How colour saturation accelerates purchase behaviour, and influences food choice:

a consumer profiling and eye-tracking analysis

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Abstract

This study aims to detect if, in addition to personal characteristics, packages with different colour saturations can improve consumers' attention and influence their choice. Eye-tracker monitors consumers during the decision process and detects their attention. Thanks to an online survey, 40 subjects have been classified according to gender, age, body mass index (BMI), individual attitudes, preferences, food literacy, chronotype, and eating behaviour. During the experimental phase of the study, the subjects had to choose between alternative saturated and non-saturated coloured packages of healthy and non-healthy food projected on a computer screen, simulating what would happen in an online shop. Results show that, in general, people are more attracted to saturated colours, and this does not depend on the type of food (i.e., both healthy and non-healthy food). Also, people with non-conformal BMI spend less time watching packaging before choosing a product. Contrary, people with high nutritional education (food literacy) spend more time. Findings highlight the vulnerability of not conform BMI and food literacy as a protection factor. The paper offers interesting suggestions to marketers and social marketing managers for designing more attractive packages, also for healthy food.

Keywords: consumer neuroscience, consumer behaviour, food choice, eye tracker, individual characteristics

Introduction and objectives:

When we stand in front of a shelf choosing food, we receive several stimuli. How we look at the product can impact our decision (Gidlöf et al., 2017; Pärnamets et al., 2015) and modify

our diet. The literature has explored which stimuli affect visual attention, identifying two categories: bottom-up and top-down. Top-down refers to intentions that move consumers to pay attention to a specific characteristic for their goals (van der Laan et al., 2015). Bottom-up attention concerns external stimuli catching the visual saliency, e.g., packaging, position, and brand. Among the product and environmental stimuli, colours have a well-established role. For instance, they can deliver non-verbal messages (Babin et al., 2003; Jin et al., 2019). However, the role of colour saturation is a new and somehow unexplored field in the decision-making contest. Mead and Richerson have recently shown that more vivid or less saturated colours induce a perception of non-healthiness and healthiness, respectively. (Mead & Richerson, 2018). To deeply study unconscious reactions to different saturated packages, we applied principles and techniques of consumer neuroscience. Neuroscience offers alternative tools, such as eye-tracking (Iloka & Anukwe, 2020) and electroencephalography (EEG) (Bazzani et al., 2020). A fixed eye-tracker follows the eyes that move, watching objects on a screen. Recorded data allow us to measure gaze metrics, e.g., how many times and how long the eyes stop on a specific area. Through an eye-tracker, we can check if strong attention corresponds to a first-sight attraction and a lasting preference. We are also interested in studying personal characteristics, and we profile consumers to assess if this heterogeneity explains differences in the decision-making process and choice. For instance, the literature shows that those who are more active during the evening and go to bed later (evening chronotype) prefer sugary food and fewer fruits and vegetables (Mazri et al., 2020). Also, higher food literacy is associated with more attention to nutritional content and properties in the purchase process. Women have a higher level of food literacy compared to men (Trieste et al., 2021). Overall, we aim to study if the different degrees of saturation (external variable) can impact food choice using an eye tracker and study the relationship with the individual character of our sample (internal variable).

Framework

In literature, different theoretical frameworks try to explain food choice. A first approach models food choice as the effect of three dimensions: personal characteristics, food characteristics, and environmental characteristics (Sanjur, 1981). Chen & Antonelli (2020) also accounted for cognitive and sociocultural factors. The second approach assumes that food choice mainly depends on disposable time and income. (Bonke, 1993). Finally, according to the theory of planned behaviour, food choice is the final stage of a process determined by behavioural intention, personal belief, motivation, and subjective norms. (Ajzen & Fishbein, 1980). In line with Chen & Antonelli's perspective, the present paper assumes a pre-model step focusing on colour saturation as a product characteristic. As personal characteristics of consumers, the paper includes age, sex, BMI, eating disorder, chronotype, food literacy, and the level of attention (frequency and duration of eyes' fixation) during the purchasing process.

Research questions

Our research aspires to understand whether: food choice is affected by the saturation of coloured packaging, and by the fixed effects of personal characteristics (Hp.1); choice heuristics and gaze metrics (number fixations, fixation duration) vary according to personal characteristics and colour saturations (Hp.2); position and colour saturation of the food drive the purchase behaviour (Hp.3).

Method

The study consists of two steps: a survey and a laboratory experiment conducted on subjects that signed their informative consensus. The inclusion criteria were adults >18 y.o. and Italian speaking. The exclusion criteria were to be affected by the incapability to perceive colours correctly.

The survey asked for:

- anthropometric data: weight, age, sex, height;

- personal attitudes: chronotype, assessed through the Reduced version of the Morningness - Eveningness Questionnaire (Natale et al., 2006); food literacy through the Self-perceived food literacy scale (Poelman et al., 2018) and eating behaviour through the Eating attitude test (Garner et al., 1982)

- education.

In the second step of the study, subjects watched eight (8) pairs of images projected on a computer screen and declared their preference.

A validated database (Blechert et al., 2019) offered four (4) images of food: a slice of watermelon, a packet of vegetable soup (the healthy food items), a slice of cake, and a packet of cheeps (the non-healthy food items). We obtain two versions of each image by applying a -/+ 50% of colour saturation. Finally, the computer screen projected eight couples of images, randomly positioned (i.e., upper, choice A; or down, choice B). For each subject, an eye-tracker (Tobii Studio) registered eye movement. To simulate what could happen in an online shop, we selected food images, two products with, and two products without packaging. For the same reason, we put products at the top and the bottom of the screen.

Findings

We enrolled 40 participants. 65% were female and 35% male, with a median age of 30 years (sd$\pm$15) and an average body mass index of 23 Kg/m2 (sd$\pm$4.3). 62% obtained a high school diploma, as described in Table 1. People with a non-regular body mass index (BMI<18.5 and BMI>25) have an eating disorder (p value=0.085) and a low level of food literacy (p-value=0.056)

Concerning the food choice, subjects preferred saturated images (81%) independently to the healthiness of the related foods.

The number of fixations and fixation durations differ for saturated and non-saturated imagines, both in position A (p-values: 0.0021 and 0.00015, respectively) and B (p-values: 1.7e-10 and 9e-10, respectively).

Products placed on the top of the screen received more total fixations (p-value: 0.01062).

Comparing gaze metrics and personal characteristics, we observed that for people with a BMI>25, the number of fixations of non-saturated images in position B and less saturated located (lower average duration fixation, p value= 0.0153). An explanation in the case of non-saturated images could be that position prevails over colour as a driver of choice.

Finally, subjects with a high food literacy spend more time on products in position A (p-value=0.0482).

Table 1

Continuous variables	Min	Mean (sd)	Median	Max
Age	18	30 ($\pm$15)	24	71
BMI	18	23($\pm$4.3)	22	41

SPFL	9	(±3.5)	18	23
EAT-26	0	(±9.6)	5	51

Discrete variables (N)

Sex	M	F		
	N=16 (35%)	N=24 (65%)		

Chronotype	E	N	M	
	11(28%)	22(55%)	7(17%)	

Education	MS or less	HS	G	PG
	2(5%)	25(62%)	4(10%)	9 (23%)

MS: middle school; HS: high school; G: graduate; PG: post graduate education
BMI: Body Mass Index; SPFL: Self-Perceived Food Literacy; Questionnaire; EAT-26: Eating Attitudes Test
Sex, M: Male, F: Female, N: Not to answerer
Chronotype, E: Evening-Type, N: intermediate type, M: Morning Type

Discussion

The first hypothesis of our study was that colour saturation impacts the choice differently because of the heterogeneity of individual characteristics. However, results show how most of the respondents (81%) chose the high saturated package, suggesting that, in this case, individual differences do not influence how packaging is perceived and how it affects choice. The second hypothesis investigated whether personal characteristics could explain the observed gaze metrics of eyes that move and stop on saturated and non-saturated colour packages. The answer is positive. Personal characteristics and colour saturation affect gaze metrics (number fixation and duration fixation). In the decision-making process, subjects with non-conformal BMI (BMI<18.5 and BMI>24.9), as well as people with a high level of BMI (BMI>24.9), look at the product less saturated in a down position for less time. Also, in the case of non-conformal BMI, significantly less fixation duration is generally observed. On the contrary, people with high competencies in nutrition (food literacy) spend more time on the product placed on the top (choice A).

Concerning the third hypothesis, when the package is low-saturated, the related products in the upper position (A) are mainly preferred.

Conclusion and managerial implication

The results offer interesting suggestions marketers or policy makers may use to make healthy food more attractive and protect vulnerable consumers from risky choices.

Although packages of healthy products are usually soft and have lower vivid colours, our findings suggest using high saturated colours for healthy food, too. The positioning also plays a relevant role in decision-making and choice. Vulnerable consumers have an instinctive reaction to food, the decision-making process is too fast, and they show a lower duration fixation in decision-making. Therefore, making healthy products more accessible could help vulnerable consumers to make less risky choices. Additionally, the relevance of food knowledge emerges as a protective factor in reducing impulsivity of choice.

Limitations

The sample size is the first limitation of our study. The study carried out a laboratory experiment, making recruitment of a larger sample size more difficult. In times to come, we will increase the collection. The second limit comes from external validity. The

experimentation took place in a laboratory rather than in a natural setting. An additional limitation is the fact that, we used the same images with different degrees of saturation. Therefore, choices may refer also to the preferred image instead of choice. Considering different images and saturations, an alternative experimental could be more appropriated to assess preferences on food, only."

Further Research

For future research, we aim to deeply study the relation between colour saturation and personal variable, adopting neuroscience techniques. To explore the unconscious responses of consumers to these stimuli, we will combine electroencephalography and the eye tracker. Results may suggest how to improve the effectiveness and efficiency of social marketing initiatives, inducing behavioural changes toward healthier choices.

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