in Figure 5. Furthermore, V6-number of fonts, V9-image style and V12-image motif have not been associated with the idea of sustainability by the respondents. Either they have not perceived the differences between the proposed options or they were not able to connect them with the concept.












Graphic variables					
Color			Fonts	Image	
					
One ink or one color (V1)	Natural tones or contained-product related tones (V2)		Regular-thickness font (V7)	Monochromatic (V10)	No images (V11)
					
High brightness/contrast (V3)	Positive design (dark text/images over light/white background) (V4)	Colorless background (V5)	Lower case (V8)	Geometrical lines (V13)	Few images (V14)

Figure 5: Graphic Variables Associated with a “Sustainable-look” in Packaging.
Source: Ampuero-Canellas, Gonzalez del-Río, and Tarazona-Belenguier 2023

With reference to the third part of the investigation, the outcomes show that there indeed are some significant differences in the answers according to the demographic features of the participants: age (RQ3) and educational level (RQ4) (Table 3), in line with the study carried out by Bou-Mitri et al. (2020).

Table 3: Chi-Squared Analysis Results

	Age	Educational level
V1. Number of colors	$\chi^2=31,717$ (p<0,01); gl 6	$\chi^2=12,183$ (p<0,05); gl 4
V2. Tone	$\chi^2=30,490$ (p<0,01); gl 6	
V3. Brightness/Contrast	$\chi^2=48,105$ (p<0,01); gl 6	$\chi^2=19,045$ (p<0,01); gl 4
V4. Positive/Negative	$\chi^2=19,898$ (p<0,01); gl 6	$\chi^2=18,917$ (p<0,01); gl 4
V5. Background color	$\chi^2= 32,669$ (p<0,01); gl 6	$\chi^2= 9,706$ (p<0,05); gl 4

<i>V6. Number of fonts</i>	$\chi^2=55,719$ (p<0,01); gl 6	$\chi^2=28,062$ (p<0,01); gl 4
<i>V7. Font thickness</i>	$\chi^2=37,588$ (p<0,01); gl 6	$\chi^2=10,656$ (p<0,05); gl 4
<i>V8. Font shape</i>	$\chi^2=36,780$ (p<0,01); gl 6	
<i>V9. Image style</i>	$\chi^2=69,069$ (p<0,01); gl 6	$\chi^2=19,870$ (p<0,01); gl 4
<i>V10. Image color</i>	$\chi^2=54,574$ (p<0,01); gl 6	$\chi^2=14,324$ (p<0,01); gl 4
<i>V11. Image use</i>	$\chi^2=26,587$ (p<0,01); gl 6	
<i>V12. Image motif</i>	$\chi^2=33,892$ (p<0,01); gl 6	$\chi^2=20,641$ (p<0,01); gl 4
<i>V13. Stroke type</i>	$\chi^2=30,335$ (p<0,01); gl 6	$\chi^2=25,426$ (p<0,01); gl 4
<i>V14. Number of images</i>	$\chi^2=70,064$ (p<0,01); gl 6	$\chi^2=43,034$ (p<0,01); gl 4

Regarding age (RQ3), differences between each category are remarkable (p<0,01) in all the analyzed variables (Table 3). We can thus affirm that age affects the perception of the concept of sustainability transmitted through the graphic elements of the packaging.

Considering the respondent's age (Figure 6), we observe there is a characteristic behavior when answering "can't find a difference". The older the participants are the more the percentage of this answer increases. In some cases, the difference is less obvious (V4 or V12) but in others it can be substantial (V6, V10 or V14) to the point that the percentage of this answer among the oldest participants can even be double that of the lowest age category.

Results according to age range (Value in %)

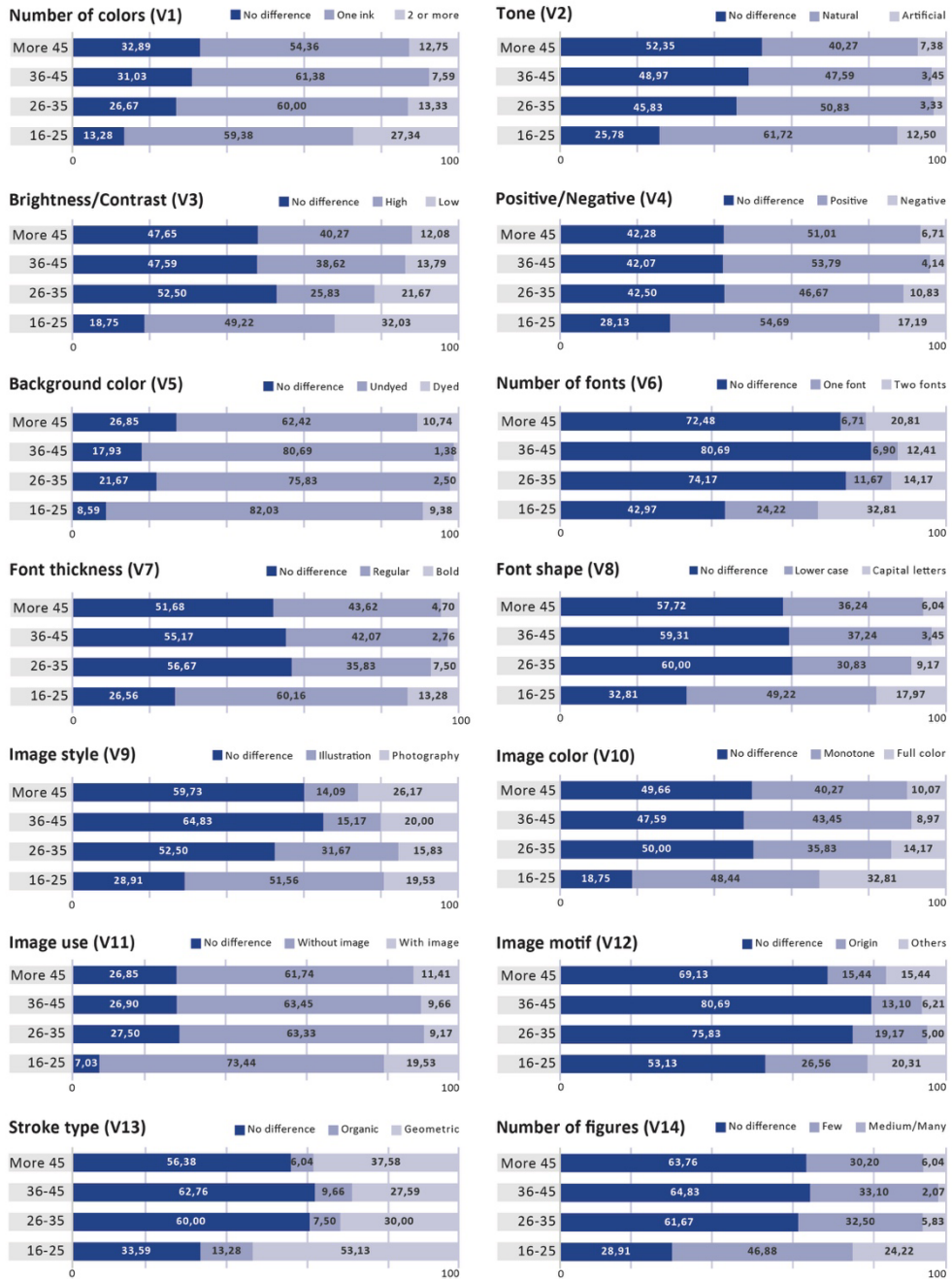


Figure 6: Results According to Age Range.

Source: Ampuero-Canellas, Gonzalez del-Rio, and Tarazona-Belenguer 2023

A reason for this could be that younger generations are more used to visual stimuli and hence they have learned how to extract more information from them than older generations that are more habituated to decode verbal stimuli. At the same time, younger respondents are more conscious about sustainability and show more interest and concern towards a sustainable product (Sánchez-Bravo, Chambers and Noguera-Artiaga 2020), which could make them more able to assess a product's sustainability.

Additionally, the percentage of people that choose those designs that include more ink and therefore are more harmful to the environment (V1-number of colors, V4-positive/negative, V5-background color, V7-font thickness, V10-image color, V11-image use and V14-number of images) is higher for the "16 to 25 years old" group and lower in the rest of categories (except for V5-background color where the higher percentage is in the more than "45 years old" group); however, the election of this choice is scarce if we compare it with percentages obtained for "use less ink" or "can't find a difference" options.

However, it is in the youngest age category (16 to 25 years old) where we find more differences regarding general aspects of a so-called "packaging with a sustainable-look" (Figure 5). The highest percentages were those related to regular or non-bold fonts (60,16%) and lower case (49,22%), and as related to images, packaging is perceived as more sustainable when it includes illustrations (51,56%), geometrical lines (53,13%), and a reduced number of images (46,88%). In the case of the other age-groups we detect differences only in those variables linked to color: an increase of "can't find a difference" answers in V3-brightness/contrast and in V2-tone (this last one for the oldest age group).

Concerning educational level (RQ4), there are differences in 8 variables with a p value lower than 0,01: V3-brightness/contrast, V4-positive/negative, V6-number of fonts, V9-image style, V10-image color, V12-image motif, V13-stroke type and V14-number of images; and in other three variables with a p level lower than 0,05: V1-number of colors, V5-background color and V7-font thickness (Table 3). No other meaningful differences linked to this feature have been found.

As in the case of age criteria, we can also observe remarkable behavior when answering "can't find a difference" on the basis of the educational level (Figure 7). Thus, the higher the educational level is the more the percentage of "can't find a difference" answer increases. In some cases, this surge is low, such as in V1-number of colors or in V5-background color; but in other cases, it is much higher, as in V6-number of fonts, V13-stroke type or V14-number of images, where the number of "can't find a difference" answers doubles or even triples in the group of people with the highest educational level in contrast to the lowest educational level.

Results according to the level of studies (Value in %)

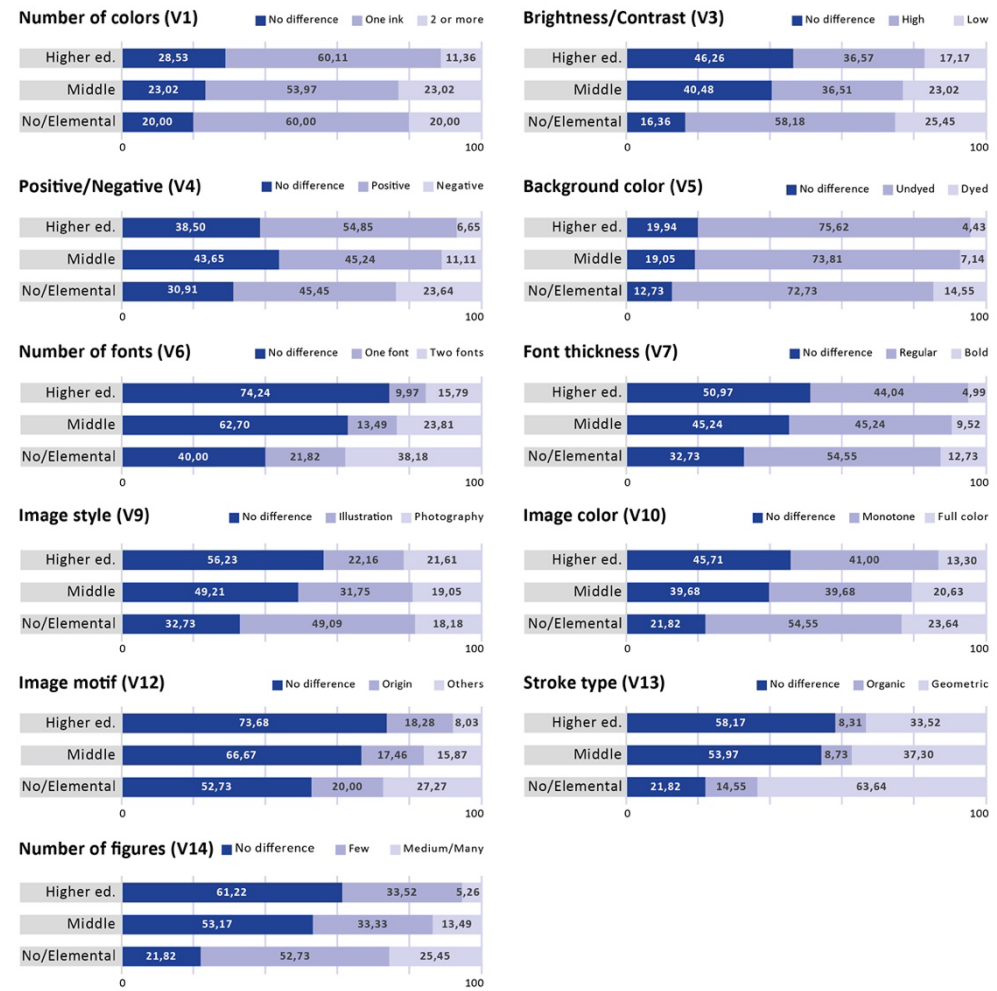


Figure 7: Results According to Level of Studies.

Source: Ampuero-Canellas, Gonzalez del-Río, and Tarazona-Belenguer 2023

In relation to the options that use more ink and therefore are less sustainable both environmentally and economically: two or more colors (V1), negative design (V4), tinted background (V5), bold fonts (V7), full-color image (V10), several or many images (V14); we observe that the highest percentage of people who select them are in the group with the lowest educational level and this decreases as the educational level becomes higher. Therefore, those options that use less ink are perceived as more sustainable by the respondents with medium or high educational level to a higher degree than by those with low or non-educational level.

This contrast connected to the educational level leads us to the conclusion that there is a need to change some general aspects of the indications given in the Figure 5 when designing packaging aimed at a low-educational-level target. Because this group places more value on

high brightness/contrast, regular fonts (non-bold), use of illustrations, geometrical lines and few images when analyzing the sustainability of the packaging of a product.

Conclusions

From the research carried out, we can affirm that graphic elements of the packaging contribute to transmitting sustainability; through them, consumers describe a container as sustainable or not sustainable. Therefore, visual components such as color, fonts or images should also be considered, besides slogans, labels or materials, for communicating this concept. In this way, the design of the package as a whole will constitute a coherent and clear message, without inconsistencies, since all its elements (structural, visual and textual) will support each other to communicate sustainability.

From the three graphic-design variables analyzed (color, fonts and image) outcomes indicate that the chromatic factor is the one that best transmits a product's sustainability (RQ1). Thus, on the basis of the results obtained, a suitable strategy for designing packaging for a sustainable product would be to use color to transmit the concept and leave the rest of the graphic components variables (images, fonts or others) to communicate other attributes such as brand, quality, price, ingredients, etc.

We conclude that "sustainable-look" packaging design should be austere and minimalist, so it should include the minimum possible amount of graphic resources, especially as regards color (RQ2). All features of this "sustainable-look" are directly associated to both ecological and economical dimensions of the concept of sustainability. It is obvious that the lower the use of inks, the slighter the impact sustained by the environment and the more resources saved. Conversely, it is more difficult to appraise the social dimension within the outcomes of the research. A further investigation could focus on studying the connection between graphic elements and this social aspect in sustainability.

Sociodemographic features (age and educational level) have an influence on the perception of the graphic elements of the packaging (RQ3, RQ4). So communicative strategies that include graphic components will work better for the youngest segment of the target (16 to 25 years old) than for older people when transmitting the concept of sustainability.

Likewise, outcomes indicate that the analyzed sociodemographic factors only slightly modify the election of those graphic features considered part of a "sustainable-look" in packaging. Except for a few exceptions, all consumers regardless of age or educational level would consider a graphic design that follows the parameters indicated here sustainable.

Regarding management processes, the obtained results will serve as guidelines for both packaging designers and entrepreneurs for creating containers that better transmit the value of sustainability through the use of graphic elements. Moreover, we think that these outcomes could also be applied to other communication processes of the company and of the product (although a pertinent investigation should be carried out to confirm this).

Lastly, the obtained results should be read considering the following constraints. This research has been carried out with consumers from one country (Spain) and using only one product (orange juice), but perceptions about what is a sustainable packaging can vary from one territory to another and from one product to another (Spence 2016; Herbes, Beuthner and Ramme 2020; Sánchez-Bravo, Chambers and Noguera-Artiaga 2020). Also, the survey includes images of dummy packaging with only one graphic variable. These limitations could be overcome by performing similar investigations in other countries, analyzing different products, and including all graphic elements in the prototypes similar to real packaging. Additionally, it would be interesting to research where visual aspects of the packaging would be related to its structural and verbal features.

Informed Consent

The author has obtained informed consent from all participants.

Conflict of Interest

The author declares that there is no conflict of interest.

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