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NEUROPSYCHOLOGICAL ASPECTS OF PERCEPTION OF EMOTIONALLY LOADED AND NEUTRAL ADVERTISING ILLUSTRATIONS¹

Bożydar L.J. Kaczmarek^(A,D,E,F,G), Marcin Stencel^(A,B,D,E,F),
Wioletta Ozga^(B,C,D,E,F), Aleksandra Kilijanek^(B,C,D,E)

The University of Economics and Innovation in Lublin, Poland

SUMMARY

Background:

The differences between perception and the recollection of emotionally loaded, provocative, and neutral illustrations were measured. It was hypothesized that the provocative illustrations will be better remembered as they evoke emotions.

Material/ Methods:

The program SMI Experiment Center was used, with the movements of the participants' eye-balls being recorded on the Eye-tracker iViewX RED500. Two types of advertisements were presented to the participants: (1) those evoking emotions, and (2) neutral ones. In consequence, six illustrations were used. Three were of a provocative character and three were neutral. The neutral advertisements were modifications of the provocative ones. Forty four undergraduate students answered questions concerning individual elements of the presented pictures. This enabled an analysis of the relationships between the type of the advertisement watched and the number of elements memorized. The participants were also asked to select the answer concerning: the degree of a particular advertisement's attractiveness, the strength of its emotional impact, and the types of evoked emotions (positive – neutral – negative).

Results:

Emotionally loaded illustrations provoked participant interest increasing the amount of the information processed. However, only provocative advertisements of a positive nature were better memorized than their neutral counterpart. The study revealed that an examination of eye movements is a useful and desirable measure providing detailed information on the manner our brain processes perceived data.

Conclusions:

It was found that the intensity of such emotions as sadness, disgust, surprise, and anger were significantly higher in the experimental group than in the control group. No significant differences in the degree of positive emotions were noted. This leads to the conclusion that we should be very careful while selecting the illustration to be presented to patients.

Key words: Provocative illustrations, eye movements, data processing, memorizing, emotions

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INTRODUCTION

Attempts to gain insight into the ways of processing visual data in the brain by recording eye movements had already been conducted in 1792 by William Wells (Pačalska 2007). Yet, it is Johannes Müller who is usually credited with being the pioneer of eye movement studies. This might be due to the fact that he published three books on vision and eye-movement, and one of them *Handbuch der Physiologie des Menschen* was translated into English with the title *Elements of Physiology* in 1843 (after Wade, 2010). It dealt with relating binocular eye movements to binocular single vision, while a photographic device (Dodge photophograph) that required no attachment on the eye was created by Raymond Dodge in 1901 (Dodge and Cline 1901; Dodge 1904). After Dodge's development of the photographic eye tracker there followed a proliferation of experiments in this field.

At that time other eye-tracker devices were also in use, the most common being the attachment eye tracker developed by Isaak G. Orschansky in 1899. Here the movements of eyes were observed as reflections from "mirrors" attached to the subjects eyelids. That technique was improved by Alfred L. Yarbus, who used suction cups, which made it possible to attach small mirrors to the eyes without causing discomfort to the subject. Yarbus' works are well known and his book published in 1967 entitled *Eye Movements and Vision* has become a classic in the scientific literature on perception. The book was first published in Russian in 1965 under the title *The Role of Eye Motion in Vision Processes* (Wade & Tatler, 2005; Wade, 2010).

It might be worthwhile to recall that it was Guy T. Buswell who noted that the instructions given to an observer influence the places that he fixates. He had described that already in 1935 in his book *How People Look at Pictures: A Study of the Psychology of Perception in Art* (Buswell 1935/2012). Moreover, Buswell examined 200 subjects each viewing multiple pictures, while Yarbus performed his experiment with only one participant. Yet, the works of Yarbus are the most cited. One of the reasons may be the fact that he published a number of papers in the Russian journal *Biofizika*, which has also an English edition - *Biophysics*. He also collaborated with many renowned scientists, among whom were such famous psychologists as Michael S. Smirnov, an expert in sensory physiology and communication (see Tatler et al., 2010), and Aleksandr R. Luria, a founder of neuropsychology (see Kaczmarek and Pačalska, 2014). The article co-authored with Luria and Karpov (1966) revealed the possibility of cognitive control evaluation with the use of an eye-tracker. Those findings are still valid, and proved be of use for the evaluation of healthy subjects prone to aggressive behaviors (Harrison et al., 2016).

From that time on many experiments on using an eye-tracking technique have been performed on a wide variety of topics, both commercial (Chapman & Underwood, 1998; Ho et al., 2001; Frazier, 2006; Pieters et al., 2002; Duchowski, 2007; Li et al., 2015) and clinical (Leong et al., 2007; Kundel et al., 2008; Heitger et. al., 2009, Samadani, 2015). To our knowledge, however, emotional aspects have been rather

neglected, and papers that deal with emotions concentrated mainly on fear and anxiety are rare (see Burke and Edell, (1989; Yiend and Mathews, 2001; Tipples, 2006; Onnis et al., 2011). As pointed out by Pačalska et al., (2014) emotional features of illustrations may affect the perception of the patient therein making diagnosis difficult not to say false. It means that knowledge about the emotions evoked by a particular illustration are of importance in constructing any diagnostic tool.

The background of our study was an extended Model of Eye-Fixations Effects on Memory for Brands proposed by Pieters, Warlop and Wedel (2002) describing how information is extracted and stored during eye fixations, and then retrieved from memory. The results of those studies indicate that original advertisements drew more attention to the advertised brand. The duration of the fixation time spent on a specific location provides information of both the perceptual and cognitive processing devoted to that region (Rayner, 2009). On the other hand, the studies by Burke and Edell (1989) suggest relationships between the emotions evoked by an advertisement and their evaluation as well as remembering the brand (see also Pačalska et al. 2015). The model created by Falkowski and Grochowska (2009) takes into account the impact of emotions elicited by a given advertisement upon its evaluation and remembering. There is a general agreement that advertisements should include components which will attract the attention of recipients and in consequence have impact upon their behavior. To this effect provocative advertisements that break social ethical and/or moral standards are often used. As a rule such advertisements present topics that are believed to be risky, shocking, and raising strong often negative emotions, aiming at drawing consumers' attention to the traceability of a given product. It seems, however, that the use of provocative illustrations may be risky since they may provoke the recipient to focus attention on the shocking themes or items. In effect, the advertisement's message for a given product, producer or offer might be lost.

Objectives

Bearing in mind the above considerations the present experiment aimed at investigating and analyzing the effects of the advertisement type (provocative versus non-provocative) on recipients' attention, recall and emotion intensity. The main goal was to reveal which components of an advertisement (the product versus provocative element) the recipients were focusing their attention on, how many information units they were able to memorize, and what the impact of emotions, if any, was. The interactions across the particular variables were also calculated.

MATERIALS AND METHODS

Participants

Forty four students of the University of Economics and Innovation provided written consent to volunteer for this experiment. Data from two participants were

excluded because of difficulties in calibration. Therefore, the experiment was conducted with the remaining forty two subjects ($M = 29.4$; $SD = 8.28$; 21 male, 21 female). All participants had normal or corrected to normal vision.

Apparatus

A video based eye tracker iViewX™ RED500 recorded eye position (spatial resolution of 1° , 500 Hz). Eye position was measured binocularly. Viewing distance was 57 cm. Stimulus presentation was controlled by a PC running the SMI Experiment Center™ software. BeGaze 3.0 software was used in order to export eye tracking data to IBM SPSS 21 software. The manual response was collected by a standard keyboard.

Stimuli

Materials consisted of three types of advertising illustrations, with one of them covering ecological issues. This advertisement was related to animal abuse for the testing of cosmetics. The second emphasized the erotic aspect of perfumes and the third one was related to the ethical standards of a social role. Two versions of each advertisement, provocative and non-provocative were used for each of the above types: original, provocative advertisement and the altered non-provocative counterpart. The provocative advertisements were real advertising materials available via foreign mass media, hence, the participants were not familiar with them. *Figure 1* shows two versions of the stimuli: (a) provocative and (b) non-provocative as presented to the participants.

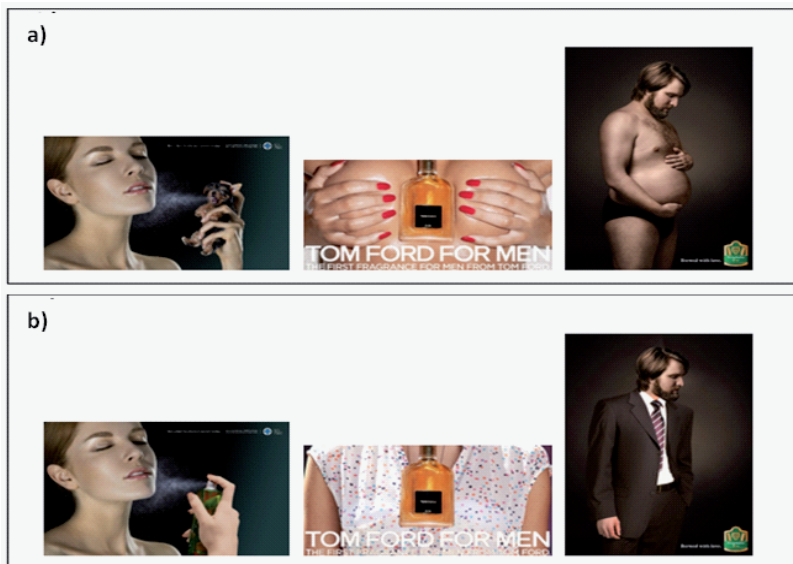


Fig. 1. Stimuli used for the experiment: (a) original provocative advertising illustrations, (b) altered non-provocative illustrations

Experimental design

To minimize any familiarization effect the non-provocative and provocative advertisement were displayed to two different groups. Accordingly, the experimental group was presented with the emotionally loaded (provocative) illustrations, and the control group looked at the non-provocative (modified) illustrations. Participants were randomly assigned to one of them. There was almost an equal number of males (11) and females (10) in each group. The experimental procedure was the same for each group. The experiment used a mixed design with two factors. The type of advertisement (the provocative versus non-provocative) was used as a between subject's factor, type of AOI (the product versus provocative element) as equally as a within subject's factor (see *Figure 2*).

Procedure

During the experimental session, the illustrations were presented in a random order. Seven points calibration was done before starting the experiment. Participants were given the following instruction "Try to remember as many details, concerning the advertisements presented, as you can." A fixation point appeared in the center of the screen (1000 ms) and then, the participant was allowed to view the presented illustration for 3000 ms. Afterwards, 14 questions were displayed on the screen. There was no time limit to answer the questions. The first question ran as follows "How interesting do you consider the advertisement?" Subsequent questions concerned the type of emotion evoked by the advertisement. Participants were asked to rate the intensity of 6 emotions: joy, sadness, disgust, surprise, fear, anger. Responses were given on a five-point Likert scale. In addition, the levels of advertisement provocativeness were assessed by the subjects. The final set of questions measured how much information about the product or provocative element was memorized. The indicator of product and the provocative element recall was measured with a series of 5 questions. The same sequence of events was used in the evaluation of each advertising illustration (see *Figure 3*).

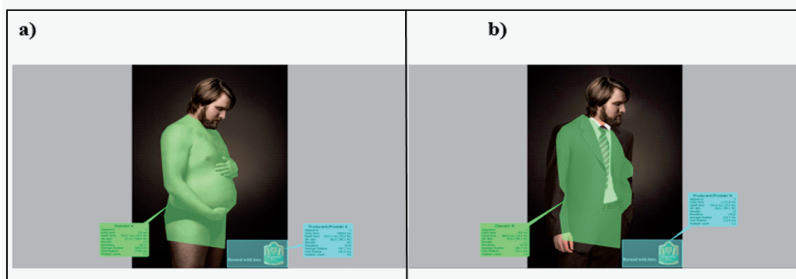


Fig. 2. Illustration of the areas of interest for the product (the area highlighted in blue) and specific element (the area highlighted in green); a) AOI in a provocative condition; b) AOI in a non-provocative condition

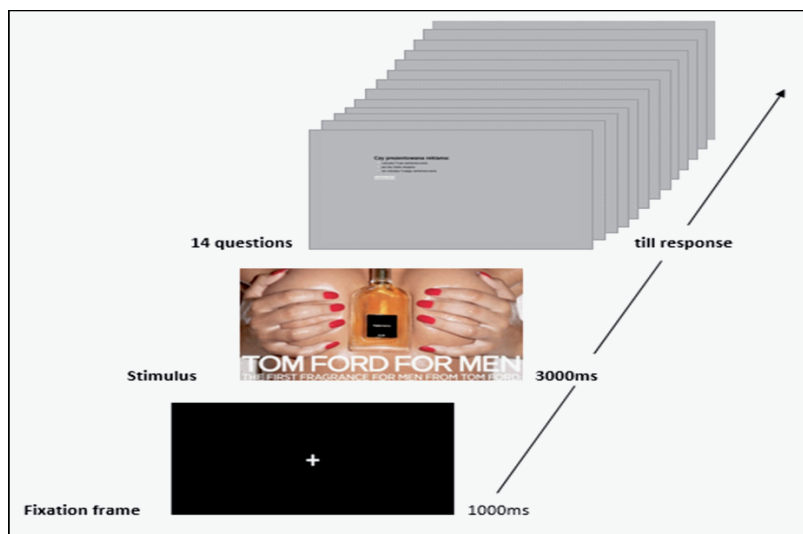


Fig. 3. Illustration of the sequence of events used in the experiment

RESULTS

Evoked Emotions and advertisements attractiveness measures

A chi-square test of independence was performed to examine the relation between the type of advertisement and the interest evoked by a given illustration. A statistically significant difference between the experimental and control group was noted only for the erotic versus non-erotic version of the advertisement, $\chi^2(1.42) = 6.67$, $p = 0.036$. Despite the fact that provocative illustrations induced significantly higher interest (72.2%) than non-provocative illustrations (27.8%), only the advertisement depicting animal abuse for the testing of cosmetics evoked significantly higher negative emotions in the experimental group (92.3%) than in the control group (7.7%), $\chi^2(1.42) = 13.48$, $p = 0.000$.

However, an analysis performed with the use of the U Mann Whitney test revealed significant differences between the experimental and control groups concerning emotion intensity. The ratings of intensity for sadness, disgust, surprise, and anger were significantly higher in the experimental group than in the control group (see Table 1).

Tab. 1. Differences in emotion intensity for the experimental and control group

Dependent variable	Experimental group		Control group		U	P
	M	SD	M	SD		
Sadness	5.33	1.91	4.10	1.48	134.00	0.024
Disgust	6.57	2.52	3.81	1.08	67.50	0.000
Surprise	9.81	3.10	4.95	1.63	53.50	0.000
Anger	5.57	2.36	3.38	0.50	105.50	0.002

Eye movement measures

To explore the hypothesis that different type of advertising illustrations have an impact on the visual attention dynamics in responses to the type of AOI eye movement measurements were analyzed with a 2 x 2 mixed ANOVA. The mixed-model ANOVA was conducted for the type of advertisement illustrations (the provocative versus non-provocative) as a between subjects factor, while the type of AOI (the product versus provocative element) as a within subjects factor.

Entry Time

Neither the main effect of the type of AOI nor the interaction approached significance, although there was a trend for the main effect $F(1,42) = 3.46, p = 0.070, \eta^2 = 0.08$. The main effect of between subjects also did not approach significance.

Dwell Time

The data revealed the significant main effect of the area of interest (AOI) type. $F(1,42) = 56.73, p = 0.000, \eta^2 = 0.586$. Mean Dwell time on AOI relating to the advertising product was higher ($M = 994.58$ ms; $SD = 302.65$) than on the area relating to the provocative element of advertising ($M = 507.88$ ms; $SD = 231.57$) for both groups. The interaction, however, was nonsignificant. Yet, the analyses revealed a significant main effect for the type of advertisement, $F(1,42) = 5.41, p = 0.025, \eta^2 = 0.119$. The experimental group spent more time on the provocative element ($M = 608.17$ ms, $SD = 220.99$) than the control group ($M = 407.59$ ms, $SD = 199.92$).

Fixation time

The analyses revealed a significant main effect in the AOI type, $F(1,42) = 50.58, p = 0.000, \eta^2 = 0.558$. Both groups spent more time fixating the product ($M = 910.63$ ms; $SD = 298.22$) than the provocative element of each advertisement ($M = 467.88$ ms; $SD = 216.65$). Although the interaction effect did not approach significance, the data showed a significant main effect for the type of adverti-

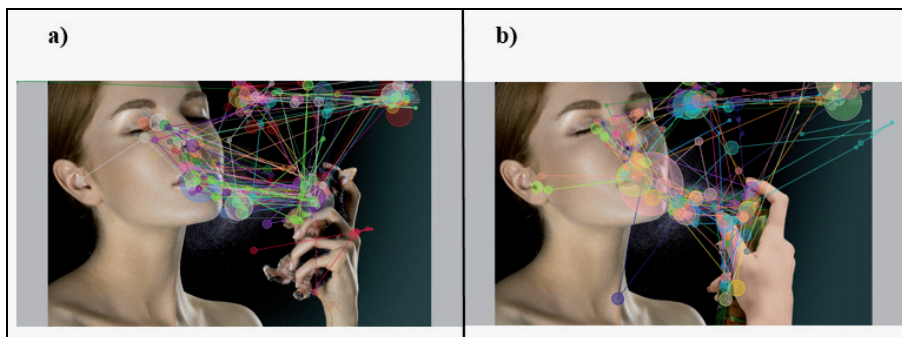


Fig. 4. The scan path of the eye tracking data from a provocative condition (a); the scan path of the eye tracking data from a non-provocative condition (b)

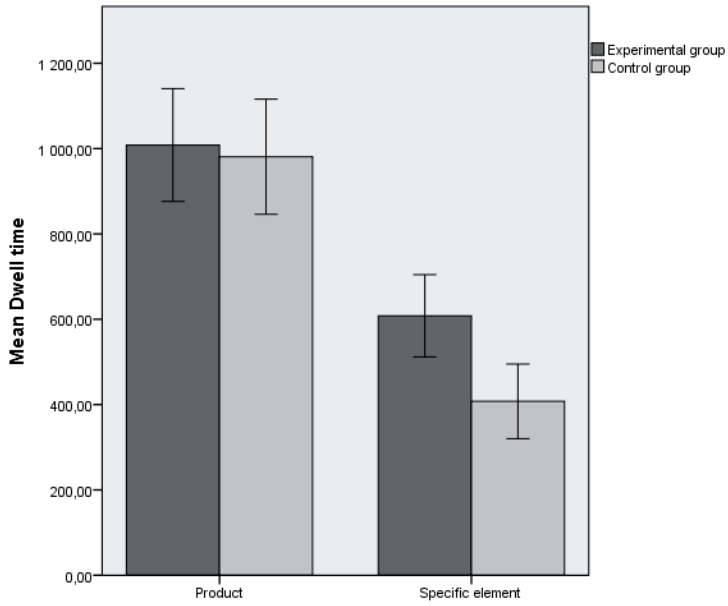


Fig. 5. Mean dwell time on the product and provocative element for the experimental and control group. Error bars represent standard error of the mean

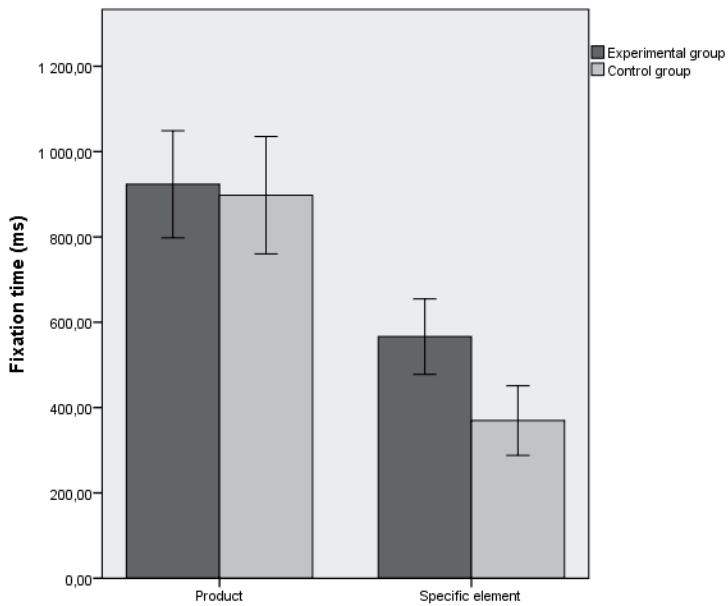


Fig. 6. Fixation time on the product and provocative element for the experimental and control groups. Error bars represent standard error of the mean

sement, $F(1.42) = 5.46$, $p = 0.025$, $\eta^2 = 0.120$. Participants of the provocative advertisements group fixated their gaze on the provocative element for longer ($M = 566.27$ ms; $SD = 202.48$) than did the control group on its non-provocative counterpart ($M = 369.50$ ms; $SD = 186.80$).

Fixation count

The data showed the significant main effect in the AOI type, $F(1.42) = 33.54$, $p = 0.000$, $\eta^2 = 0.456$. The mean fixation count on the AOI relating to the advertising product was significantly greater ($M = 3.42$; $SD = 1.11$) than on the AOI relating to the specific element of advertising ($M = 2.24$; $SD = 0.89$). The interaction was nonsignificant. The analyses revealed a significant main effect in the type of advertisement, $F(1.42) = 5.41$, $p = 0.025$, $\eta^2 = 0.119$. The experimental group fixed their gaze significantly more often on significant elements of the illustration ($M = 2.56$; $SD = 0.83$) than did the control group ($M = 1.92$; $SD = 0.85$).

Accuracy

To explore the hypothesis that presenting participants with different types of advertising illustrations affects memory for the product and provocative element the 2×2 mixed ANOVA was applied. The mixed ANOVA was conducted for the type of advertising illustration (the provocative versus non-provocative) taking into account the across subjects factor, and the accuracy of the memorized advertisement elements (product versus specific element) treated as the within subjects factor.

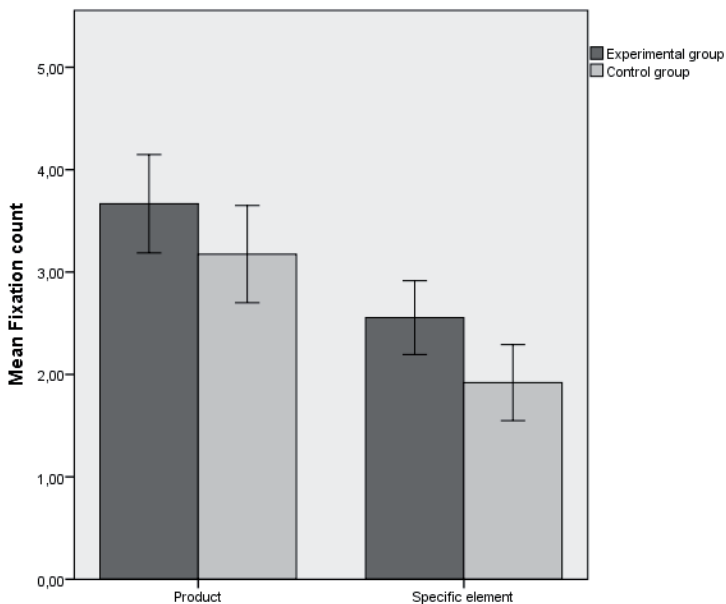


Fig. 7. Mean fixation count on the product and provocative/non-provocative elements for the experimental and control groups. Error bars represent standard error of the mean

The analyses revealed the significant main effect of answers accuracy $F(1,42) = 3.81, p = 0.000, \eta^2 = 0.451$. The mean of information units concerning the provocative element was significantly greater ($M = 4.69; SD = 0.47$) compared to the mean of the information units memorized concerning product ($M = 3.64; SD = 1.25$) for both groups. The interaction was significant $F(1,42) = 5.49, p = 0.024, \eta^2 = 0.12$, and the experimental group memorized more information about specific elements ($M = 4.48; SD = 0.51$) than on the product ($M = 3.00; SD = 1.00$). The data showed also a significant main effect for the type of advertisement, $F(1,42) = 5.46, p = 0.025, \eta^2 = 0.120$, since the provocative advertisements group stored more elements about the product ($M = 4.29; SD = 1.15$) when compared to the control group ($M = 3.00; SD = 1.00$).

Covariates measures

The hypothesis that emotions evoked by the presented illustrations can effect a number of memorized elements was tested. The MANCOVA test was conducted for the type of advertisement (provocative versus non-provocative) as an across subjects factor, for the level of elements memorized (concerning product versus provocative elements), for the intensity of the emotions evoked (surprise, disgust), and for covariates. The main effect of the type of advertisement approached significance for the product $F(1,42) = 6.46, p = 0.015, \eta^2 = 0.145$. There was also some interaction between the type of advertisement and surprise as covariate but this did not reach a statistical significance $F(1,42) = 3.74, p = 0.061, \eta^2 = 0.090$.

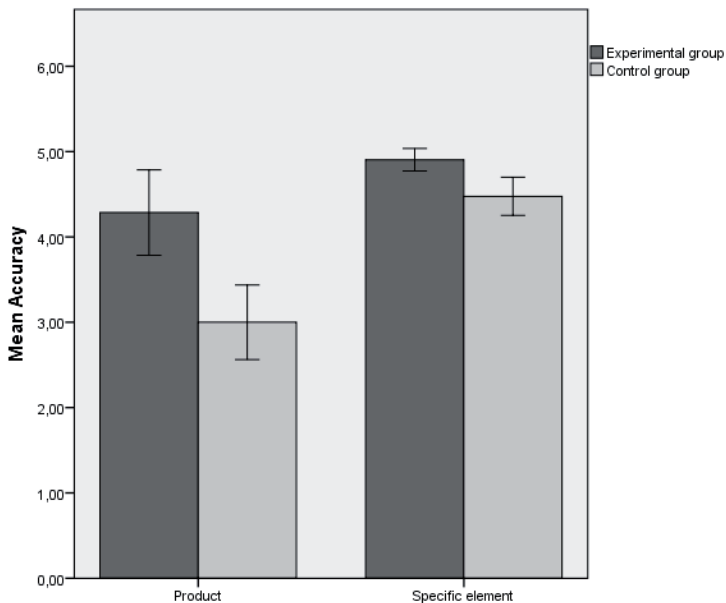


Fig. 8. Mean correct answers concerning aspects of the product and provocative elements for the experimental and control group. Error bars represent standard error of the mean

DISCUSSION

The study revealed that all participants spent more time and fixated on the product more often than on the provocative elements. It shows that provocative, emotionally loaded advertising illustrations do not divert attention from the advertised product. According to Rayner (2009) it reflects a deeper cognitive and perceptual processing devoted to that area. Moreover, the provocative advertising illustrations enhanced information storage about the advertised product. Pieters et al. (2002) found a similar effect in relation to originality. This suggests that illustrations of that type may provoke interest by increasing the amount of the processed information, which in effect results in their enhanced effectiveness.

Taking into consideration the type of provocative element it was found that the erotic aspect of the advertisement evoked the greatest interest among participants despite the equal number of males and females in each group. It allows one to draw the conclusion that the usage of erotic symbols is an effective way of drawing consumers' attention. A trend to moderate the accuracy of answers (especially concerning the provocative elements) through surprise was also found (see also Pąchalska, Kaczmarek & Kropotov 2014). It has also been noted by Falkowski and Grochowska (2009), but that aspect requires further study. It seems, however, that its effectiveness depends to a considerable degree upon the type of receiver (Bushman, 2005). Therefore, it is not recommended to use it in a clinical setting as many patients exhibit instability in their emotional reactions.

Careful consideration should also be given to the use of emotionally loaded pictures presented to patients, since our study revealed that provocative advertising illustrations evoked strong emotions. Moreover, the level of emotions was highest in the case of the negative emotions induced by social advertisements. As pointed out by Tanner et al. (1991) experiencing negative emotions results in the creation of discomfort, leading to actions aimed at its elimination. Therefore, we should be very careful in selecting illustrations to be used for diagnostic purposes since the emotionally loaded pictures may provoke nightmares and hallucinations in brain damaged patients.

Another important finding of the present study is showing that an examination of eye movements constitutes a useful and desirable measure; one providing detailed information on the manner our brain processes perceived data. At the same time, it revealed that an examination of eye movements may be applied in a wider spectrum of factors than simply eye field control.

CONCLUSIONS

It was found that intensity of emotions such as sadness, disgust, surprise, and anger were significantly higher in the experimental group than in the control group. No significant differences in the degree of positive emotions were noted. This leads one to the conclusion that we should be very careful when selecting illustrations to be presented to patients.

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Corresponding author

Bożydar L.J. Kaczmarek

The University of Economics and Innovation in Lublin, Poland

