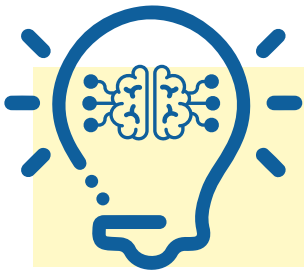


VEGETA & PASSATA RAJČICA VS. **BIO** LABEL



The Impact of BIO label on Decision-Making Behavior

Insight into subconscious preferences of the consumer's brain



OBJECTIVE

- To assess whether the **color packaging affects the BIO label** and if such a label is **essential for consumers' purchasing behavior**.
- The packaging designs of two well-known products (**Vegeta & Passata**) from one of Croatia's most prominent food processing companies were manipulated in packaging color and the BIO label placement.



Figure 1. Vegeta in original BIO packaging (a), original color combination but without the BIO label (b), and manipulated color combination (c)



Figure 2. Passata in original BIO packaging (a), original color combination but without the BIO label (b), and manipulated color combination (c)

RESULTS

- A color gradient overlay visualization (**heat map**) was used to show the general distribution of gaze points and to inspect which packaging design elements attract attention the most.
 - Regardless of the packaging design and product type, subjects spent most of the time looking at the BIO label area, while the EU organic logo label was barely or not at all noticed (Figures 3 & 4)



Figure 3. Attention results based on the heat map for Vegeta original packaging with BIO label (a), original packaging without the BIO label (b), and manipulated blue packaging (c)



Figure 4. Attention results based on the heat map for Passata original packaging with BIO label (a), original packaging without the BIO label (b), and manipulated blue packaging (c)

METHODOLOGY

- A sample of **168 subjects from Croatia** (18-65, both gender) were involved in the testing. More than 60 percent of participants were 36-55, while the others were 18-35 years old. The majority of the participants were either entirely or partially responsible for procuring groceries in their households, while 3 participants were not.
- Based on the G*Power output, a sample size of $n = 84$ was required to detect the effect with a power of 80% and a two-sided significance level of 5%. Tested subjects were recruited from the database of Podravka customers who regularly buy their products, as well as from the database of students of the Faculty of Food Technology and Biotechnology (students with a master's degree in nutrition) in the Republic of Croatia.
- Statistical power analysis program G*Power (version 3.1.9.7) was used for the calculation of the sample size by use of the one-way analysis of variance (ANOVA) and fixed effects, using the F-test. Selected parameters used for the recall results were as follows: an average effect size $f = 0.4$; alpha (α) error probability = 0.05; power $(1-\beta) = 0.95$ for two groups. The calculation, based on the input parameters, required 84 subjects, but to avoid any losses (as failures in recording, not finishing the task), a minimum of 150 subjects was defined as the total sample, which resulting in a representative pool of 87 respondents who fully completed the study. The online platform for advanced quantitative research Sticky by Tobii Pro used for **webcam-based eye-tracking** (15 Hz) and **facial coding** to assess visual behavior and emotional reaction to the different product designs. Based on previous testing's, Sticky's average gaze error in a real-world environment is 1.6 to 1.8 degrees, equivalent to approximately 5% of the screen width and 7% of the screen height on a computer, which suffices this type of neuromarketing research for obtaining a robust outcome.

Procedure

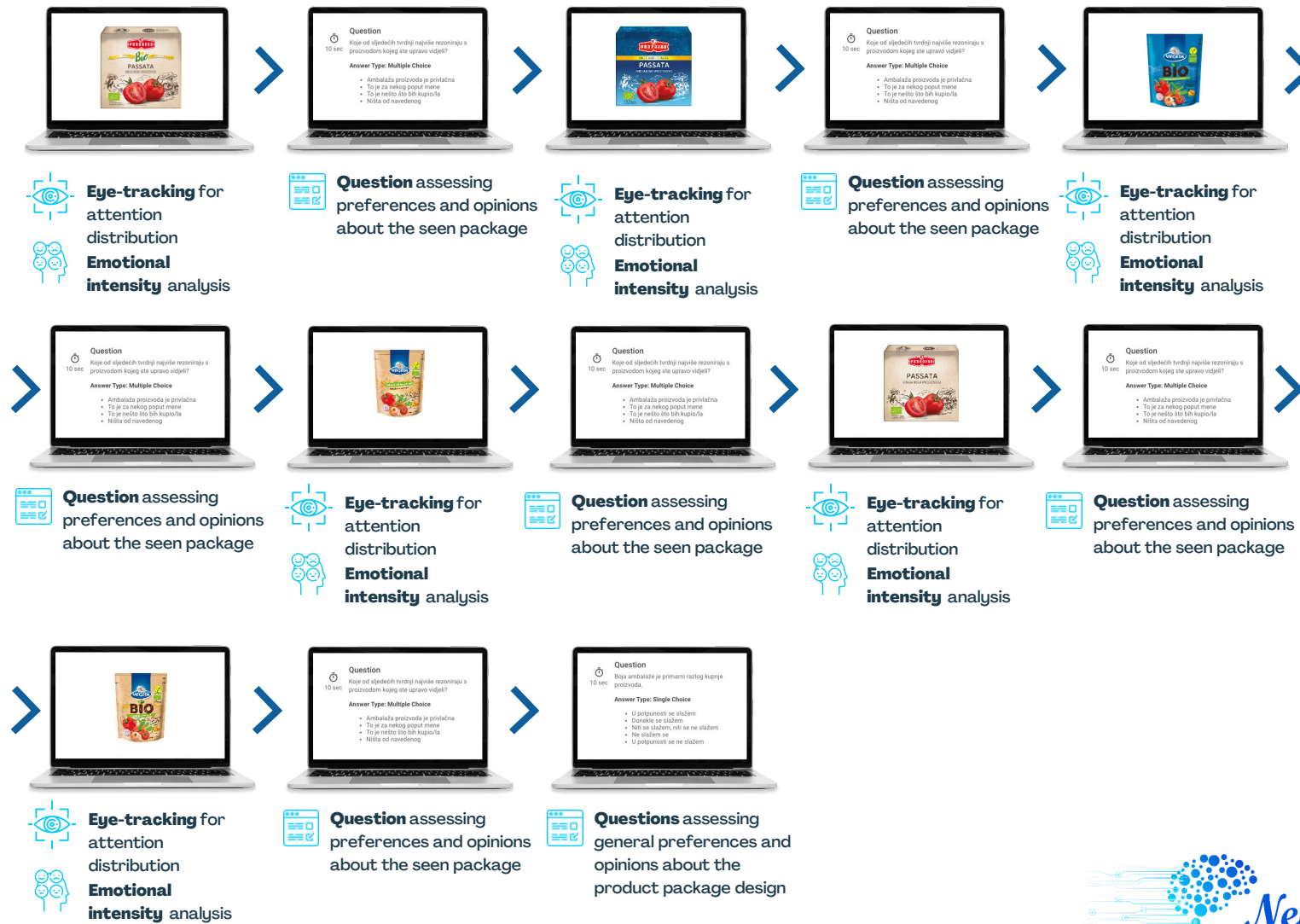
An "HTML" link was distributed to all participants. Only participants with access to computer devices with a working webcam were able to participate. We have limited participants to access from computer devices only, to avoid possible distractions (fuzzy environment, lack of concentration, more had movements, low lighting conditions, etc.), when they are exposed to different design which often happens with mobile device testing. The task started with a 5-point-eye-tracker calibration which is a standard procedure when using eye-tracking device. Afterwards, participants were given instructions to assume that they were currently in the store and that they would like to buy Passata / Vegeta. To inspect the item better, they would take that item from the shelf and during the inspection, they would decide whether they would buy it or not, given that the price is not an issue. Then, they were shown three different images per product category. To control for the order effect, the order of the images was counterbalanced across participants for both products, and each image was displayed for 5 seconds, during which webcam-based eye-tracking measured participants' gaze behavior and emotional expression. Participants were also instructed to skip any product image with the mouse click at any time. On this way doing was able to capture the overall interest of participants during the experiment. After each image, participants were given four statements to rate assessing their conscious preferences and opinions about the seen packaging. They had 10 seconds to do that. **The total duration of the study was 3 minutes and 22 seconds.**

Statistical Analyses

Statistical analyses of tests of within-subject effects were performed with IBM SPSS for eye-tracking metrics of attention for both products to analyze the difference in the visual attention between the three different package designs. In addition, the eye tracking qualitative data was used to assess what participants do not see at all on the packaging. This was a great asset what we can provide with this testing as the traditional marketing testing methods cannot capture subliminal activity.

To investigate the relationship between the results collected by the questionnaire and the neuromarketing approach, multivariate approach, by use of partial least squares (PLS) regression was conducted. The efficiency of the input/output variables was quantified with the regression coefficients (Rc). The multivariate analysis was carried out in the program XLSTAT Version 2014.5.03.

EXAMPLE of the EXPERIMENTAL SETUP



BIO LABEL MANIPULATION

Vegeta:

- Longer dwell time for the BIO label area on the original packaging without the BIO label than on the packaging with the BIO label ($F(1,32) = 29.36, p = 0.00$).
- More fixations directed toward the BIO label area of the original packaging without the BIO label than at the same area of the original packaging with the BIO label ($F(1,32) = 30.38, p = 0.00$).

Passata:

- Longer dwell time at the BIO label area on the original packaging without the BIO label than on the packaging with the BIO label ($F(1,32) = 6.01, p = 0.02$).
- Shorter TTFF to the BIO label area on the original packaging design without the BIO label than on the packaging with the BIO label ($F(1,32) = 17.03, p = 0.00$).
- More fixations at the BIO label area on the original packaging without the BIO label than on the original packaging with the BIO label ($F(1,32) = 5.97, p = 0.02$).



Figure 5. Average emotional valence intensity when looking at Vegeta.

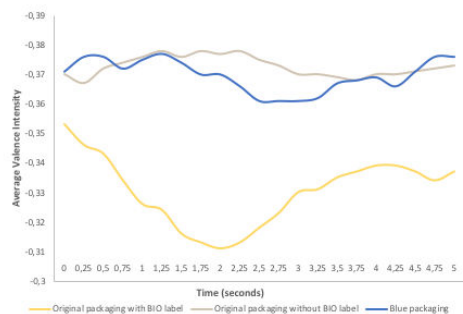


Figure 6. Average emotional valence intensity when looking at Passata.

Table 1. Eye-tracking metrics assessing visual attention during BIO label manipulation for both products.

AOI	Dwell time (s)	TTFF (s)	Number of fixations
VEGETA			
Original packaging with BIO label	4.47	0.12	2329
BIO label	1.61	0.44	835
EU organic logo	0.35	2.45	171
Packaging without BIO label	4.39	0.16	2218
BIO label area	2.50	0.38	1298
EU organic logo	0.54	2.31	222
PASSATA			
Original packaging with BIO label	4.40	0.14	2225
BIO label	1.33	0.94	633
EU organic logo	0.28	2.84	82
Original packaging without BIO label	4.44	0.09	2317
BIO label area	1.82	0.28	948
EU organic logo	0.35	2.99	117

Table 2. Eye-tracking metrics assessing visual attention during color manipulation for both products.

AOI	Dwell time (s)	TTFF (s)	Number of fixations
VEGETA			
Original packaging with BIO label	4.47	0.12	2329
BIO label	1.61	0.44	835
EU organic logo	0.35	2.45	171
Blue packaging	4.35	0.09	2274
BIO label	1.92	0.39	1003
EU organic logo	0.38	2.39	135
PASSATA			
Original packaging without BIO label	4.44	0.09	2317
BIO label area	1.82	0.28	948
EU organic logo	0.35	2.99	117
Blue packaging	4.51	0.12	2358
BIO label area	2.12	0.52	1103
EU organic logo	0.34	2.85	103

COLOR MANIPULATION

Vegeta:

- The BIO label area of the blue packaging had a higher number of fixations than the BIO label area from the original packaging with the BIO label ($F(1,32) = 4.00, p = 0.05$).

Passata:

- Shorter TTFF to the BIO label area on the original packaging without the BIO label than on the blue packaging ($F(1,32) = 6.22, p = 0.02$).
- A higher number of fixations for the BIO label area on the blue packaging than on the original packaging without the BIO label ($F(1,32) = 5.07, p = 0.03$).

EMOTION ANALYSIS

- Emotional valence associated with the stimulus
 - A value between -1 and +1 describes the intensity of elicited emotion
 - Positive values: pleasantness, attractiveness; negative values: aversiveness, unpleasantness
- **Vegeta** (Figure 6): the intensity of negative emotion increased with time for blue packaging and original packaging without the BIO label
 - the opposite pattern is observed for the original packaging with the BIO label: the intensity of negative emotion decreased with time.
- **Passata** (Figure 7): higher intensities of negative emotion for all packaging designs
 - A slight drop in the negative emotion intensity after 2 seconds for the original packaging with the BIO label (subjects looked at the area around the BIO label and the product name)

COGNITIVE TESTING

- In addition to the subconscious eye-tracking measurements, a cognitive testing was conducted to learn about the conscious preferences of the participants and to be sure of the validity of the results. In the case of Vegeta, a relatively high percentage of participants for all the package designs said that they are visually appealing; however small percentage of people would buy them or consider that they are for someone like them. On the other hand, in the case of Passata, a relatively low percentage of participants said that package designs are visually appealing, but still, a higher percentage would buy those products.
- In order to examine the relationship of the emotional response and the results of cognitive testing, multivariate tool, rather the partial least squares (PLS) regression, was performed. The data of emotional response (Puzzlement; Disgust; Fear; Joy; Neutral; Sadness and Surprise) were used as input data set, while the monitored cognitive parameters (It is visually appealing; It is for someone like me; It is something I'd buy and None of the above) were set as output parameters. All data (regardless of the product; Passata or Vegeta) were used as a data matrix on which PLS analysis was performed. Regression models has a linear form:

$$y_i = a_i \text{Puzzlement} + b_i \text{Disgust} + c_i \text{Fear} + d_i \text{Joy} + e_i \text{Neutral} + f_i \text{Sadness} + g_i \text{Surprise} + \text{Intercept}_i$$

Where;

y_i - represents the four observed cognitive parameters ($i=1, \dots, 4$);

$i=1$ - It is visually appealing

$i=2$: It is for someone like me

$i=3$: It is something I'd buy

$i=4$: None of the above.

All model parameters (a_i to g_i) are presented in table 3

Table 3. Model parameters with the corresponding regression coefficient (Rc)

Variable	It is visually appealing ($i=1$)	It is for someone like me ($i=2$)	It is something I'd buy ($i=3$)	None of the above ($i=4$)
Intercept	39,1945	24,9941	52,7321	6,7179
Puzzlement	-0,1382	-0,2752	1,3817	-1,5490
Disgust	-0,4023	-0,8010	4,0215	-4,5085
Fear	-0,4007	-0,7979	4,0060	-4,4911
Joy	-0,0609	-0,1213	0,6089	-0,6826
Neutral	0,0059	0,0118	-0,0593	0,0664
Sadness	0,1236	0,2461	-1,2355	1,3851
Surprise	0,1721	0,3428	-1,7210	1,9294
Regression coefficient, Rc	0,7204	0,7204	0,7790	0,6845

CONCLUSION

To the best of our knowledge, this is the first study using remote eye tracking measurements to assess the underlying physiological responses of BIO-labelled products on the consumer purchasing decisions. The aim of the current study was to observe whether BIO label affects decision making processes, and if the color of the BIO packaging is important with the help of online webcam-based eye-tracking and facial coding. The eye-tracking results from both tested products reveal that the color of the packaging and the BIO label placement matter. Namely, in the case of Vegeta, the higher number of fixations and the longer dwell time at the BIO label on the blue packaging indicates that such higher levels of visual attention are associated with processing difficulty which can be explained with the color of the packaging. Vegeta Original is a well-known product which consumers for decades associate with the blue color and without the additional labeling such as BIO. A similar pattern was also observed for Passata. The shorter time to first fixation to the BIO label area on the original packaging without the BIO label than to the same area on the blue packaging suggests that such area was visually more salient since the consumers were used to seeing such article on the store shelves in blue color. On the other hand, a higher number of fixations and longer dwell time at the BIO label area on the blue packaging indicate that such higher levels of visual attention are again associated with processing difficulty, as it was the case with Vegeta.


When it comes to the BIO label placement on the packaging, in the case of Vegeta, longer dwell time and the higher number of fixations directed to the BIO label area on the original packaging without the BIO label suggests again that such packaging was confusing for the consumers as the BIO label area was different than expected. The same pattern was also observed for the Passata. More visual attention was directed towards the original packaging without the BIO label which was the direct result of lower processing fluency. In addition, the emotional analysis via facial coding has also revealed that regardless of the packaging design for both products, a higher intensity of negative emotion was present when looking at the products. However, in the case of Vegeta, the intensity of negative emotion decreased with time for the original packaging with the BIO label and in the case of Passata, a slight drop in the intensity of negative emotion occurred after the 2 seconds of watching the original packaging with the BIO label. At that moment, a deeper inspection of the gaze plot and heat map recording showed that participants were looking at the area around the BIO label and the product name. Taken together, these results indicate that the BIO label is essential part of the BIO packaging and should be visually highlighted on the packaging. Moreover, the color of the BIO packaging is important parameter and should reflect the earthy-color tones. Even the survey assessment of consumers' conscious preferences revealed that the color of the packaging and the visual appearance of the product are one of the key reasons for buying the product. However, a discrepancy between the survey answers and neuromarketing testing was observed. Almost half of consumers claimed that the BIO/ECO label is somewhat important on the product packaging but they all failed to notice the EU organic logo on products.

The results of the current study serve not only to designers and marketers in creating the products that are subconsciously desired on the market, but as well as the evidence how traditional marketing approaches focused on surveys and group discussions fail to show the full-picture. On the other hand, utilizing neuromarketing methods such as eye tracking and facial coding can yield valuable insights of consumer behavior. Despite the use of online research with the webcam-based eye tracking solution (15Hz), the obtained results are the example of how very accurate and useful marketing insights of the consumers subconscious on the decision making process and preferences can be obtained. Limitation of the study was the big screen out (26 subjects) where we presume this is due to the reason what participants did not receive any incentives for attending to this research. In addition, the software used is highly sensitive and discredits the participant at a slight shift of the head, which gives us a merit results at the very end. Since the research was limited to the computer device to achieve the best results possible, the total sample size needed to be increased which resulted in obtaining a better percentage of quality recordings. Based on the regression coefficients that reflect the quantitative measure of the importance of the relationship inseparable from the qualitative characteristics of the relationship being studied, there is a clear strong connection between the results collected by the questionnaire and the neuromarketing approach.



WHERE YOU CAN FIND MORE INFO?

The paper entitled " The Impact of Bio-Label on the Decision-Making Behaviour", authored by: Doc. Dr. Hedda Martina Šola, Prof. Dr. Jasenka Gajdoš Kljusurić and Doc. Dr. Ivana Rončević is accepted for publication in the Top Tier Academic Journal and will be published in 'Frontiers in Sustainable Food system', soon.

 frontiers

The Impact of Bio-Label on the Decision-Making Behavior

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11 **Keywords:** packaging design, eye-tracking, neuromarketing, decision-making, bio-product

12 **Abstract**

13 Unlike traditional research methods used for investigating consumer responses to different stimuli
14 such as surveys, interviews or focus groups, recently, the autonomic neuropsychological measures
15 have been implemented within the neuromarketing field to obtain subconscious preferences from the
16 consumer's brain. In the current study, the webcam-based eye-tracking technology is used to analyze
17 both visual and emotional reflects of the consumer green purchasing behavior, which has grown
18 notably in the last decade. The main interest was to assess whether the color packaging affects the
19 BIO label and if such a label is essential for consumers' purchasing behavior. The packaging designs
20 of the two-well known products from one of Croatia's most prominent food processing companies
21 were manipulated in packaging color and the BIO label placement. The results have shown that
22 regardless of the package design and the placement of the BIO label, participants elicited higher
23 intensities of negative emotion. The eye-tracking metrics showed that for both products the color of
24 the packaging and the BIO label placement matter.

Facts

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