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## Investigating the effect of external reference prices' representation on consumer behavior with eye tracking method

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### Abstract

According to the core principle of behavioral economics, consumers frequently apply heuristics when deciding which can lead to biased perceptions and decisions. In our investigation we concentrated some peculiar 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 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' behavior. 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

Behavioral Economics, Reference Price, Framing, Loss Aversion, Eye Tracking

**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 consumer society outgrows itself causing an unlimited number of products and services on the global market. People are surrounded by so much information and offers that it is impossible to follow. For example, only 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 to this the appearance and the increasing usage of dynamic pricing make even more difficult for people to compare offers, because those are personalized for them 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 by 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 the emotions, traditions, norms and many other factors. In the 1970's behavioral decision making and its research, the new sub-discipline of psychology, had a big influence on economics and led to the appearance of behavioral economics (Anger and Lowenstein, 2012). The most well-known names in behavioral economics are Daniel Kahneman and Amos Tversky. After years of empirical observations and researches 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, 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 into our minds. For this reason people usually make their estimations and decisions 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 anchoring effect (Tversky and Kahneman, 1974; Thaler and Sunstein, 2008). The above mentioned initial point can also be called 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, because we evaluate the offers and make decisions based on this comparison (Kahneman, 2011).

This phenomenon has been also investigated in 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 which influence them when making decisions and evaluations.

## 2. Literature Review

In this section we are going to explain all the heuristics, phenomena and pricing techniques which had been investigated during our research. First of all, reference price and external reference price which was in the focus of our study has to be defined.

We can identify the above mentioned reference point effect in case of prices and then we can call it a reference price. It 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 and Sharma and Wedell, 2001). It can be a price which 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

external reference price. External reference prices occur when retailers display both the original and the sale price of an offer (Rekettye and Liu 2018; Cheng and Monroe, 2013). Furthermore, the consumers when buying 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 which has to be mentioned is loss aversion. It 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. It means that we can present something either in a positive or in a negative way (Kahneman and Tversky, 1984). In case of prices, the visual presentation also can 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.

The other factor which 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, color, shape, size and placement of the prices (Rekettye and Liu, 2018). When 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 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 (Rekettye and Liu, 2018). Previous researches show that most people do not consider all the dimensions of prices, but focus on 1 or 2 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 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 gazing of people in 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. In another study it was investigated how the red highlight of prices affect consumers' perceptions on savings in a certain store. It has been found, that when only one price in the store is highlighted with red color (instead of many red price highlights), it lowers consumers' perceived savings from 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 color 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 that 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 get more insights about the effect of selling price, reference price, colors 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 in Hungary on 2021 with a fixed eye-tracking camera. In our research, we conducted an eye tracking experiment with 26 participants. According to the literature, in case of eye tracking experiment a sample size around 30 people can provide reliable data (Lázár and Szűcs, 2020; Bercea 2013; Nielsen and Pernice 2009). The participants could apply to the experiment voluntarily. All participants of the investigation were the students of University of Szeged, however, the most of them (18 people) were from the Faculty of Economics and Business Administration. Most of them (17 students) were men, but we also had 9 women volunteers. The average age of the participants was 22.6 years. 22 people from the participants were bachelor while 6 of them were master students. We collected the data of the eye tracking with 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 an online shopping. We only displayed the offers on the screen and asked the participants about which product they would buy if it would be 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 Y. In group X there were 5 female and 8 male, while in the other group 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 very good". Furthermore, in 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 fixations' durations and fixations' frequencies in case of the AOIs. AOIs are defined as the "Areas of Interest" on the image, which can be determined by the software before the experiment (Korpás and Szabó, 2019). Fixation occurs when the eye 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 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 demographical 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 for 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 multinational retail chain and a travel agency. In 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 was aiming to investigate 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 side of 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 side of the picture there was the same jacket (B) with an original price of 15.000 Ft and additional 20% of discount. The difference between the two groups was that in case of group X we emphasized that there is 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 calculate to determine the real costs of the offers. Furthermore, we framed the same jacket with the same price in case of the offers, however, A offers contained a loss, which was the shipping cost, while B offers contained one or two gains (discount,

free shipping). We assumed that more people will 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 will be higher in group X, where the additional free shipping information was added to the offer.

**Figure 1** The jacket offers in case of the two groups



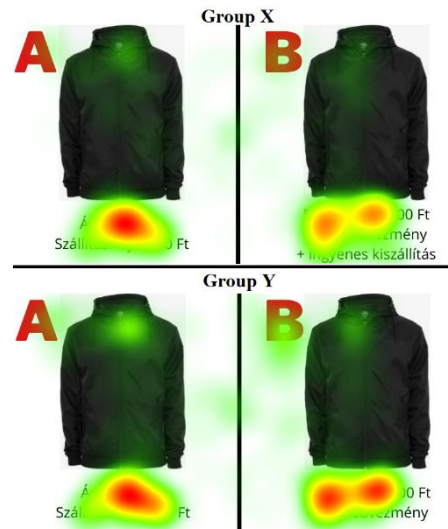
Source: own editing

Surprisingly, we found that in both groups most of the people would have bought jacket A. However, in group X the ratio of people of 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 one, because in group X more people wanted to buy jacket B. Based on the interviews we can say, that in case of those who wanted to buy jacket B, the discount had an influencing role, as well as, they assumed that the quality of a jacket with a higher original price is better, despite they were told that the products are the same. In group X free shipping also had an effect on the choice. In case of those who choose 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 for the first look.

We also assumed that those, who fixated longer or more frequently on the price or the discount of the offers, they can recall it better. From the results of eye tracking data and the results of price recall we can say that in case of prices this assumption has to be rejected, because we did not find any connections between these two variables. However, in case of the discount those, who looked at it longer and more frequently could recall it more precisely. The reason behind this can be, that people concentrate more on the discounts than the prices themselves, or it can also be, that it was a smaller number which is easier to remember for. We also found that in group X where we had an additional information

of the free shipping, people could not recall the price as well as in the other group, which can be reasoned by the more information. On Figure 2 it can also be seen, that the attention of people in Group X were less focused, because of the more information. The darker colors always indicate longer fixations and people fixated the longest on the parts indicated by red color. Based on this we can say that when marketers use more information people will be less likely to remember the prices.

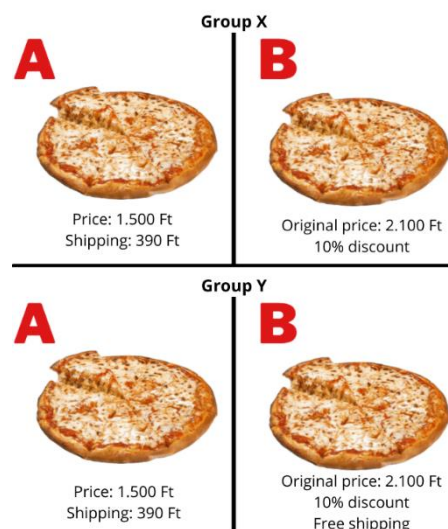
**Figure 2** Heat map results of the jacket offer in case of the two groups



Source: own editing

We investigated the same phenomena with another product category, to find out if there are similarities or differences if we want to sell something else. In this case the offers were about the same pizzas. As it can be seen on Figure 3, pizza A was the same for both of the groups.

**Figure 3** Pizza offers in case of the two groups

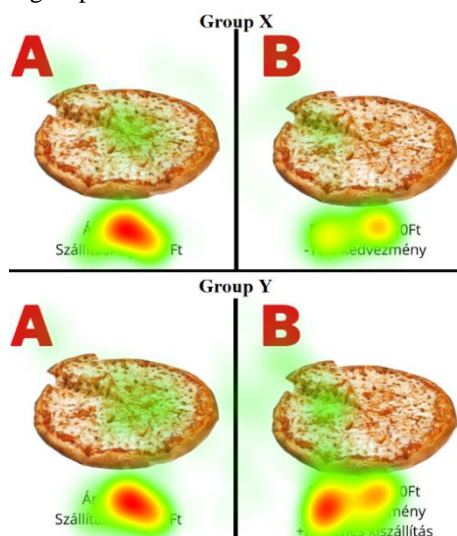


Source: own editing

It cost 1500 Ft and had an additional shipping fee of 390 Ft. In 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 people will choose pizza B, and in group Y the ratio of people who choose it will be even higher. 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 reasoned it with 3 main things. First, they said that it seemed cheaper because of the price, second, they could calculate the final cost in 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 will occur as 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 case of pizza B where free shipping was not emphasized, they thought it has an invisible cost. Those who choose pizza B were convinced by the discount, and especially in group Y, by free shipping. In this group from the 7 people who chose pizza B, 5 mentioned free shipping as the main decision influencing factor. The heat maps of the offers can be seen on Figure 4.

About 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 case of the recall of the shipping cost in both groups.

**Figure 4** Heat map results of the pizza offer in case of the two groups



Source: own editing

To sum up, from 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 case of the shipping cost, which was initially a smaller number. This supports the fact that it is easier to remember for smaller numbers.

In the next section of our experiment, we were interested about how the representation and positioning of prices influence people. On the first picture participants were shown a travel offer to Prague (Figure 5).

**Figure 5** The travel offers in case of the two groups



Source: own editing

The only thing which differed in case of the groups was the positioning of the price. The content of the offer and the picture was the same on the two stimuli pictures. In case of group X the price showed up at the end of the offer, while in the other group it was placed on the top of the offer. 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 very good”). We assumed that in group X, where the price was positioned to the bottom of the picture, people will first read the content and then look at the price, therefore, they will evaluate the offer higher and would be more willing to pay for the trip. Regarding this, we did not find any differences between the two groups. 61.5% of the people would have paid for this trip, and rated it to 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

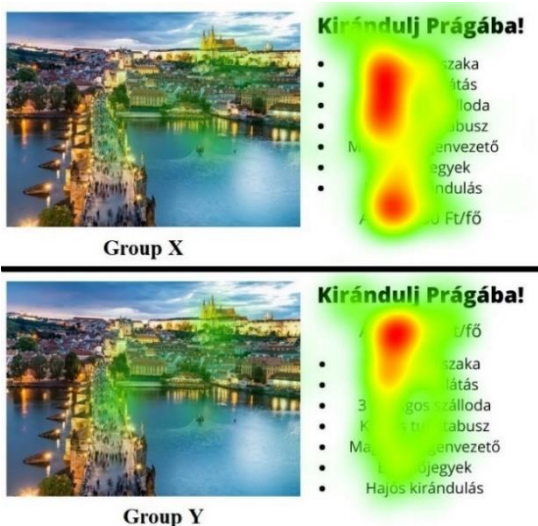


would not be interested in all the programs or they do not like to travel with tourist buses. Others who would not go to Prague reasoned it with the high price or the fact that they would be able to organize it for themselves for less money. Those, who chose to go to the trip all were satisfied with the price and they evaluated the content of the offer excellent. We also assumed that participants of group Y fixated more and longer on the price. The results supported our assumption. We found that people in group Y fixated on average 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 case of group Y while in group X this number was 9.08. The results of the heat maps also support this (Figure 6).

The darker (red) colors indicate the longer fixation on a certain part of the stimuli picture. From this we can see that in case of those, who had the price on top of the offer, it had a bigger 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 nevertheless 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 found connection between price consciousness and the duration of fixation on the price but surprisingly in case of this offer we did not find any.

**Figure 6** Heat map results of the Prague trip offer in case of the two groups.



Source: own editing

In our other example we wanted to see how the presentation of original and sale prices influence the decision, the price evaluation and the price recall of our participants. On 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 red color.

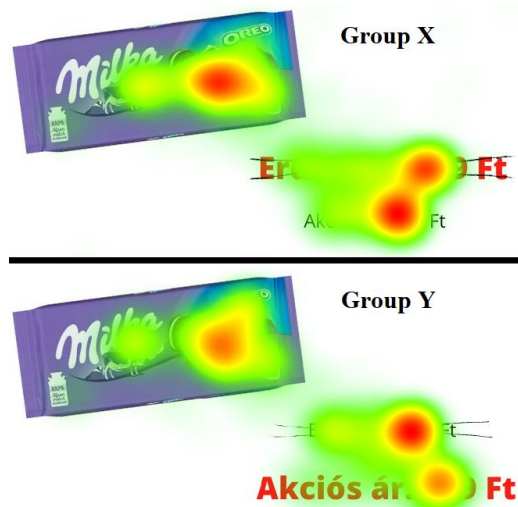
**Figure 7** Milka chocolate and the representation of its prices in case of the two groups.



Source: own editing

The offers of the groups only differed in the emphasized price. In case of group X the original price was bigger and colored to 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, will be more willing to buy the product and rate the offer higher on a 1 to 5 Likert scale. The results proved these assumptions. All the 13 participants of group X wanted to buy the chocolate for this price, while in there other group 3 people said no for the offer. This means that 88.5% of the participants would have bought the chocolate on the slae price. Furthermore, in group X the ratio of those people who rated this offer for the maximum 5 point (20.41%) were double compared to group Y (10.64%). The average point based on the Likert scale was 3.7 points. 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 by more than 50% longer time on the prices compared to the more price conscious people. The most important finding in case of these stimuli pictures was that in group X where 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 of group X spent by 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 it can be seen on Figure 8, even in case of group Y, where the sale price was highlighted, the focus and attention of people were more on the original price which acts like a reference point for participants to be able to make comparisons to. Therefore, the representation of the original price is very important in case of sale offers, what is more, it should be highlighted instead of the sale price.

**Figure 8** Heat map results of the Milka chocolate offer in case of 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 bias like framing, loss aversion, multidimensional pricing and the effect of different price displays. We used an experimental method, eye tracking which we combined with 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 barely surprising, however it can be considered as a validation for our method, as it showed that the results of the eye-tracking were in accordance with the results of interview and survey. We also found that between price consciousness and the duration of fixation either has no connection or the connection is negative, which means that more price conscious people looked at the prices for a shorter time. This is an unexpected result and can be explained by 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 with the observation of the original price. It can be considered as an important managerial implication that in case of sale offers it is recommended to highlight the original price instead of the sale price. The summary table of the investigated distributions and averages in case of all

offers can be seen below in Table 1. (Empty cells mean that in case of that offer we did not investigated that certain indicator.)

**Table 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	-	-
	<b>Total</b>	38,5	-	-
Pizza	X	30,8	-	-
	Y	53,9	-	-
	<b>Total</b>	42,3	-	-
Prague trip	X	-	61,5	3,69
	Y	-	53,9	3,69
	<b>Total</b>	-	57,7	3,69
Milka chocolate	X	-	100	3,77
	Y	-	79,9	3,62
	<b>Total</b>	-	88,5	3,69

Source: own editing

Our research had some limitations which also have to be mentioned. We could only ask 26 instead of the previously planned 40 participants, which was caused by the pandemic situation. For this reason we had less data than expected before. Furthermore, based on the interviews and feedbacks we should rethink the products we used in the experiment. All in all, it was very interesting for us how people explained the ways of calculations they did and reasoned 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 deeper with more participants, other product images and by focusing more on the differentiation of price consciousness and price sensitivity groups.

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