



Investigating the effect of external reference prices' representation on consumer behaviour with eye-tracking method

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Abstract

According to the core principle of behavioural economics, consumers frequently apply heuristics when deciding which can lead to biased perceptions and decisions. In our investigation we concentrated some particular types of these heuristics, namely loss aversion, framing and reference point, when investigating the effect of external reference prices' representation on consumers' price evaluation and decision-making. In our research we implemented an eye-tracking method and complemented it with interviews and a short attitudinal survey at the end of the experiment. Our aim was to investigate the effect of the above-mentioned biases on consumers' price evaluation and decision-making. We found that those who fixated on the prices longer could recall them more precisely. Furthermore, we found, that people concentrate more on the original prices when evaluating a sale offer, therefore, it is advisable to highlight the original price, which is a reference point, instead of the sale price. Surprisingly we found a negative connection between price consciousness and the fixation duration spent on the prices.

Keywords

behavioural economics, eye tracking, framing, loss aversion, reference price.

JEL Classification: M31, D12

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Investigating the effect of external reference prices' representation on consumers' price evaluation and decision-making with eye-tracking method

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1. Introduction

In the last few decades, the consumer society has outgrown itself, creating an unlimited number of products and services on the global market. People are surrounded by so much information and so many offers that it is impossible to follow. For example, Amazon, which is the biggest e-commerce company, sells more than 12 million products. In this consumer environment it is very hard to choose the perfect option. In addition, the appearance and the increasing usage of dynamic pricing make it even more difficult for people to compare offers, because those are personalized based on their previous online activities and purchases. For this reason, when deciding, it is getting more difficult for consumers to rely on their own price knowledge or internal reference prices.

Neoclassical economics consider people as rational decision-makers who are provided with all the information about their decision and always choose the best alternative. From our everyday life we know that it is impossible, because we do not even have all the necessary information to decide rationally. It is also proven that the decision-making of people depends on their emotions, traditions, norms and many other factors. In the 1970s', behavioral decision-making and its research, the new subdiscipline of psychology, had a big influence on economics and led to the appearance of behavioural economics (Anger and Loewenstein, 2012). The most well-known names in behavioural economics are Daniel Kahneman and Amos Tversky. After years of empirical observations and research, they identified several heuristics and connected biases. Based on these, they created an alternative model of consumer decision-making, called "Prospect Theory" (Kahneman and Tversky, 1984; Angner and Loewenstein, 2012; Kahneman, 2011). One of the mental shortcuts, or so-called "heuristics", they identified is anchoring and adjusting, which is related to the reference point effect mentioned in prospect theory. Anchoring and adjusting means that external stimuli can get stuck in our minds. For this reason, people usually make their estimations and deci-

sions based on these initial points. This is mostly an external stimulus, which we can recall from our memory. Different initial points can lead to different decisions and they bias the evaluation towards the initial reference point. This phenomenon is called the anchoring effect (Tversky and Kahneman, 1974; Thaler and Sunstein, 2008). The above-mentioned initial point can also be called a reference point. Reference points are essential for people to be able to make comparisons and evaluations (Kahneman, 2011). As Ariely (2008) says, everything is relative and the reason why reference points are so important is because we evaluate the offers and make decisions based on this comparison (Kahneman, 2011).

This phenomenon has also been investigated in the case of prices, where we can call this initial point a reference price. Several previous studies proved that reference prices as well as the display of internal reference prices can bias and have an effect on the price perception and price evaluation of people. For this reason, in our study we investigated the impact of external price display on consumers' price evaluation and choice. Our aim was to identify specific patterns in consumers' behaviour as well as the factors that influence them when making decisions and evaluations.

2. Literature Review

In this section we explain all the heuristics, phenomena and pricing techniques that we investigated during our research. First of all, reference price and external reference price, which were the focus of our study, have to be defined.

We can identify the above-mentioned reference point effect in the case of prices and then we can call it a reference price. This refers to the process when consumers evaluate and compare prices to a "standard" price (Cheng and Monroe, 2013). Therefore, reference price by definition is the price we compare to the price of other products (Niedrich, Sharma and Wedell, 2001). It can be a price that we recall from our memory (Kotler, Keller, Brady, Goodman and Hansen 2012) or it

can mean all the available prices of other products in the store (Reketye and Liu, 2018). The former is called “internal reference price” while the latter is the “external reference price”. External reference prices occur when retailers display both the original and the sale price of an offer (Reketye and Liu 2018; Cheng and Monroe, 2013). Furthermore, when buying, the consumers not only compare the sale price to the original one, but also take the prices of other products within the same product category into consideration (Manning and Sprott, 2009). Therefore, the competing brands provide important reference prices at the place of purchase (Bolton and Shankar, 2003).

The other phenomenon that has to be mentioned is loss aversion. This indicates that people typically overestimate losses relative to gains. Research shows that losing something causes twice as much sadness as the happiness we feel when gaining the same thing (Thaler and Sunstein, 2011). This means that people hate losing and like the feeling of gaining or winning something. That is why framing, which is the next phenomenon, is important. The point of framing is that the choice of consumers is biased by, and partly based on, how the problem is presented. This means that we can present something either in a positive or in a negative way (Kahneman and Tversky, 1984). In the case of prices, the visual presentation can also be a framing technique (Santana et al., 2020). Coulter and Coulter (2005) found that the size of a price influences how large consumers perceive it. Thus, a promotional price with a smaller size is perceived as more advantageous, as it is consistent with the magnitude of the price.

Other factors that can have an influence on the perception of prices is their spatial and visual representation and positioning. Price understanding, price comparison, price perception and evaluation, are also influenced by the font, colour, shape, size and placement of the prices (Reketye and Liu, 2018). When a comparative price display is used, the original and discounted prices are side by side. They can be displayed vertically or horizontally; close together or with distances between them. Sometimes consumers will notice the higher price first, but other times the lower price. These all affect evaluation, but it is not exactly clear how (Cheng and Monroe, 2013). Weiser (2016) mentions another method of price display, which he calls “extreme positioning”. This refers to the phenomenon of highlighting the base price of a product, which is extremely high, and then displaying the actual price to be paid below it in smaller and thinner font. He says that, because of the perceptual contrast, the customer will be more likely to understand the discount and buy the product if it is displayed this way.

Another pricing technique, which is connected to our research, should be mentioned here. It is the so-

called “multidimensional” pricing. A price is multidimensional if it consists of more than one piece of numerical information and the consumers need to make calculations to determine the real cost (Estelami, 2003). Understanding and comparing multidimensional prices, therefore, requires much more complex cognitive processes, as mathematical calculations are needed to understand the actual price (Reketye and Liu, 2018). Previous research shows that most people do not consider all the dimensions of prices but focus on one or two elements. As the number of dimensions rises, the degree of simplification increases, and heuristics occur. Consumers' attention to a particular price component depends on the relative importance of it compared to the other components of the price (Kim and Kachersky, 2006). Therefore, price components can provide a reference point to evaluate each other. Furthermore, in the case of multidimensional prices, it has been found that consumers tend to focus on one important component and ignore all or some of the other components (Estelami, 2003).

In our experiment we used eye tracking, which shows what the participants looked at on the given stimuli pictures. In the case of offers and prices it is not exceptional to use eye tracking for investigation, however, the literature regarding this topic is limited. Ngan et al. (2020) investigated the gaze of people in the case of restaurant menus and prices. They found that the menu layout has a significant impact on the meal choice; what is more, they found differences between the gazing of more and less price conscious consumers. Another study investigated how the red highlight of prices affects consumers' perceptions on savings in a certain store. It was found that when only one price in the store is highlighted with red colour (instead of only black price displays), it lowers consumers' perceived savings during buying in the store (Ye et al., 2020). This supports the idea that price highlights can have an impact on consumers' perceptions not only about the product, but also about the store itself. Bogomolova et al. (2020) studied how the position, font size, signposting and the colour on the price label influences consumers' eye movements when deciding. They found that the enhanced label design increases the number of eye fixations, especially when the price is highlighted and the consumer is less price conscious. They also found that the higher number of fixations had no effect on the final product choice. These experiments show that the display of prices can influence the decision of consumers, which can be investigated with eye-tracking methods. Dos Santos et al. (2015) also supports the utilization of eye-tracking methods in pricing analysis in order for marketers to obtain more insights into the effect of selling price, reference price, colours of prices, amounts of sale prices (in currency or percentage) and develop their strategies, flyers or offers accordingly.

3. Methodology and Data

In our research we aimed to investigate the above defined phenomena. In two cases we wanted to see the effect of multidimensional prices, their framing and loss aversion on consumers' decision-making. In one case we investigated the effect of displaying the sale and the original prices differently, while in our last offer we wanted to see whether the positioning of the price of a travel package has any effect on the evaluation and buying intention of people.

The experiment took place at the University of Szeged, Faculty of Economics and Business Administration in Hungary, June 2021 with a fixed eye-tracking camera. In our research, we conducted an eye-tracking experiment with 26 participants. According to the literature, in the case of eye-tracking experiments a sample size of around 30 people can provide reliable data (Lázár and Szűcs, 2020; Bercea, 2013; Nielsen and Pernice, 2009). The participants could apply to take part in the experiment voluntarily. All participants of the investigation were students of the University of Szeged, however most of them (18 people) were from the Faculty of Economics and Business Administration. The majority (17 students) were men, but there were also 9 women volunteers. The average age of the participants was 22.6 years. Twenty-two of the participants were bachelor and 6 were master students. We collected the data of the eye tracking using a Tobii Pro X2-30 fixed eye camera and its software and analyzed the data in Excel, based on the outputs made by the software. The software also created heat maps of the eye movements of the participants. The experiment was carried out on computers, however the shopping situation was not the same as during online shopping. We only displayed the offers on the screen and asked the participants about which product they would buy if it was a real purchase situation. The participants were divided into two random groups of 13 people at the beginning of the experiment, which we named group X and group Y. In group X there were 5 females and 8 males, while in the other group comprised 4 female and 9 male participants. The groups received slightly different stimuli pictures, which only differed either in the display or positioning of the price, or the framing of the multidimensional prices. This way we could compare the results of the two groups according to the price display. During the eye tracking, participants had to decide which offer they would choose or whether they would buy the offer or item. In some cases (travel trip and chocolate) they had to rate the offer on a 1 to 5 Likert scale, where 1 meant that they "do not consider the offer good at all", while 5 meant that they "consider the offer to be very good". Furthermore, in the case of the stimuli picture of a bar of Milka chocolate they also had to estimate the

average price of the product. In the analysis we calculated the sum of the duration and frequency of the fixations in the areas of interest (AOIs). AOIs are defined on the image, which can be determined by the software before the experiment (Korpás and Szabó, 2019). Fixation occurs when the eyes stop moving and the participants gaze at certain points of the picture (Feng, 2011). It is during fixations that the actual information is absorbed, which triggers the cognitive processing of stimuli (Korpás and Szabó, 2019). In the case of our research these AOIs were the prices and the products on the stimuli images. The eye tracking was followed by a short interview, where we had a chance to further investigate the reasons behind the participant's decisions. In this section they were also asked to recall prices or discounts they had seen during eye tracking. At the end of the experiment, they also had to fill out a short questionnaire, which contained attitudinal questions of their price consciousness as well as demographic information, which gave us further grouping possibilities. The results of the attitudinal grouping and the interviews are mentioned in this paper only when they provide any additional information or interesting findings to the eye-tracking results.

In our research we used images of either FMCG products, like pizza and chocolate, which we buy on a daily basis, or products which are known to everybody (unisex jacket). The only exception from these was an offer of a trip to Prague, where we provided not only the price but more information about the offer. In this case we wanted to investigate the effect of price positioning compared to the position of all the other information. Furthermore, the prices of the products were given in Hungarian currency. During our research 1€ was equal to 350–360 Forints. It also has to be mentioned that the prices of the Prague trip and Milka chocolate were real, taken from the webshop of a multinational retail chain and a travel agency. In the case of the two other products (jacket and pizza) we used hypothetical prices based on the average prices of these products in Hungary.

4. Empirical Results

The results of the different methods are presented in a thematic order below. The first two stimuli pictures of our investigation were aimed at investigating the framing of multidimensional prices and the effect of loss aversion. First, both of the groups received an offer of two unisex jackets, which were totally the same but sold by different webpages (Figure 1). On the left-hand side of the stimuli picture of both groups the jacket's (A) price was 10,500 Ft and they had to pay 1500 Ft for the shipping. This part of the offer was the same for both groups. While on the right-hand side of the picture there was the same jacket (B) with an original price of

15,000 Ft and an additional 20% discount. The difference between the two groups was that in the case of group X we emphasized that there was additional free shipping in case of the B jacket. The prices of the jackets were multidimensional in all cases, because they were split into different parts and participants had to make a calculation to determine the real costs of the offers. Furthermore, we framed the same jacket with the same price in the case of the offers, however the A offer contained a loss, which was the shipping cost, while the B offer contained one or two gains (discount, free shipping). We assumed that more people would choose offer B, where they have no losses and have one or two gains. Furthermore, that the number of participants who would buy jacket B would be higher in group X, where the additional free shipping information was added to the offer.



Figure 4-1 The jacket offers for the two groups.

Source: own editing.

Surprisingly, we found that in both groups most of the people would have bought jacket A. However, in group X the ratio of people who wanted to buy it was higher (46.2%) compared to the other group (30.8%). Therefore, we reject our first assumption, because most of the people would have bought jacket A. However, we can accept the other assumption, because in group X more people wanted to buy jacket B. Based on the interviews we can say that in the case of those who wanted to buy jacket B, the discount had an influencing role and that they assumed that the quality of a jacket with a higher original price is better, despite having been told that the products were the same. In group X, free shipping also had an effect on the choice. In the case of those who chose jacket A, one of the main reasons was that it was easier for them to calculate the price of it and the other was that it seemed cheaper at the first look.

We also assumed that those who fixated longer or more frequently on the price or the discount of the offers could recall it better. From the results of the eye-tracking data and the results of price recall we can say that in the case of prices, this assumption has to be rejected, because we did not find any connections between these two variables. However, in the case of the discount, those who looked at it longer and more frequently could recall it more precisely. The reason behind this could be that people concentrate more on the discounts than the prices themselves, or it may also be that it was a smaller number, which is easier to remember. We also found that in group X, where we had the additional information of the free shipping, people could not recall the price as well as in the other group, which can be explained by there being more information. In Figure 2 it can also be seen that the attention of those in Group X was less focused because of there being more information. Darker colours always indicate longer fixations and people fixated the longest on the parts indicated by the red colour. Based on this, we can say that when marketers use more information people will be less likely to remember the prices.

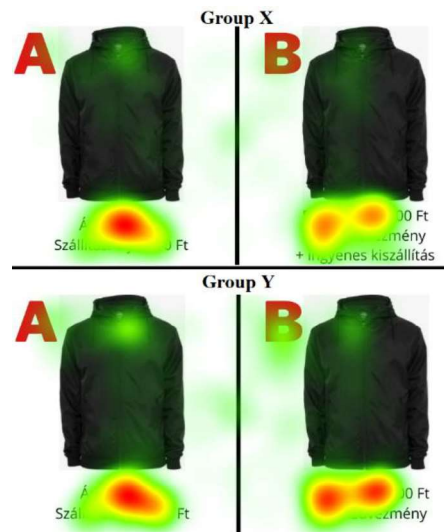


Figure 4-2 Heat map results of the jacket offer in the two groups.

Source: own editing.

We investigated the same phenomena with another product category, to find out whether there are similarities or differences if we want to sell something else. In this case the offers were about the same pizzas. As can be seen on Figure 3, pizza A was the same for both groups. It cost 1,500 Ft and had an additional shipping fee of 390 Ft. In the case of pizza B the participants knew the original price (2100 Ft), had the same discount of 10% and this time group Y had the additional free shipping emphasized in the offer. But again, all of

the offers had the same total cost. So, here we also applied multidimensional prices and framed them with losses or gains. We assumed that most of the participants would choose pizza B, and in group Y the ratio of people who chose it would be even higher.

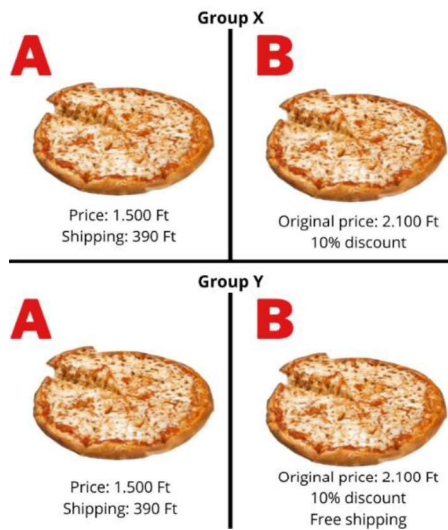


Figure 4-3 Pizza offers in case of the two groups.
Source: own editing.

We found that more people chose pizza A (57.7%). However, in group Y more people (53.8%) chose pizza B. Participants who chose pizza A explained it based on three main things. First, they said that it seemed cheaper because of the price, second, they could calculate the final cost in the case of this display more easily, and the third thing, which was especially mentioned by the participants of group X, was that they had no information about the shipping of pizza B, so they assumed, that it would be an additional cost. Probably, this result was a bit biased by the previous stimuli picture, where group X had information about the free shipping of the jacket. Therefore, in the case of pizza B, where free shipping was not emphasized, they thought it had an invisible cost. Those who chose pizza B were convinced by the discount, and especially in group Y, by the free shipping. In this group, of the seven people who chose pizza B, five mentioned free shipping as the main decision-influencing factor. The heat maps of the offers can be seen in Figure 4.

With regard to price recall, we found that those who fixated longer or more frequently on prices could recall them a bit better than those who did not look so long or often at them. This connection was even stronger in the case of the recall of the shipping cost in both groups. To sum up, of the 26 participants, 14 could recall exactly the same shipping cost and 12 the price of pizza B. We also found that the absolute error when recalling prices was smaller in the case of the shipping cost,

which was initially a smaller number. This supports the fact that it is easier to remember smaller numbers.

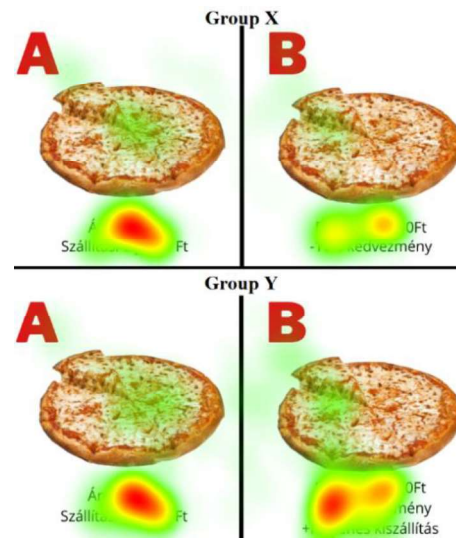


Figure 4-4 Heat map results of the pizza offer for the two groups.

Source: own editing.

In the next section of our experiment, we were interested in how the representation and positioning of prices influence people. In the first picture, participants were shown a travel offer to Prague (Figure 5). The only thing that differed in the case presented to the groups was the positioning of the price. The content of the offer and the picture was the same in the two stimuli pictures. In the case of group X, the price showed up at the end of the offer, while in the other group it was placed on top of the offer.



Figure 4-5 The travel offers for the two groups.

Source: own editing.

We asked the participants to decide whether they would pay for this trip and also to evaluate the offer on a 1–5 Likert scale (where 1 meant that they “do not consider the offer good at all”, while 5 meant that they “consider the offer to be very good”). We assumed that in group X, where the price was positioned at the bottom of the picture, people would first read the content and then look at the price, therefore they will evaluate the offer better and would be more willing to pay for the trip. With regard to this, we did not find any differences between the two groups. A majority (61.5%) of the people would have paid for this trip and rated it as 4 or 5 on the Likert scale in both groups, which means that they really liked the offer. However, this ratio was higher (69.2%) in Group X, where the price was displayed on the bottom, while in Group Y this ratio was 53.9%.

The average point of all participants was 3.7 points based on the scale. Even from those who would not pay for this trip, there were people who considered it a good offer. Their reason for not buying this trip was that they would not have been interested in all the programmes or they do not like to travel with tourist buses. Others who would not go to Prague explained that it was due to the high price or the fact that they would be able to organize it for themselves for less money. Those who chose to go on the trip were all satisfied with the price, and they evaluated the content of the offer as excellent. We also assumed that participants of group Y would fixate more and for longer on the price. The results supported our assumption. We found that people in group Y fixated, on average, for 4.08 seconds on the price, while in the other group this duration was only 2.55 seconds. In addition to this, the average number of fixations on the price was 15.23 in the case of group Y while in group X this number was 9.08. The results of the heat maps also support this (Figure 6).

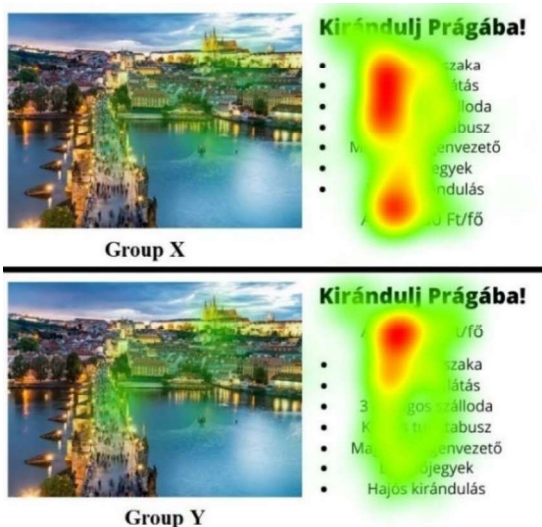


Figure 4–6 Heat map results of the Prague trip offer for the two groups.

Source: own editing.

The darker (red) colours indicate a longer fixation on a certain part of the stimuli picture. From this we can see that in the case of those who had the price on top of the offer, there was a stronger emphasis on the eye movement compared to the other parts of the whole stimuli picture. In group X, price was also important, but here it was equally important as the offer itself.

Based on these results, we can say that the positioning of the price within the offer has an influence on consumers. In addition to this, we have to mention that during the interviews many people from group Y said that they think it is better to display the price at the bottom of the offer. In contrast to this, participants of group X said that regardless of the position, they looked at the price first and only started to read the offer after that. This supports the result that the positioning had no influence on the evaluation and choice in the two groups. We also tried to find a connection between price consciousness and the duration of fixation on the price but surprisingly in the case of this offer we found none.

In our other example we wanted to see how the presentation of original and sale prices influences the decision to buy, the price evaluation and the price recall of our participants. In the stimuli picture this time we had a bar of Milka chocolate (Figure 7). In the original pictures the bold texts (group X original price; group Y sale price) were emphasized with a red colour.

The offers of the groups only differed in the emphasized price. In the case of group X, the original price was bigger and coloured red, while in the other group the sale price had the same characteristics. We assumed that participants of group X where the original price, which is a reference point, was highlighted, would be more willing to buy the product and rate the offer better on a 1 to 5 Likert scale.



Figure 4–7 Milka chocolate and the representation of its prices in case of the two groups.

Source: own editing.

The results proved these assumptions. All 13 participants of group X wanted to buy the chocolate for this price, while in the other group three people said no to the offer. This means that 88.5% of the participants would have bought the chocolate at the sale price. Furthermore, in group X the ratio of those people who rated this offer with the maximum 5 points (20.41%) was

double compared to group Y (10.64%). The average point based on the Likert scale was 3.7. Here, we also found that more price-conscious people fixated on the prices for a shorter time on average. The less price-conscious participants spent more than 50% longer time on the prices compared to the more price-conscious people. The most important finding in the case of these stimuli pictures was that in group X, where the original price was highlighted, people fixated on it by 69% more than on the sale price, while in the other group the difference was only 7%. This is a significant difference. Similar results occurred when we investigated the duration of fixations. Participants in group X spent 83.4% more time on the original price compared to sale price, while in group Y we observed a difference of 11.7%. However, as can be seen in Figure 8, even in the case of group Y, where the sale price was highlighted, the focus and attention of participants were more on the original price, which acts as a reference point for them to be able to make comparisons to. Therefore, the representation of the original price is very important in the case of sale offers; what is more, it should be highlighted instead of the sale price.

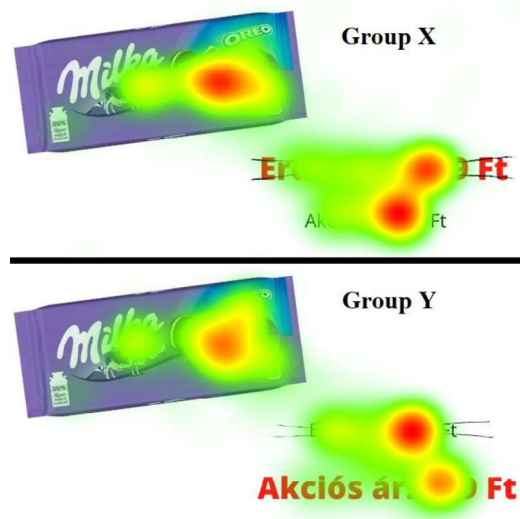


Figure 4–8 Heat map results of the Milka chocolate offer in the two groups.

Source: own editing.

5. Conclusion

In our experiment, we aimed to investigate the effect of the representation of external reference prices on consumers' choice, evaluation and perception. During the investigation we also considered the effect of other decision biases, such as framing, loss aversion, multidimensional pricing and the effect of different price displays. We used an experimental method, eye tracking, which we combined with an interview and a short survey about price consciousness. Our participants were

divided into two equal groups, so we had a chance to compare the effect of additional information, the positioning of the price or the highlighted price. Based on our results, we can conclude that those people who fixated longer on prices could recall them more precisely – that is hardly surprising, however it can be considered as a validation of our method, as it showed that the results of the eye tracking were in accordance with the results of the interview and survey. We also found that there is no connection between price consciousness and the duration of fixation or that the connection is negative, which means that the more price-conscious people looked at the prices for a shorter time. This is an unexpected result and can be explained by the fact that they already had a more precise price knowledge, so they only needed a short refreshment of their knowledge. Last, but not least, the importance of the original price has to be mentioned. We found that even when the sale price is highlighted next to the original one, people spend more time observing the original price. This can be considered as an important managerial implication as in the case of sale offers it is recommended to highlight the original price rather than the sale price. The summary table of the investigated distributions and averages in the case of all offers can be seen below in Table 1. (Empty cells mean that in the case of that offer we did not investigate that particular indicator.)

Table 5–1 The distributions and average Likert point in case of the offers

Offer	Group	Ratio of people who would choose offer B, %	Ratio of people who would buy the product, %	Average Likert scale point
Jacket	X	46,2	-	-
	Y	30,8	-	-
	Total	38,5	-	-
Pizza	X	30,8	-	-
	Y	53,9	-	-
	Total	42,3	-	-
Prague trip	X	-	61,5	3,69
	Y	-	53,9	3,69
	Total	-	57,7	3,69
Milka chocolate	X	-	100	3,77
	Y	-	79,9	3,62
	Total	-	88,5	3,69

Source: own editing.

Our research had some limitations, which also have to be mentioned. We could only ask 26 participants instead of the previously planned 40, which was caused by the pandemic situation. For this reason, we had fewer data than expected. Furthermore, based on the interviews and feedback we should rethink the products we used in the experiment. All in all, it was very interesting for us to see how people explained their ways of doing calculations and the reasoning behind their decisions. Regarding these, it was also interesting to see the differences between the less and more price-sensitive people. For these reasons we think that in the future, the effect of reference prices should be investigated in more depth with more participants, other product images and by focusing more on the differentiation of price-consciousness and price-sensitive groups.

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