The effect of distraction on visual attention in consumers' decision-making

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Acknowledgements:
This research is supported by the Prague University of Economics and Business IGS F6/12/2021

Cite as:
Bažantová Simona, Novák Michal (2022), The effect of distraction on visual attention in consumers' decision-making. *Proceedings of the European Marketing Academy*, 50th, (111779)

Paper from the EMAC Regional 2022 Conference, Kaunas, Lithuania, September 21-23, 2022

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Abstract:

There is an endless battle between companies for customers' attention. The study investigates the effect of a distraction on gaze behavior and visual attention towards a preferred product in consumer decision-making. It was achieved through an eye-tracking experiment with 2-AFC questions related to product choice. The results showed no significant difference in eye-tracking fixations in the distracting condition compared to the non-distracting condition. However, interesting differences emerged at the individual respondent level. Further, the study suggested the impact of consumer distraction on the strength of the relationship between visual attention and preferred product variant. The results of this research point to the importance of further developing theories of attention in the context of consumer decision-making concerning essential attention characteristics such as divided attention and selective attention with respect to distractors in the form of the mobile phone.

Keywords: consumer, gaze behavior, distraction

Track:

1. Introduction of Paper

Consumers are exposed to a vast number of stimuli every day. However, one of the main characteristics of attention is selectivity (Desimone & Duncan, 1995) and related limited capacity. So, attention is considered a scarce resource. Selectivity is defined as the ability to filter irrelevant stimuli and focus of attention on decision-relevant information (McMains & Kastner, 2009). Attention as a complex system is influenced by many factors (for review see e.g. Ladeira et al., 2019 or Orquin & Loose, 2013). On the other hand, visual attention does play a significant role in consumer decision-making and purchase intention (Ladeira et al., 2019). These are the reasons for the competition for consumer attention and gaze behavior (visual attention) and the cause of the large investments in attention research by leading companies in the market.

Today's consumers typically live in an online/offline hybrid space. They are simultaneously involved in physical and virtual environments, primarily due to the development of mobile technologies (Šimůnková, 2019). The mobile phone tends to be used in two situations in a consumer's purchasing decision while browsing in a store. One is activities that are related to the purchase (e.g., shopping list); on the other hand, there are situations where the consumer uses the mobile phone at the point of sale in activities that are not related to the purchase (e.g., texting/calling) (Sciandra & Inman, 2016). In previous studies, mobile phone use (non-purchase related) at the point of sale has been evaluated, for example, in terms of its impact on unplanned purchases (Sciandra et al., 2019). In this perspective, mobile phone use (activities unrelated to the purchase) can be defined as a distractor (a distracting factor or element that affects the consumer). At the point of sale, distractors influence consumers' behavior, including gaze behavior and visual attention too. Orquin et al. (2013) mention music in the supermarket as a distractor in their review study. These authors referred to the study conducted by Day et al. (2009) and also mentioned that distractors will increase the difficulty of the decision task, which should increase the number of eye fixations in the decision task. Based on this statement, it can be assumed that there are changes in gaze behavior under conditions of consumer distraction. Publications addressing the impact of mobile phone use (as a source of consumer distraction, hereafter referred to as distractor) leading to changes in visual attention and gaze behavior in consumer purchase decision making are scarce (e.g., Grewal et al., 2018). So, this study aims to investigate the extent to which consumer distraction (through mobile phone use for activities unrelated to purchase decisions) affects gaze behavior and visual attention in a product choice decision situation.

As mentioned, many variables have been discussed concerning visual attention. In the literature, conflicting results have been indicated in the relationship between visual attention and consumer preferences (especially preferences based on the choices). There are studies suggesting a close relationship between visual attention and consumer preferences (e.g., Atalay et al., 2012). In the context of product choice decision making from multiple alternatives (e.g., 2-AFC tasks), the alternative with longer eye fixation time (Atalay et al., 2012) and with a higher number of fixations (Jantathai et al., 2013) are more likely to be chosen. The tendency toward longer eye fixation at a subsequently chosen alternative is referred to as *gaze bias* (Saito et al., 2017). Subsequently, Goyal et al. (2015) indicated that time to first eye fixation and duration of the first fixation on the product alternative could not predict consumer choice. On the other hand, Reutskaja et al. (2011) mention that the first fixed alternative has a higher probability of being consequently chosen. However, the relationship between visual attention and preferences tends to be questioned (e.g., Wei et al., 2019). Our study further explores the relationship between visual attention and consumer preferences (as expressed by product choice) and the influence of consumer distraction via mobile phone on this relationship in a purchase decision situation.

2. Methodology

The study investigates the extent to which consumer distraction (through mobile phone use for activity unrelated to purchase decisions) affects gaze behavior and the relationships between visual attention and consumer preferences. It is achieved through an experiment, in particular using an eye-tracking device, to investigate the between visual attention and consumer preferences (preferred product in 2-AFC tasks) in purchase decision making, under conditions of consumer distraction (distractor in the form of a mobile phone) and without a distraction. Based on the literature (see above), the following research hypotheses were defined: H_1: Consumer distraction (via mobile phone conversation) influences consumers' gaze behavior in a situation of purchase decision.; H_{2A}: There is a relationship between visual attention and consumer preferences (expressed in terms of product choice) in a purchase decision situation.; H_{2B}: Consumer distraction (via mobile phone conversation) impacts the strength of the relationship between visual attention and consumer preferences (as expressed by product choice).

2.1 Procedure and participants

The 2×6 pictures with two variants of cola beverage products (2-AFC task, six pairs of cola drinks in condition without distraction and six pairs in condition with distraction) were shown to the respondent while their visual attention was monitored using eye-tracking. During the

experiment, respondents were asked to choose the preferred one that he/she would buy in the shop.

Ten respondents (four males and six females, ranging in age from 18 to 28 years) who were students at the Faculty of Management in the Prague University of Economics and Business in the Czech Republic participated in this study. This can be considered sufficient as Nielsen (2000) argues that data saturation can be achieved in eye-tracking studies even with such a small number of respondents. The respondents signed informed consent to participate in the research and stated that they had no eye defects (normal vision).

2.2 Measures and data analysis

The most commonly used metrics in eye-tracking experiments related to eye fixations were used to detect and measure **gaze behavior** (**visual attention toward products**). Specifically, Time to First Fixation (TTFF), Total Fixation Duration (TFD), Total Fixation Counts (TFC), and eye fixation returns (Revisits) within the predefined so-called AOI (Area of Interest). In the present experiment, the AOIs included individual products named "Product A" and "Product B". The eye-tracking metrics were converted (within research hypotheses H_{2A} and H_{2B}) to binary variables (A and B) depending on: the product the respondent looked at first (TTFF); the product the respondent looked at longer (TFD); the product showed more fixations (TFC); product showed more eye-fixation returns from outside the AOI (Revisits). **Consumer preferences** were expressed by choosing a product between two alternatives (preference / chosen product A or B). **Distraction** in purchase decision making (distractor) via mobile phone use (unrelated to product choice decisions, i.e., mobile phone conversation/call) was used in one of two follow-up experiments. In the first experiment, respondents were presented with six pairs of products, among which they had to select a preferred product (condition without distraction). In the second experiment, they had the same task (selecting a preferred product that they would probably actually choose (e.g., in a supermarket) from 6 modified product pairs), but at the same time communicating with the interviewer by phone during the decision-making process (a condition with distraction). The topic of conversation was especially about spending time the previous weekend.

The data were analyzed in the statistical software R. Especially t-tests were used to analyze the data within H_1. Within H_{2A} and H_{2B}, due to the binary character of the variables, association statistics (Cohen's kappa and Cramer's V) were used to analyze the relationship between consumer preferences and visual attention. McNemar's test compared the above relationship between distraction and distraction-free environments.

3. Results and Discussions

3.1 The effect of consumer distraction on gaze behavior

First, data concerning the effect of consumer distraction (via mobile phone conversation) on gaze behavior was analyzed (H_1). This study investigated whether there is a difference between the length (duration) of all fixations within 2-AFC tasks in the non-distracting condition compared to the distracting condition in product choice decisions. The analysis results indicate a statistically significant difference between the lengths of fixations in the distraction and distraction-free environments (ratio of variances is not equal to 1, F = 0.082, p-value = 0.001; Welch Two Sample: t-test, t = -3.843, p-value < 0.001). However, this statistically significant difference seems to be non-significant in terms of practical investigation of eye fixations in consumer research (due to the relatively small difference in mean values, 0.02 seconds). Despite the expectation that consumer distraction through mobile phone conversation (as a distractor in product choice decisions) would lead to higher fixation counts, this pattern has not been supported in 2-AFC tasks. The significant difference in means of the number of fixations in non-distracting and distracting conditions were not supported (Paired t-test: t = -0.773, p-value = 0.443).

The results are surprising, particularly because the length or number of fixations were not substantially different under changing environmental conditions in the product choice decision (distraction, no distraction). However, it is interesting to mention the results at the level of some product pairs for individual respondents. There were several outliers (deviations from the general results of the primary analysis) indicating a significant effect of conditions (environment with and without distraction) on gaze behavior. For example, the Gaze plots in Figure 2 show noticeable changes in the number of fixations within the non-distracting condition compared to the distracting condition for one respondent.

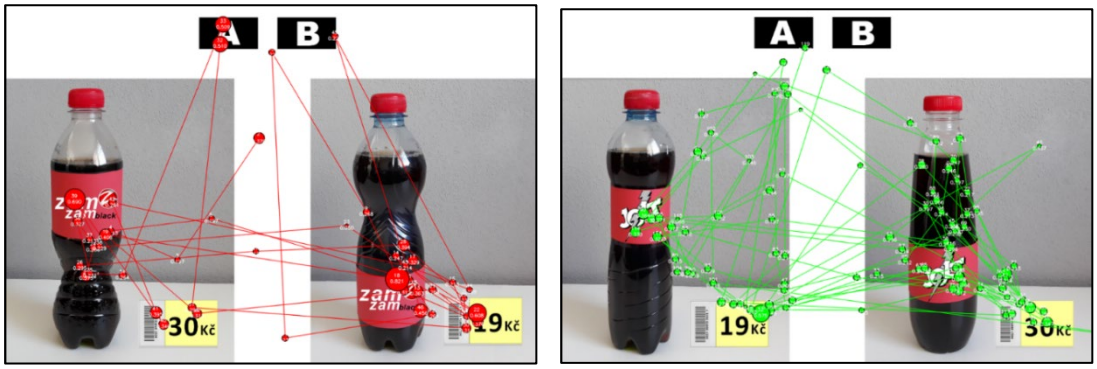

Figure 2. Gaze plots for respondent R1 in the environment without distraction (on the left) and the environment with distraction (on the right)

Although there was no statistically significant effect of consumer distraction on gaze behavior during the purchase decision (2-AFC tasks) in the overall analysis, considerable

differences were found in the distraction-free and distraction-free stimuli in terms of the number of eye fixations at the level of individual respirations in this research. It can be assumed that, in some cases, the presence of a distractor in the form of a mobile phone influences consumers' gaze behavior in a situation of purchase decision, even though it was not statistically significant across the research sample in this analysis. Research hypothesis 1 (consumer distraction via mobile phone conversation influences consumers' gaze behavior in a situation of purchase decision, in 2-AFC experimental task setup) cannot be rejected.

In addition to the characteristic of attention regarding selectivity (the ability to ignore irrelevant stimuli), the literature also discusses the ability to divide attention between multiple elements related to process automaticity, i.e., in the context of multitasking (Wickens & McCarley, 2008). One of the reasons for the individual differences (found in this study) could be this ability (related to automaticity processes). It can be assumed that some individuals have so automatized interaction with their mobile phone (it is possible due to the generation of respondents included in the present study) that this activity does not play important role in distracting them and therefore does not limit their attention too much in their purchasing decisions (thus at once not making the task more difficult).

3.2 The effect of consumer distraction on the relationship between visual attention and consumer preferences

The following analysis is related to the relationship between visual attention and consumer preferences (as expressed by product choice) (H_{2A}) and the influence of consumer distraction (via mobile phone) on this relationship (H_{2B}) in a 2-AFC decision situation. Tables 1 and 2 contain coefficients to measure the degree of association (Cramer's V statistic, V) and agreement (Cohen's Kappa statistic, κ) between each eye-tracking metric and product preference (measured by choice of a given alternative in the 2-AFC questions).

	Condition without distraction		**Condition with distraction**	
	Cohen's Kappa (κ) Sample estimates (p-value)	**Cramer's V (V)**	**Cohen's Kappa (κ)** Sample estimates (p-value)	**Cramer's V (V)**
TFD and CHOICE	**0.358** (p-value <0.003)	0,358	0,794 *(p-value <0.001)*	0,794
	0.21-0.40 = "Fair agreement" *(Landis and Koch, 1977)* H_0 is rejected	**0.2-0.39 = Low association** *(based on output in R)*	**0.61-0.80 = Substantial agreement** *(Landis and Koch, 1977)* H_0 is not rejected	**0.70-0.89 = High association** *(based on output in R)*
TFC and CHOICE	**0.687** (p-value <0.001)	0,696	0,697 *(p-value <0.001)*	0,697
	0.61-0.80 = Substantial agreement *(Landis and Koch, 1977)* H_0 is rejected	**0.70-0.89 = High association** *(based on output in R)*	**0.61-0.80 = Substantial agreement** *(Landis and Koch, 1977)* H_0 is not rejected	**0.70-0.89 = High association** *(based on output in R)*
Revisits and CHOICE	**0.611** *(p-value <0.001)*	0,620	0,561 *(p-value <0.001)*	0,582
	0.61-0.80 = Substantial agreement *(Landis and Koch, 1977)* H_0 is rejected	**0.4-0.69 = Modest association** *(based on output in R)*	**0.41-0.60 = Moderate agreement** *(Landis and Koch, 1977)* H_0 is not rejected	**0.4-0.69 = Modest association** *(based on output in R)*
	0.075 *(p-value* =0,279*)*	0,075	0,339 *(p-value <0.004)*	0,359

TTFF and CHOICE	**0.00-0.20 = Slight agreement** *(Landis and Koch, 1977)* H_0 is not rejected	**0.19 or less = Very low association** *(based on output in R)*	**0.21-0.40 = "Fair agreement"** *(Landis and Koch, 1977)* H_0 is not rejected	**0.2-0.39 = Low association** *(based on output in R)*

Table 1. The level of association and agreement between visual attention and product choice (condition without distraction and with distraction)

The results of the association and agreement levels (in conditions without distraction) show substantial agreement and a high or modest association between preferred alternative and eye fixation revisits ($\kappa = 0.611$; V = 0.620), as in the case of eye fixation counts ($\kappa = 0.687$; V = 0.696). The respondent returned eye fixations more (revisits) at the later chosen alternative than the non-chosen and looked at that alternative more (with more eye fixation) than the non-chosen one. The results suggesting a closed relationship between the number of fixation and a preferred alternative are consistent with Jantathai et al. (2013) and support a relationship between visual attention and consumer preferences (preferred alternative of product). On the other hand, there was a slight association and agreement between eye fixation duration and chosen alternative ($\kappa = 0.358$; V = 0.358). In other words, the association between the longest fixated alternative and the later chosen one is low. These results are in particular contrast to Atalay et al. (2012) study. At the same time, they do not support an effect referred to as gaze bias (Saito et al., 2017), which is defined by the tendency toward longer eye fixation at a subsequently chosen alternative. At the same time, the association with the preferred alternative is not significant for the metric reflecting first fixation (V = 0.075, indicating a very low association; $\kappa = 0.075$ with a p-value 0.279). So, the assumption (within the research hypothesis 2A) about the relationship between visual attention and consumer preferences (expressed in terms of product choice) in a purchase decision situation was indicated. However, this was not the result of all visual attention metrics examined.

Based on Table 1, differences in the strength of the relationship between certain metrics within eye fixations (defined based on commonly used eye-tracking metrics) and the preferred (chosen) product alternative are evident according to the distracting and non-distracting conditions. The results show a lower level of agreement ($\kappa_{\text{non-distraction}} - \kappa_{\text{distraction}} = - 0.436$) between the longer-fixed (based on the *Total Fixation Duration* metric) and preferred product in the non-distracting condition compared to the condition with the distractor. The effect of conditions (distraction and non-distraction) is statistically significant (McNemar's test, p-value = 0.017). Within the eye-tracking metric *Time To First Fixation* (and its relationship to the selected product), the Kappa coefficient ($\kappa_{\text{non-distraction}} - \kappa_{\text{distraction}} = - 0.264$) is lower in the non-distracting condition (without distractor in the form of phone calls during product choices) than in the distracting condition (with distractor). It suggests a closer agreement between the first

fixed and the preferred product in conditions with distraction. However, this effect of conditions (distraction and non-distraction) is not statistically significant (McNemar's test, p-value = 0.200). Other measures of association and agreement between the preferred alternative and both Revisits and TFC do not differ significantly, depending on the environment. Any differences are not statistically significant (Revisits: McNemar's test, p-value = 0.824; TFC: McNemar's test, p-value = 0.771). Research hypothesis 2B, related to testing the effect of consumer distraction (via a mobile phone call) on the strength of the relationship between visual attention and consumer preferences (as expressed by product choice), is significant for the Total Fixation Duration.

These results indicate a stronger tendency for a *gaze bias effect* (e.g., referred by Saito et al., 2017) in distracting conditions. In the context of attentional selectivity, future research could examine the relationship (between visual attention and consumer preferences) at the level of product factor preference (such as price, brand, package design, etc.). Namely, to investigate whether a brand loyal consumer (where the brand is an important factor in their product choice decision) looks longer at a product's brand label than at the product's price (or other aspects of the product) in distracting (via mobile phone) conditions (compared to non-distracting conditions).

4. Conclusions

The goal of this study was to investigate whether consumer distraction (in the form of a distractor via mobile phone conversation) influences gaze behavior (eye fixation) during purchase decision making and also whether the relationship between product preference (expressed by choice) and visual attention to toward preferred alternative is influenced by consumer distraction during purchase decision making. The main limitations of this study come from the sample of respondents. First, the size of the sample is limited. Moreover, the respondents are all from the Faculty of Management (the Prague University of Economics and Business).

The results showed no significant difference in eye-tracking fixations in the distracting condition compared to the non-distracting condition. However, interesting differences emerged at the individual respondent level. These variances may be due to the ability to divide the attention, which is related to process automaticity, i.e., during multitasking (Wickens & McCarley, 2008). These exclusions may have been based on individual habits and characteristics of individuals regarding the automation of their interaction with the mobile phone. Furthermore, as Orquin & Loose (2013) state, the difficulty can influence visual attention and gaze behavior. It may appear that decisions in distracting conditions could be

more difficult. However, automatization can be the explanation - the difficulty of the decision task across conditions was not significantly varied for some respondents. Further, the study suggested the impact of consumer distraction on the strength of the relationship between visual attention (in the Total Fixation Duration metric) and preferred product variant. These results indicate a stronger tendency for a *gaze bias effect* (e.g., referred by Saito et al., 2017) in distracting conditions. Publications addressing the impact of mobile phone use (as a source of consumer distraction, hereafter referred to as distractor) leading to changes in visual attention and gaze behavior in consumer purchase decision making are scarce. The results of this highlight and indicate the importance of testing and extensions theories of attention and its characteristics in consumer decision-making with respect to modern trends - the evolvement of mobile technologies and their use.

Future research should investigate whether consumer distraction (in the different forms of a distractor via mobile phone, e.g., texting, reading the messages browsing the internet) influences eye fixation (gaze behavior) during purchase decision making in real-world environments and real-world purchasing situations. Furthermore, it would be beneficial to consider factors that may influence visual attention (top-down processes) resulting from mobile phone habits and other characteristics of the individual considering the variables like generation of respondents or the difficulty of decision making.

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