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THE HARDER IT IS TO FIND, THE LESS WE LIKE IT; AT LEAST, WE SAY SO

Trifu Dănuț *,
Marketing Faculty, University of Economic Studies, Bucharest, Romania.

Stan (Bizon) Claudia Cristina
Marketing Faculty, University of Economic Studies, Bucharest, Romania.

*** Corresponding Author: Trifu Dănuț**

ABSTRACT

In common buying frameworks of interest for consumer behavior, top-down and bottom-up attentional mechanisms interact, with the prevailing one changing frequently. The current study investigated the effects of increased effort to locate a stimulus on the self-reported valence and intensity associated with the respective stimulus. Two types of stimuli, of positive and negative valences, were evaluated. Both were placed in two visual fields with distractors of the same type; while the distractors were the same, their placement in one field facilitated the target location while in the other made it more difficult. Significant differences were found for the same stimulus in the two visual fields it was presented in concerning the valence, and more moderate regarding the intensity. Within each of the four resulting visual fields (positive stimulus easy to find, positive stimulus difficult to find, negative stimulus easy to find, and negative stimulus difficult to find, respectively), significant negative correlations were found between the time to first fixation (TFF) on target and the self-reported emotion valence; a significant positive correlation between TFF on target and self-reported *intensity was found only for the negative stimulus presented in the difficult to find placement.*

Keywords: Attention, Emotion, Valence, Intensity, Visual search, Fixation time, Consumer behavior, Stimuli, Eye-tracking, Distractors

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1. Introduction

According to some estimates (Franken, 2020), up to 70% of total buying decisions are made in-store, while, on the other hand, advertising budgets have been ever-increasing and are forecasted to continue to do so for the coming years – for 2025, the total advertising market is estimated to increase with 6.5% as compared to 2024, reaching USD 1.16tn (Statista, 2025). While most of the advertising efforts, in their various forms, aim at conditioning the consumer to look for a specific offer when getting into a buying situation – i.e., to exert top-down attention – package and point of sales materials of the targeted products and distractors – competing offers – aim at capturing the bottom-up attention by their intrinsic characteristics (such as color, contrast, brightness, and shape). The experiment described in the current paper addresses this common situation: a prospective buyer is looking for a specific product, but in the visual field, such as a physical shelf or an online shop page, the target is placed among various distractors – competing offers. Once successful, will a little extra effort needed to locate his or her target bring an extra amount of serotonin and increase the valence associated with the product, will the frustration associated with spending extra resources be transferred to the product evaluation, or will have no impact whatsoever? Obviously, for marketing practitioners, each possible answer would have different implications in gearing the ATL / BTL efforts. Researchers in other areas, from psychology to neuroscience, did help with valuable findings in explaining deployment and exerting bottom-up and top-down attention, assessment and modulation of emotions intensity and valence and influence of attention and exposure duration on the assessed values of these characteristics. Several distinct brain areas are known to be activated for modulating visual bottom-up or top-down attention thanks to the works of many researchers, including Connor et al. (1996), Büchel et al. (1998), Chawla, Ress, & Friston (1999), and Bisley (2011). There is also a consensus related to the deployment time for each of these two types of attention: bottom-up attention-supporting neural populations are recruited within 120ms from exposure to the stimulus and generally fall within 300ms, while top-down attention takes about 300ms to deploy but may be maintained for much longer; once a stimulus causes superior colliculus and the pulvinar nucleus of the thalamus to switch from top-down to bottom-up attention, it may take about 200ms to restore to processing the stimulus purposefully of interest (Corbetta & Shulman, 2002; Ling & Carrasco, 2006; Carrasco, 2011). It is obvious, in this context, that it would be quite difficult to monitor with electroencephalogram (EEG) metrics the variations in the levels of the two types of attention and to link them with stimulus orientation, location, and emotion elicitation. A software application for predicting the order in which various stimuli in a visual field would attract attention relies mostly on the bottom-up (the pure computational models, incorporating the characteristics known to be associated with saliency, such as brightness, shape, contrast, or movement, predicts strictly the bottom up attention-grabbing, while the ones based on training artificial neural networks with images and their analysis with eye-tracking devices might be said to incorporate elements of the bottom-up attention).

The relationship between the attention a stimulus is allocated and the emotion it elicits has long been investigated, and a great number of valuable insights were generated. Nevertheless, a unified model across various types of stimuli (of positive valence, neutral, and negative, social and non-social) and exposure durations, and even consistent reported results on similar stimuli and durations (but not experiment designs) have not yet emerged. Mrkva, Westfall, & Van Boven (2013), and Shao, Li, & Ren (2023) found significant differences in emotional modulation between cued and non-cued conditions, while the last one also found differences between social and non-social, positive and negative stimulus, respectively. Finally, the “mere exposure effect” (an increased number of exposures makes a stimulus be perceived as more attractive) mentioned by Zajonc (1968) was repeatedly confirmed (de Zilva et al., 2013), although the effect was reduced by longer durations (Bornstein & D'Agostino, 1992); the effect increased exposure has on the perceived attractiveness of human faces, on the other hand, is still uncertain - while Peskin & Newell (2004) found a positive effect, Rashidi, Pazhoohi, & Hosseinchari (2012) found a negative one.

2. Method

66 participants were asked to evaluate a positive-valence stimulus and a negative one about the intensity and valence of the emotions they elicit. Each stimulus was presented in the same visual field with several distractors (of the same category, as presented in Appendix I – Pictures used in images 1A and 1B). But, while in Image 1A the placement of the target and distractors made it easier for the participant to locate the verbally described picture of interest (in this case, “the bunch of black roses”), in 1B the finding and orienting task was made more difficult; Appendix II and Appendix III presents the gazeplots generated with FengGui image analyzer for the positive valence stimulus (Feng Gui, 2024); the negative stimulus went through a similar process, resulting Image 2A, where the negative stimulus was easier to find, and 2B, more difficult to find (the target is represented by the image of palms affected by a contagious disease, for this reason, visual fields 2A and 2B are not presented in this article).

Pictures of all targets and distractors were taken from Pixabay (2024). Each participant was presented a stimulus only once, in one of the different visual fields, controlling for the order of appearance and number of appearances for each. Exposure time was four seconds for each image, followed by two intervals of four seconds for self-reporting the emotion valence and intensity, respectively. The necessary time to locate the target picture (TFF) was recorded with the help of an eye-tracking device provided by Captiv NeuroLab (2024). Data analysis was performed with the corresponding module of Excel, and significance levels were tested against critical levels of available student distribution tables. Within each group of observations (1A, 1B, 2A, and 2B), correlation coefficients were computed between TFF, self-reported valence (VS), and self-reported intensity (IS). Means differences were tested for statistical significance between each pair of groups of observations, especially for 1A-2A and 1B-2B, concerning the same stimuli.

3. Results

Table I – Descriptive statistics presents the average time and standard deviation (in seconds) to locate the targets in the four visual fields and the corresponding self-reported emotions’ intensity and valence (on a 10-point Likert scale, 1 = min, 10 = max). As each participant was exposed to two visual fields, 33 targets’ evaluations were obtained for each of the four images.

Table I – Descriptive statistics

	TFF		IS		VS	
	Mean	SD	Mean	SD	Mean	SD
Image 1A	0.310	0.015	4.030	0.266	6.061	0.234
Image 1B	0.501	0.082	4.333	1.493	5.030	1.630
Image 2A	0.232	0.060	5.061	1.223	4.182	1.310
Image 2B	0.452	0.095	5.727	2.066	2.970	1.311

As one can see, FenGui's predictions were correct about the targets' location necessary time, much shorter in field 1A as compared with 1B and in 2A as compared with 2B.

Table II – Means differences presents the means differences test results for 1A-2A and 1B-2B. As one can see in the first four lines of the table, differences were even larger for 1A-2A and 1B-2B; these were nevertheless excluded from further analysis and presentation as they stem from the different natures of the stimuli presented in Images 1 and 2, respectively, and because the TFF differences between 1A and 2A, and between 1B and 2B are not statistically significant. Note that the correlation coefficients of TFF with self-reported valence are significant at 0.001 (the p-values are actually much lower); the correlation coefficient of TFF with self-reported intensity is statistically significant only at 0.05, and only for the negative stimulus.

Table II – Means differences

Means difference	TFF	IS	VS
1A-1B	-0.19061	-0.30303	1.030303
2A-2B	-0.21976	-0.66667	1.212121
1A-2A	0.077576	-1.0303	1.878788
1B-2B	0.048424	-1.39394	2.060606
t-calculated			
1A-1B	-3.19731	-1.18863	3.878981
2A-2B	-3.16528	-2.07846	4.301348
1A-2A	1.503521		
1B-2B	0.661151		
t-critical, 0.05; df=64	1.99773		

t-critical, 0.001; df=64	3.449142		
p-values			
1A-1B	0.02157	0.238989	0.00025
2A-2B	0.02373	0.041687	0.000059
1A-2A	0.137629		
1B-2B	0.510889		

Finally, Table III presents the correlation coefficients within each group of observations, for each of the four images. Note that the critical t-values, for df=32, are 2.036933 for a significance level of 0.05 and 3.621802 for 0.001.

Table III – Correlation coefficients for each image observations and computed t-values

Correlation Coefficients					Computed t-values			
Image 1A					Image 1A			
	TFF	*IS*	*VS*			*TFF*	*IS*	*VS*
TFF	1				TFF			
IS	0.083635	1			IS	0.474775		
VS	-0.57927	-0.22863	1		VS	-4.02003	-1.32854	
Image 1B					Image 1B			
	TFF	*IS*	*VS*					
TFF	1				TFF			
IS	-0.0325	1			IS	-0.18393		
VS	-0.45852	-0.18411	1		VS	-2.91869	-1.05958	
Image 2A					Image 2A			
	TFF	*IS*	*VS*					
TFF	1				TFF			
IS	0.074192	1			IS	0.420851		
VS	-0.41711	-0.10461	1		VS	-2.59619	-0.59502	
Image 2B					Image 2B			
	TFF	*IS*	*VS*					
TFF	1				TFF			
IS	0.441014	1			IS	2.779668		
VS	-0.42891	-0.17629	1		VS	-2.68585	-1.01309	

The negative correlation coefficients between the time needed to locate the target and the valence associated with the emotion the respective picture elicits are significant for all the four combinations of positive–negative valence and easy–difficult to locate. Self-reported intensity is positively significantly correlated with TFF only for the negative stimulus difficult to find – Image 2B.

4. Discussion and further developments

The intrinsic valence and intensity of the two stimuli were the most powerful explanatory factors for the differences in the declared emotions' values of the four images. The maximum target location time was 0.67 seconds, and we did not record any cases of target confusion or failure to find it within the four seconds available. Given the presented average necessary time – as well as the minimum of 0.17 seconds – and the after-location task's very low difficulty, one could have expected that the target location was a success in itself, a few tenths of a second would have made this success even more rewarding and the associated emotion would be partly transferred to better self-reported emotions elicited by the respective stimuli. On the contrary, the supplementary effort proved to be significantly correlated with worsening the self-reported stimulus valence; one could have rather expected a transfer of the intensity of not easily finding the target to the reported intensity of the emotion it elicits: generally, TFF positively correlated with the self-reported intensity induced by the stimulus, but the coefficients were not significant in three cases out of four. Many studies proved the importance of stimulus salience in the absence of loyalty or even previous knowledge (Richins, 1997; Plassman, Ramsøy, & Milosavljevic, 2012). The current paper argues that even when the stimulus is looked for, the easier it is to find, the better for the self-reported valence.

Although the commercially available EEG metrics do not usually include one for bottom-up attention, such a metric could be relatively easily constructed (Trifu, Goga, & Bostănică, 2024). Even in its absence, engagement, focus, valence, and intensity may be measured before and after the target location and at the end of the exposure time, allowing for a better understanding of the processes leading to the self-reported values. A workable solution for synchronizing an eye-tracker with an EEG headset is needed, which proved to be more difficult than usually advertised.

Finally, despite warnings of possible contamination in the case of asking respondents to report both intensity and valence after a stimulus exposure (effect (Wilcox & Wlezier, 1993; Shentu & Xie, 2010), no significant correlations were found between self-reported values in any of the four images.

5. Conclusions

When the decider looks for a specific stimulus, the more he or she needs to find it, the less attractive this stimulus will be evaluated, no matter its intrinsic valence and intensity. The current study focused on a buying-like context, with four seconds to locate and evaluate the attractiveness and intensity of the emotions various stimuli elicit, and some tenths of a second between easy and difficult-to-find targets. The importance of easy-locating a product in real life is probably superior to the one suggested by this study, as the targets in the research could not be replaced by the distractors.

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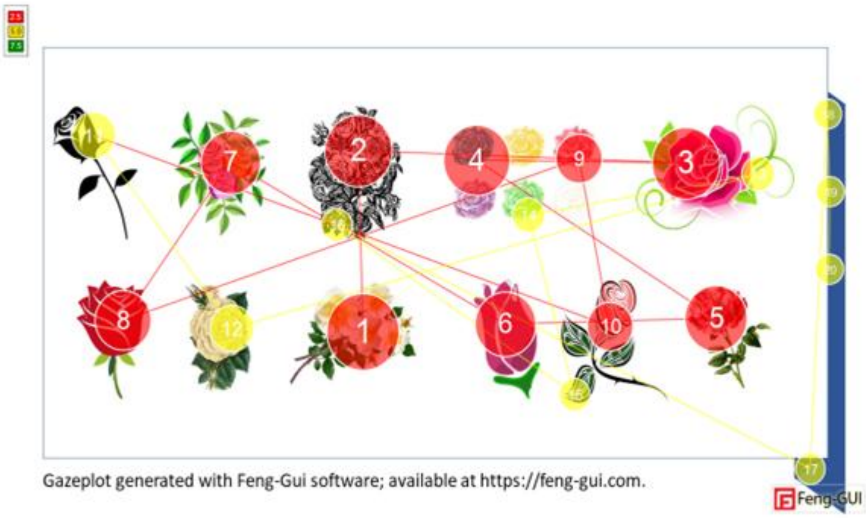
Appendix I – pictures used in Images 1A and 1B

Pictures from Pixabay; available at https://pixabay.com/images/search/stylized%20flowers

Appendix II Gazeplot of Image 1A



Gazeplot generated with Feng-Gui software; available at https://feng-gui.com.

Appendix III Gazeplot of Image 1B

Gazeplot generated with Feng-Gui software; available at https://feng-gui.com.

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