NEUROMARKETING RESEARCH ON CONSUMERS' VISUAL PERCEPTION OF CRYPTOMARKING A PRODUCT PACKAGE

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Abstract

Packaging methods in the dairy industry are increasingly changing to meet the needs of consumers and the rest of the food industry. New digitalization concepts for dairy packaging include many features that provide not only protection, but also extended shelf life and provide improved consumer awareness of product quality and functionality.

This article discusses the possibility of using cryptographic protection of a two-dimensional barcode (QR code) on milk packaging to effectively inform consumers about the product and its ingredients. A preliminary neurophysiological analysis should be carried out to assess its visual salience. Therefore, the aim of this research was to analyze and evaluate consumers' visual perception of cryptographic marking in order to determine the best position for the QR code on the product package. A comprehensive neuromarketing experiment was carried out to study the visual attention and interest in cryptographic marking on a soft milk package. The results were processed using economic-mathematical and statistical analysis methods, implemented in SPSS. After summarizing the results of the processed data, the best QR code positioning options for a soft milk package were found. The revealed positioning areas were proved to be the best by the objective neurophysiological parameters of the testees' visual perception of various milk test packages. An investigation was conducted for cryptomarking in the selected areas on experimental materials and then tested in a control group by focusing on testees' attention. The areas of interest and memorability of milk brands were also distinguished. The obtained results can be used as a practical tool for managing consumer attention in choosing milk. Further studies should be conducted, related to the research of the visual visibility of cryptomarking in foveal and

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peripheral eyesight, making it possible to understand the consumer's situational behavior in the decision-making process.

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1. INTRODUCTION

One component of each country's national security strategy is the effective development of the food market, since the depth of the range and quality of food products sold determines the standard of living and the health of the nation as a whole. At the same time, a number of food products make up the FMCG (Fast-Moving Consumer Goods) market, which includes products that are inexpensive, frequently sold, quickly consumed, and sold in large quantities (e.g. fruits and vegetables; meat and processed meat; bread and bakery products; pasta; dairy products; confectionery and sweets, etc.). Meanwhile, the market for FMCG commodities is booming and growing at 4% per year which is more than the global GDP in the Indian economy (Sharma et al., 2019). Every person in the world purchases FMCG on a daily basis. In terms of marketing, products purchased within the FMCG segment are products to which people react emotionally rather than rationally. It should also be noted that purchase engagement in this segment is low, as a consequence of which, consumers make decisions based on brand awareness and response to marketing incentives, level of quality, knowledge, and product attributes (Sharma et al., 2019). Also, FMCG products have a short shelf life, either as a result of high consumer demand, or because the product spoils quickly (Reddy et al., 2018).

Given that the FMCG market is oversaturated: the number of products and brands on the market is increasing, the range is expanding and deepening - it is quite difficult for consumers to specify their choice. As a result, manufacturers are actively involving consumers in the choice process, encouraging them to make purchase decisions by means of marketing techniques, such as focusing their attention on packaging, and its graphic and textual elements. It is notable that all historical changes, including the technological revolution, the development of the Internet, mobile devices, and the digitalization of production and trade processes, have had an impact on the way products are bought, consumed, and packaged. Indeed, packaging is now multifunctional and serves not only a protective function, ensuring the safety and transportability of goods, but also informs the consumer about the contents and highlights key information about the packaged product (Scetar et al, 2018; Han, 2005; Karaman et al., 2015; Khoshgozaran et al., 2012). As rightly pointed out by Robertson (1992), packaging is often referred to as the 'silent seller', indicating that packaging should protect what it sells and sell what it protects (Patel et al., 2017: 15). However, manufacturers' use of sensory technologies to attract attention through promotional materials and attractive visual graphics, colors, and textual information on packaging, only adds to the information noise in the retail environment.

It should be understood that in the process of making a purchase decision, the consumer collects and studies primary information about the product. The quicker, more accurate, and more reliable this information is, the better the purchase decision will be. In this study it was found that the average duration of a decision to choose a particular product in a shop or sales organization, based on a visual analysis of

the basic information about the product on its packaging, is about 5 seconds, which does not allow the consumer to fully familiarize himself with all the information on the packaging. As a result, the consumer may make an incorrect choice of goods, or his choice may not coincide with his desires and needs.

The consolidation of marketing and information resources through the use of information and communication technologies in production and sales, will help manufacturers to better adapt to the needs of end users. The packaging industry is undergoing a transformation as digital technologies are introduced into the existing business architecture. One of the newest marketing tools in digital information technology is the two-dimensional barcode or quick response code (hereinafter QR code), which does not take up much space on packaging, but allows comprehensive generation and recognition of basic information about a product and its manufacturer, as well as fast transfer of this information to the end consumer. However, it requires a camera or special application on a mobile device with an Internet connection. In 2021, 66.6% of the world population (5.22 billion people) used mobile devices, while almost 60% of the world's population (4.66 billion people) used the Internet (the number of users in 2021 increased by 7.3% compared with 2020). In Russia, the number of Internet users in 2021 increased by 5.1% (+6 million compared to 2020) and now stands at 124 million people. Internet penetration in Russia was 85% in January 2021 (Digital, 2021). This means that most consumers both globally, and nationally in Russia, have the necessary technical resources to read and recognize a QR code on packaging, quickly obtaining basic information about a product to make an informed purchase decision.

It should be noted that dairy products are prominent in consumption within the FMCG segment, as more and more consumers pay attention to health issues and are more aware of the benefits of consuming dairy, although its sale requires quality and safety controls. As the cheapest in the Russian domestic market, pasteurized milk (FP) in soft pack is the most perishable and frequently purchased product. This trend is also common in India, as most dairies in urban areas have introduced polythene bags as packaging, which are single-use packages that are very light in weight, lowering distribution costs in comparison to glass bottles. Losses during filling of bags are less than those of bottles and less space is required for packaging compartment and cold storage (Kumar, 2004: 194). The need for precautionary measures by consumers is due to their caution and hesitation as more and more consumers want to buy natural products. At the same time, soft packs allow dairy products to be packaged without or with less preservatives and have therefore become a popular solution for the minimally processed products that are increasingly required by today's consumers (Robertson, 2016).

In general, milk packaging must be suitable for printing and must contain all product information required by law (Karaman et al., 2015). A considerable amount of information should be printed on the packaging of dairy products: date of manufacture of the product, proper storage conditions, instructions for use, size, and number of servings per package, information on nutritional value per serving, name and address of the producer, cost, country of origin, etc. (Patel et al., 2017: 15). In addition to the above, in Russia, the requirements for affixing the necessary information on milk and processed milk products packaged in retail containers and sold in the Russian Federation in wholesale and retail trade are set out in paragraph 25 of Article 35 of the Federal Law "Technical Regulations for Milk and Dairy Products" of 12.06.2008 No. 88-FZ (Federal Law "Technical Regulations for Milk and Dairy Products", 2008). The packaging of this product must also show the following parameters in addition to those listed above: product name, mass fraction of fat in percent, name and location of the manufacturer, net

weight of the product or its volume, list of product ingredients, nutritional value, date of manufacture, and expiry date.

At the same time, the placement of this information is not regulated, as a result, producers place it depending on the marketing strategy and package design, and it is quite difficult for the consumer to assess all the qualitative parameters of the dairy product label of a particular manufacturer in a short time in order to form a general idea about the product (Koshkina, et al., 2017). The results of an earlier experimental neuromarketing study, in which subjects looked specifically for errors, inaccuracies, and inconsistencies, in the labeling information on milk packaging, showed that the subjects, when examining the front and back of the soft-serve milk packaging, did not identify errors and did not compare the inaccuracies made on milk packaging in 96% of cases (Visual neuromarketing: Fundamental and applied research, 2020: 239). In addition, as noted by researchers, packaging material may not always protect the integrity or quality of the product (Duncan et al., 2009), and dairy products may not be stored correctly (Jayamanne and Adams, 2004), which can directly affect product quality, reduce purchase satisfaction, and ultimately have a negative impact on consumer health. As a result, a feature of today's consumer market, particularly in Russia, is the high proportion of low-quality, hazardous products that are brought into circulation in circumvention of current procedures for admitting products to the market, thus damaging the lives and health of citizens. The highest level of adulteration of dairy products occurs in butter, whole milk, condensed milk, ice cream, cheese, and sour cream (Kalkova et al., 2020). Thus, the development of the dairy industry requires the introduction of new, innovative, and communicative tools to prevent the counterfeiting of dairy products and to inform consumers about the product and its ingredients through the application of a QR code, which is:

1. a powerful catalyst of information transparency for the consumer;
2. a tool to combat counterfeiting;
3. a tool to increase fiscal levies; and
4. an element of protection of bona fide producers.

The main information that is added to the contents of the QR code and affixed to dairy products refers to the product, its properties, and key features, as well as the manufacturer's information. This does not contradict the requirement to put the required product information on the packaging. At the same time, in practice there are cases when the QR code is incorrectly and inappropriately placed on the surface of the object, which, all other things being equal, does not permit the reading of the information from A to Z. At the same time, the question of finding the optimal location of a QR-code on milk packaging has barely been studied.

Thus, the aim of this study is to examine the cognitive perception of labeling information presented using a QR code on soft milk packaging and to assess its optimal placement for visual significance and visibility of the consumer against the background of other labeling and graphic elements.

The consumer goods and FMCG market is constantly adapting to changing consumer demand and new trends. Digital innovation, an increase in the share of online shopping, an increased focus on sustainable and healthy habits amid post-pandemic processes, geopolitical instability, and increasing negative inflationary pressures, are just some of the most significant factors affecting the consumer goods market in recent years. Digitalization has streamlined some of the manufacturing processes as well as made information available to the consumer, resulting in an increasing number of companies in the market adopting digital technologies, optimizing their operations, ensuring brand awareness, and maintaining customer loyalty in the highly competitive FMCG market.

This article provides a brief overview of

current behavioral trends in the dairy market and presents the potential for effective use of digital technologies to ensure fast and optimal purchasing decisions in a highly competitive market. The task of assessing the level of visual accessibility and consumer comprehensibility of product information generated in the form of a QR code on soft milk packaging is timely and appropriate.

2. LITERATURE REVIEW

In the fast-moving consumer goods (FMCG) market, understanding consumer needs and desires, retaining attention, and building brand loyalty are of particular relevance to the manufacturer (Pappu Rajan, et al., 2021). The current situation in the FMCG market is such that the key success factor for a company is not so much the increase in production volumes but rather the effectiveness of promotional technologies. The purchase decision, however, does not depend solely on consumer motives, as the variety of aspects associated with purchases reflects different emotions (Soodan & Pandey, 2016). Emotions are one of the leading driving forces behind purchases, and their association with purchases increases manifold with the increasing variety and similarity of products resulting from fierce competition (Soodan & Pandey, 2016). These scientists rightly point out that the result of making a purchase decision and consuming a product can be either positive emotions and satisfaction, or dissatisfaction as a result of choosing a product that does not meet the consumer's needs, frustration with taste, or dissatisfaction with the price/quality ratio.

The consumer is unable to assess which factors influence his or her choice, so that his or her decision is guided by organoleptic evaluation as well as by the information provided on the packaging. Therefore, when the market is saturated with homogeneous foodstuffs, one of the keys to a company's success is the appropriate choice of packaging and the effective communication of information on it. Beautiful, colorful packaging is subconsciously linked to positive emotions and the expectation for a better quality product. Packaging must make the product stand out. It should help the product stand out not only from its direct competitors, but also from other products on the shelf next to it, because, as Mazhar et al. (2015), Ghosh (2016), Imiru (2017), and Chitroda & Patel (2020), prove in their works, packaging is an important component that significantly affects the decision-making process by strengthening the intention of customers to buy. As noted by Mazhar et al. (2015) and Chitroda & Patel (2020), in terms of the amount of investment in communication channels, the investment in packaging is the most effective as it is the packaging that provides the maximum amount of product-consumer contact. In addition, according to the same researchers, properly designed packaging can help to significantly facilitate promotional efforts by accurately implementing brand-positioning ideas, as well as generating additional revenue by giving the brand an element of prestige or by supporting other corporate brand products with packaging.

Packaging should ensure the storage and protection of food products, and the maintenance of their sensory quality and safety, as well as the transmission of information to consumers (Robertson, 1993). The packaging is also related to the style and graphic brand identity.

This study considers dairy products, which occupy a significant place in consumption patterns. In Russia, for example, dairy products account for 15% of total food expenditure (Visual neuromarket-ing: Fundamental and applied research, 2020: 230). Milk is an irreplaceable food in the human diet and is an important source of nutrients (Siqueira et al., 2020), as it is high in proteins, amino acids, fats, vitamins, and macro- and micro-nutrients, and can also have a positive effect on gut microflora (Loretz, 2012). It is no coincidence that cow's milk is one of the seven major food groups developed in collaboration between the National Food and Nutrition Research

Institute (INRAN) and the Italian Society of Human Nutrition (SINU) (Merlino et al., 2022). As noted in the study of Siqueira et al. (2020), in the last decade, despite a downward trend in the consumption of full-fat dairy products associated with changes in eating habits, with a shift towards increased consumption of skimmed versions or milk substitutes with vegetable sources such as margarine, yet recent clinical studies have shown that consumption of milk fats does not increase the risk of cardiovascular disease. The beneficial effects of cow's milk on human health in a balanced diet have been presented in the work of various scientists (e.g. Gómez-Cortés et al., 2018; Haug et al., 2007; Thorning et al., 2017). Grebitus et al. (2007) surveyed 260 households in Germany in 2004, analyzing the influence of certain quality characteristics and socio-demographic factors on the purchase decision-making process for whole fat milk, skimmed milk, and organic milk. Using cluster analysis, they showed the orientation of young consumers towards a healthy image when choosing milk, while for older consumers advertising activities and extending the shelf life of milk were significant. At the same time, for all consumer groups, brand is a significant factor in the choice of milk. These results were confirmed in the work of Muhammad & Kamran (2014), where a positive correlation between shelf life, producer name, and brand awareness, was traced using a Likert scale.

Hatirli et al. (2004), based on a study of the Turkish milk market, identified a number of factors that have the greatest influence on the behavior of fluid milk buyers in Turkey: number of children, household size, education level, and income, which are also valid for the Russian market. Merlino et al. (2022) identified the following factors as the most important in the choice of milk, assessed with the greatest variability within the same group according to socio-demographic characteristics: price, fat content, and taste. Since the level of income affects the purchasing power of the population, this study investigated the decision-making features when choosing pasteurized milk (FP) in soft pack (poly-pack, fin-pack, bertha-pack) as the most affordable for all consumer groups (on average, milk in this packaging is 20% cheaper compared to milk in tetra-pack, glass and other packaging). The choice of the study site is also due to regional consumption patterns and habits, as most consumers purchase milk in this packaging, which does not contradict the findings of a previous study (Saba et al., 1998) which found that habit plays a more important role in predicting behavioral attention than propensity. Additionally, Ding & Veeman (2019), Aprileet al. (2016), and Lopez et al. (2020), determined that consumers choose drinking pasteurized milk (FP) because in the consumer's mind it is associated with local production, a short supply chain, traditions, high nutritional value, and good taste, which is also true for the pasteurized milk choice in Russia.

Detailed analysis of milk package design as an important element in the promotion of goods on the market has been conducted both by Russian and foreign scientists. Style, color, compositional, and graphic, brand identity on a milk package was studied by Sokolnikova et al. (2011), and Polyakova (2013). In her work, Keller (2009) considered packaging as an important factor in recognition and creation of positive associations with the brand. The fact that a package is ineffective if it does not attract people, because it does not have a positive impact, was highlighted in other studies (Firozian et al., 2010). At the same time, the influence of the visual elements (color, design, packaging material, size, and graphics) and verbal elements (nutritional information, product information and country of origin) of a package on the consumers' behavior was studied by Shahram, Hossein, et al. (2013). In addition, Ghosh (2016) notes that the right choice of packaging color, background image, packaging design, and innovative ideas embodied in product packaging will create a sense of

happiness in consumers. All these packaging elements make an important contribution to attracting consumer attention and interest.

Thus, on the basis of regression analysis and Friedman tests the scientists show that visual elements of the color and the milk package itself, as well as its informational factors (label) significantly affect consumer behavior, whereas the size is insignificant. The importance of packaging design in enhancing the value of milk as a product has been noted in the work of Merlino et al. (2022). Kovaleva & Kostrykina (2010) studied the effect of color in the design of milk packaging on the perception of consumers and pointed out that 80% of purchase decisions were made directly at the point of sale; a housewife spends an average of 20 seconds to inspect one showcase. According to observations made by the authors in retail outlets in the city, visual examination of the packaging of the fast-moving consumer goods (FMCG) and their main information components located on the packaging is even less (10-15 seconds), which is insufficient for obtaining comprehensive information. In addition, a large number of symbolic and textual elements on packaging create "information noise" for consumers in a situation of limited time in the process of making a decision and choosing several products at the same time, due to which they can make a mistake and choose a low-quality product that does not meet their needs (Visual neuromarketing: Fundamental and applied research, 2020: 232). Therefore, good packaging should not only attract potential consumers' attention, but also effectively inform them about the properties of the product (Kovaleva & Kostrykina, 2010). Thus, as rightly pointed out by Merlino et al. (2022), it is important to properly communicate value (e.g. local branding) and higher quality products, through packaging, as differentiation tools in the market, to increase transparency and consumer awareness.

The dairy sector has one important feature, namely its association with the production of perishable products, the sale of which requires special conditions for transportation, storage, and sale, and requires quality and safety control at all stages of production and sales (Visual neuro-marketing: Fundamental and applied research, 2020: 231). Placement of labeling information on the packaging of dairy products is determined by each manufacturer independently, the legislation provides only mandatory labeling parameters on the packaging of dairy products (The Federal Law "Technical Regulations on Milk and Dairy Products", 2008). This, on the one hand, creates difficulties for consumers when examining the various packaging of dairy products, leading to increased time for decision-making and potentially a wrong choice. On the other hand, producers can mislead consumers and retailers by providing incomplete/false information about the composition, shelf life and expiry date (the shelf life of drinking milk in a soft pack is 7-10 days), technical conditions of production, and other parameters important for making purchasing decisions, as a result of which the share of counterfeit dairy products in retail chains in Russia averages 7-8% (Visual neuromarketing: Fundamental and applied research, 2020). To level out the "information noise", scientists (Karedza & Sikwila, 2017) suggest the use of labels on product packaging which contain meaningful information about the place, time of manufacture, composition and specifics of use, and expiry date of products in the FMCG segment, which includes dairy products.

The visual elements of a package are the carrier of information, affecting the consumers' emotions, and, as a result, their behavior. The significance of food marking for informing consumers was studied in the work of Polyakova (2013). However, scientists have not evaluated the dependence of the positioning of a QR code as one of the elements transferring the information placed on a package on its visual visibility by a consumer, and, accordingly, the consumer's behavior.

In addition, the growing role of

smartphones in modern society is contributing to the creation of new forms of information transfer with consumers. For example, among the latest marketing trends, one of the most promising technologies is the development of smart packaging using QR codes to improve quality and increase product information for consumer decision-making. For example, QR codes provide quick access to website addresses, emails, phone numbers, geographic coordinates, etc. via mobile devices (Konstantoglou et al., 2020). This information can be displayed on product labels and promotional media, while consumers, in turn, can access the information content from any mobile phone or smartphone with a built-in camera and QR code reading software (Xu et al., 2021).

For example, Rotsios et al. (2022) conducted a study to investigate the effectiveness of QR codes on consumer behavior for a particular product, namely bottled milk, by developing a new label supported by a QR code and by creating and running a dedicated website for the study. The study investigated the extent to which QR codes on bottled milk packaging improve the information provided to consumers about the product, increasing their purchasing intentions.

As other studies by Konstantoglou et al. (2020) show, packaging itself is considered a powerful marketing tool that is a key factor in product positioning. The level of consumer engagement and trust increases if a company provides more information about its product, as this increases the transparency of its activities for consumers. Moreover, the new trend for QR codes consists of their very customization in terms of colors and images, making it a powerful branding tool that increases brand awareness of the products themselves.

In spite of many studies conducted in this sphere, the trend of QR code application is at the "initial" stage. Thus, several problems limit their use in current market conditions. The first is insufficient awareness from consumers about this marketing technology. In fact, not everyone is aware that QR codes can be found and scanned on packaging, and if consumers are not aware of its existence, they don't even look for it.

The second problem is that companies may provide consumers with incorrect content and, as a result, consumers are reluctant to scan the QR code. Thus, in order to make the code an effective marketing tool and take full advantage of its benefits, it is important that companies pay more attention to what type of content is likely to encourage consumers to use QR codes on packaging and where it will be placed.

The packaging of drinking milk (FP) is an important element because it must complete the product, helping to sell it; in today's reality, labeling with new digital technologies will ensure more effective transmission and perception of information by the consumer, allowing the use of technology to influence purchasing intentions and attitudes, which is just as important as the product brand itself. At the same time, to increase the cumulative effect of all packaging elements, the visual prominence of the QR code should be evaluated. Determining the optimal location for a QR code will reduce the time required to obtain comprehensive information about the product and for the consumer to make a purchasing decision that meets their constraints, values, and needs.

2.1. The Purpose of the Study

The purpose of this study was to analyze and evaluate the consumers' visual perception of cryptographic marking in order to find the best possible positioning for a QR code on a milk package.

Hypothesis H_1: Optimal QR code placement is related to visual brand visibility.

Only samples of milk presented in a soft package were analyzed, due to the fact that this type of product is the one most preferred by consumers. Data from an earlier marketing survey, conducted before the neuromarketing experiment, showed that

Russian consumers prefer to buy milk in the following packages: tetra-pack – 43.48% of respondents; soft package – 32.61%; plastic bottles – 17.39%; and glass containers only 6.52%.

3. MATERIALS AND METHODS

As part of an experimental study, an eye-tracking experiment was conducted in which the eye movements of subjects when they looked at milk cartons from different manufacturers were studied. Twenty-eight people, aged between 18 and 50 years old, took part in this experiment, evenly divided into two groups - a control group and an experimental group.

Experimental studies using an iTracker do not require a large number of subjects to obtain valid data, as the volume of biometric measures obtained during the experiment is a large data set, which allows valid statistical tests to be conducted. This was confirmed in the work of the Nielsen group (2009). Participants in the experiments were healthy volunteers who signed an informed consent form before participating. None of the participants reported a history of any neurological or psychiatric illness, or visual or hearing problems.

Five milk cartons were shown as visual stimuli. The aim of the experiment was to investigate visual attention to the four highlighted areas of interest contained on the packaging: brand name; product name "milk"; product fat content; and product weight. The control group studied the visual perception of milk packaging without QR codes, while in the experimental group the same packaging was studied with QR codes. Their location was randomized according to the zones of interest.

Visual stimuli were projected onto a 24-inch monitor with a resolution of 1920x1080 pixels. In the study, a VT3 mini fixed infra-red iTracker was used. The iTracker was placed at a distance of 600mm from the subject. The correction angle did not exceed 0.5°, which corresponds to an error of the order of 5 mm. The detection algorithm for finding the centre of the pupil has a reliability of 98% with an accuracy for its detection zone of ±1 mm. Data processing was performed in EventID, and heat maps were obtained using OGAMA software. The array of data obtained on the subjects' oculomotor behavior totaled 395 sets of records.

4. RESULTS

The research algorithm used in the study included a model of aggregated data created by the research author, including 4 variables that appear on the package and which were included in the evaluation. These were brand, name «milk», fat status, and weight.

The first phase consisted of the measurement of the overall oculomotor fixations in the selected areas of interest in four experimental samples of the drinking milk package, as presented in Table 1.

Table 1. Overall Fixations on the Selected Areas of Interest (AIO) by Milk Pack, Ms.

Parameter (t_i^k), ms	**Chernomorskoe**	**Dzhankoyskoe**	**Crimean Milk Farmer**	**University milk**	**Milk Spring**
Brand	1112	956	1002	1064	697
Title	1527	487	649	364	838
Fat	512	484	24	140	622
Weight	354	102	426	287	6,44
Total time (T_i)	9272	7395	7530	11349	5487

As a result of the primary data measurements a significant accentuation of fixations was seen on the name of the milk trademark (brand). However, according to the different experimental packages tested during the experiment, the consistency of attention on the brands is different. For better understanding of the general trends and distinguishing of the total dependencies for the whole selection, the probabilities for the visibility of the visual objects was analyzed using the algorithm shown below.

The second phase in the analysis required calculation of the probability that the testee will see the analyzed variable (t_{ki}) on all packages. This is described by the formula (1):

$$P_k = \prod_{i=1}^{5} \frac{t_i^k}{T_i}, \qquad (1)$$

where P_k = the probability of visibility of the variable; t_i^k = fixation time on the selected element (variable) AOI, ms; and T_i = total fixation time on the slide.

In order to represent the data in a more appropriate way, allowing aggregation, the arithmetic average of visibility $\langle P_k \rangle$ of the four analyzed parameters is displayed.

For the results table, which includes the analysis of the probability of visibility of the parameters under study for the five brands of milk, the arithmetic average and geometric average values were calculated, as shown in Table 2.

The probability of brand visibility on all 5 packages was 100 thousand times stronger than for the weight of milk, five times stronger than the visibility of the name "milk", and 1000 times stronger than the visibility of the parameter of fat status.

The third phase involved the pairwise comparison of % average visibility of the object without differentiation by type of package. The average numbers of the visibility probabilities for the visual objects were used for calculation in the following formula, in order to keep the number order small enough for pairwise comparison (2):

$$\left\langle \frac{P_{brand}}{P_{weight}} \right\rangle; \left\langle \frac{P_{brand}}{P_{title}} \right\rangle; \left\langle \frac{P_{brand}}{P_{fat}} \right\rangle, \qquad (2)$$

where P_i^{brand} = probability of brand visibility; P_{weight} = probability of weight visibility; and P_{fat} = probability of fat status visibility.

The results of the pairwise comparison of the visibility of the four visual objects confirms the fact that the position where the name of the milk trademark (brand) is placed is the most noticeable for a consumer. This area has an average probability of noticeability 3.7 times higher than that indicated for the weight of milk. The brand was 32% more noticeable than the lettering "Milk" on the package and the brand attracts 3.1 times more attention than the marking of fat status of the product. It is possible to come to the mathematically proven conclusion that the application of a QR code from the point of view of its visibility is the most appropriate in the area where the milk trademark (brand) is placed.

Table 2. The probability of visibility of the studied parameters.

Parameter (t_i^k), ms	**Chernomorskoe**	**Dzhankoyskoe**	**Crimean Milk Farmer**	**University milk**	**Milk Spring**	P_k	$\langle P_k \rangle$
Brand	1112	956	1002	1064	697	$2{,}29\times10^{-5}$	0,49
Title	1527	487	649	364	838	$4{,}55\times10^{-6}$	0,37
Fat	512	484	24	140	622	$1{,}51\times10^{-8}$	0,16
Weight	354	102	426	287	6,44	$0{,}8\times10^{-10}$	0,13
Total time (T_i)	9272	7395	7530	11349	5487		

The fourth phase of analysis considered the rationale for the positioning of the QR code depending on the size of the standard milk package.

The standard milk package has a size of 24.4 cm long and 14 cm wide. The detection of consumers' attention zones was conducted on the basis of summing up of the total visual fixations expressed in milliseconds. The experimental packages were divided into five equal zones where visual attention was checked without reference to the parameters selected earlier. The experimental task was to analyze the areas of the testees' interest depending on the visual angle (Table 3).

The most visually significant area is in the range of 4.9–9.7 cm from the top of the package on the left. At the same time, it is necessary to take into account the layout of the informational text messages on the package and their closeness. This is confirmed in a qualitative study (Tobias Otterbing, 2013) where it was also proved that the text elements of the package are seen when placed on the left side of a retail container, whereas the graphic ones are seen if they are located on the right side. This leads to the recommendation that in order to make a QR code noticeable it must be applied on the right (from the viewer's side) part of a package as it is the most looked at.

The fifth phase involved the calculation of the information load index (I_{charge}) on the package. It is known that the presence of unnecessary information on a package distracts consumers' attention and often causes negative emotions. The survey of testees, according to the results of the experiment revealed that the retail container of the "Milk Spring" brand was perceived the most positively. In order to identify the reasons for this positive response, an information load index was used, calculated by the formula (3):

$$I_{charge} = 1 - (\sum_{i=1}^{5} \frac{T_i^{text}}{T_i^{background}}) \times 100\%, \quad (3)$$

where T_i^{text} is fixation time on text elements (brand, name, fat status, weight), ms; and $T_i^{background}$ is background fixation time, calculated by the ratio $(T_i - T_i^{text})$, ms.

Calculation of the information load index on visual objects (packages of milk) provides information explaining the attractiveness of certain consumers' samples. The less the informational load in textual format, the more favorably disposed the perception of the brand will be. According to these calculations, this index should not exceed 40%. This is partly consistent with the study (Pinya Silayoi, 2004), where it was asserted that visual elements are scrutinized only when consumers do not want to make any effort in choosing the necessary goods, when the package is "overloaded" with information. Studies conducted in the control

Table 3. Analysis of the Visual Significance of Milk Packages Depending on the Angle of View

Brand Name	**Chernomorskoe**		**Dzhankoyskoe**		**Crimean Milk Farmer**		**University milk**		**Milk Spring**	
Package size (length / width)	0-7 cm	7.1-14 cm	0-7 cm	0-7 cm	7.1-14 cm	7.1-14 cm	0-7 cm	7.1-14 cm	0-7 cm	7.1-14 cm
0-4.8 cm.	11717	3929	10426	113	11402	3195	29304	8276	11603	1316
4.9-9.7 cm.	61993	11761	25888	11370	45004	3158	54894	35999	35285	17899
9.8-14.6 cm.	36082	21334	47868	19723	28704	8250	36156	27559	23853	6157
14.7-19.5 cm	14047	3178	39985	431	13303	317	45670	20334	17189	732
19.6-24.4 cm.	21290	400	2074	185	20781	2377	1334	1831	11598	299

Table 4. The Resulting Data.

Parameter	Chernomor-skoe	Dzhankoys-koe	Crimean Milk Farmer	University Milk	Milk Spring
T_i, ms	9272	7395	7530	11349	5487
T_i^{text}, ms	3505	2029.2	2101.6	1855	2163.4
$T_i^{background}$, ms	5767	5365.8	5428.4	7639	3324
I_{charge},%	40%	63%	62%	52%	35%

(a) (b) (c) (d)

Figure 1. Packages with high (a, c) and low (b, d) information load.

group confirm the fact that overloaded packages cause more negative reactions (Figure 1).

The ratios of the number of fixations on a QR code on packages with high and low loads differ by 30%, as in the case of information overload of the package the number of fixations is higher, since the consumer is required to waste more neural resources. The results obtained in this work can be used as a practical tool for managing consumer attention when choosing milk.

5. CONCLUSION

According to the results of the data processing of the neuromarketing experiment, the best possible positions for a QR code on a soft milk package were identified. Thus, it is shown that the area where the name of the milk trademark (brand) is located is the most noticeable for a consumer, as a result of which the research hypothesis was confirmed. On average, this position has a probability of visibility 3.7 times higher than the weight of milk indication. The brand is 32% more noticeable than the lettering “Milk” on a retail container and 3.1 times more likely to attract attention than the fat status marking on the product. Therefore, the application of a QR code, from the point of view of its visibility, is the most appropriate in the area where the milk brand is placed. In addition, it is necessary to take into account the fact that the most viewed area by the testees is in the range of 4.9–9.7 cm from the top, with text forms on the left and with graphic forms on the right. Recommendations to increase the visibility of QR codes include applying it on the proper (from the view’s side) part of the package, as this part is most likely to be seen. The text layout on the package and the text closeness matter for effective visual perception. It is proved that the lower the information load in the form of text, the more favorably disposed the perception of a retail container will be.

In addition, the optimal placement of the QR code will ensure visibility and generate a set of labelling information so that the consumer cannot be deceived or misled

about the composition, properties, nutritional value, nature, origin, manufacturing and consumption method, as well as other information characterizing the quality and safety of the milk, and so that the consumer cannot mistake this product for another one similar to it in appearance or other indicators.

6. DIRECTIONS FOR FURTHER RESEARCH

The results obtained from the study of consumer behavior in the milk market can be used in the practical activities of enterprises engaged in the production and sale of dairy products. Unfortunately, local producers do not take into account the peculiarities of consumer behavior and do not pay sufficient attention to more effective information transmission using QR codes on the soft packaging of dairy products.

Further research should be connected with the study of the visual visibility of cryptomarking in both foveal and peripheral vision, making it possible to understand the situational behavior of a consumer in the decision-making process.

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