The Meta-analysis of effects of top-down and bottom-up factors on visual attention

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Resumo

The goal of the present study is to conduct the meta-analysis on the antecedents (top-down and bottom-up factors) of visual attention. 310 scientific articles were identified, and the final sample had 201 articles with a total of 781 effect-sizes. The effect size associated with visual attention was divided into two factors: top-down and bottom-up. Our research deepens and describes the interference of these two factors in the visual attention demonstrating the difference between the variables that compose them. In the top-down factors, it was possible to verify that the variable that has the greatest impact on visual attention is product involvement and the variable that has the least significant impact is the recall. In the bottom-up factors, the variable that has a greater positive and significant impact on visual attention is the visual complexity, and the variable with the least impact is the visual area of the label.

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Abstract: The goal of the present study is to conduct the meta-analysis on the antecedents (top-down and bottom-up factors) of visual attention. 310 scientific articles were identified, and the final sample had 201 articles with a total of 781 effect-sizes. The effect size associated with visual attention was divided into two factors: top-down and bottom-up. This study promoted an ordered synthesis of the different types of empirical results involving visual attention in the marketing area. Our research deepens and describes the interference of these two factors in the visual attention demonstrating the difference between the variables that compose them. In the top-down factors, it was possible to verify that the variable that has the greatest impact on visual attention is product involvement and the variable that has the least significant impact is the recall. In the bottom-up factors, the variable that has a greater positive and significant impact on visual attention is the visual complexity, and the variable with the least impact is the visual area of the label.

Keywords: theory of attention to visual marketing, eye-tracking, top-down and bottom-up factors and meta-analysis

1. Introduction

Visual attention studies have a long tradition in various fields of marketing knowledge with different purposes (Russo and Laclerc, 1994; Pieters et al., 2010; Lindström et al., 2016). These studies indicate that the visual cognitive processing happens through the visual attention that assumes the movement of the head and the eyes through fixations and saccades (Chandon et al., 2009).

The visual cognitive processing tends to be high when there are the selection and focalization processes of visual attention (Wedel and Pieters, 2000). This elevation occurs in two ways. The first is through the processing of visual memory of a long-term visual memory that affects the sequence of fixations and saccades over time and space (Janiszewski, 1998). The second through the saliency of objects promoted by many different types of visual marketing stimuli (static and dynamic) in several scenes: ads, displays, objects, brands and websites (Huddleston et al., 2015). These two paths are objects of study of the theory of attention to visual marketing (Wedel and Pieters, 2000). This theory uses the eye-tracking technique to access visual stimuli to evaluate the consumer choice process (Vu et al., 2016).

Recently, through the development of eye-tracking technique, visual attention has been evaluated through marketing studies in different contexts (retail, television commercials, print advertising, web usability, among others) with different measures (fixation frequency, time spend, fixation count, visit count and number of fixations, among others) (Chandon et al., 2009, Meißner et al., 2016; Lindström et al., 2016). This has promoted different formats of experiments that analyze the visual attention with different variables (consumer motivations, brand familiarity, product involvement, recall, recognition, visual complexity, perceived amount of information, time pressure condition, among others).

Due to this set of characteristics, we believe that the simple union of the relations analyzed in the studies of visual attention generated imprecise estimates of the size of the effect. Thus, we propose a meta-analytical study to jointly and generalize the results generated from different studies that were generated within the scope of the theory of attention to visual marketing.

The goal of the present study is to conduct the first meta-analysis on the antecedents (top-down and bottom-up factors) of visual attention. Our research makes some important contributions to the theory of attention to visual marketing. First, we synthesize key top-down

factors that affect long-term visual memory and their relative impact on visual attention and thus identify their key drivers. Second, we synthesize also the main bottom-up factors that generated through the visual marketing stimuli and their relative impact on visual attention and thus identify their key drivers.

2. Theory of attention to visual marketing and consumption choices

Visual attention is considered one of the ways that the consumer has to acquire information about products and optimize their choice process (Clement, 2007; Kim and Lennon, 2008; Lang et al., 2016; Lindström et al., 2016). Visual attention can be termed metaphorically as a spotlight in which the consumer focuses on the product and reduces event processing at the time of choice (Orquin and Loose, 2013). This spotlight is done through scan path aided by the movement of the eyes and the head determining a focus within a physical space in a certain period (Pieters and Warlop, 1999).

The scan path is constructed through two small eye fixations: fixations and saccades (Orquin and Loose, 2013). Fixations are pauses in which eyes are immobile and have durations ranging from 50 milliseconds to more than one second (Chandon et al., 2009). The saccades are quick jumps that the eyes make from one fixation to another fixation (Orquin and Loose, 2013). In these movements, vision is essentially suppressed (Chandon et al., 2009).

The set of movements promoted by fixations and saccades are measured by the various types of eye-tracker available in the market. Traditionally these devices help to measure the movement of visual attention in consumption choices (Huddleston et al., 2015, Meißner, 2016).

In consumer choices, visual attention can be influenced or influenced by several marketing variables (Pieters and Warlop, 1999; Huddleston et al., 2015). The variables that influence visual attention can be divided into top-down factors and bottom-up factors (Theeuwes, 2010; Orquin and Loose, 2013).

The top-down and bottom-up factors can be understood within the theory of attention to visual marketing (Theeuwes, 2010; Huddleston et al., 2015). This approach postulates that visual attention theory is exposed to visual stimuli and attention is composed of selection and targeting processes. In this theory, the generated meaning of the stimulus is directly affected by the visual attention that can be determined (1) by the person's characteristics, such as individual traits and motivations (top-down factors) and (2) aspects associated with the object or scene (bottom-up).

These factors determine the informational capacity and salience of visual stimuli for the consumer, generating attractive aspects to capture attention (Orquin and Loose, 2013). Both factors influence visual attention through selective enhancement of the visual features that occur through the selective and automatic suppression of the characteristics that are diagnosed (Theeuwes, 2010).

Bottom-up factors are found directly in marketing stimuli and appear instantaneously in the first eye fixation, due to some perceptual characteristic that may be associated with a product or display disclosure (Pieters and Warlop, 1999; Chandon et al., 2009). For example, a product exposed on the shelf of an attractively sumptuous product will tend to draw attention to other products that have not been properly exposed. This example happens largely involuntarily and is a clear expression of the bottom-up factors in visual attention. The variables that represent the bottom-up factors found in the literature review were amount of time spent, visual complexity, number of acquisition, perceived amount of information, the competition for attention, the size of the product, time pressure condition, visual area of advertising, visual area of body text, visual area of brand, visual area of headline, visual area of label, visual area nutritional information, visual area of pictorial, visual area of price and visual area of traffic light system.

Top-down factors are considered voluntary mechanisms that guide visual attention (Lang et al., 2016; Lindström et al., 2016). For example, look for a brand that the consumer knows or remember a benefit of the product that was seen days ago. These two examples happen on a voluntary basis and are clear top-down expressions in visual attention. The variables that represent the top-down factors found in the literature review were consumer motivations, brand familiarity, health consciousness, knowledge, memory performance, product involvement, recall, and recognition.

3. Method

3.1 Data collection and coding

At first we selected in eight databases (*Jstor*, Emerald, *PsycINFO*, *Taylor & Francis*, *Elsevier Science Direct*, *SCOPUS*, *Scielo* and *EBSCO*) studies that had the following combinations of terms: "*theory of attention to visual marketing*" and "*eye-tracking technique*" in the "*document title*" and / or "*summary*".

In a second stage, we accessed research provided by congresses and also by dissertation bank. In this case, the search was done by the platform ProQuest Dissertations & Theses Full Text. This step was aimed at incorporating unpublished studies, which allows discussing the fail-drawer problem since there is an academic current that believes in the predominance of studies publications that have significant and strong effects (Rosenthal, 1995).

After the completion of the two steps, we identified after the completion of the two 310 scientific articles. We selected studies that provide estimates on the effects on visual attention, the measured eye-tracking technique. In total 109 studies were withdrawn because they did not present estimates for the accomplishment of the meta-analysis. So, our final sample had 201 assessed articles with a total of 781 effect-sizes.

The effect size associated with visual attention was divided into three factors: (1) top-down and (2) bottom-up. The top-down factor evaluated 148 effects size divided into eight variables: consumer motivations, brand familiarity, health consciousness, knowledge, memory performance, product involvement, recall, and recognition. The bottom-up factor evaluated 374 effects size divided into sixteen variables: amount of time spent, visual complexity, number of acquisition, perceived amount of information, the competition for attention, the size of the product, time pressure condition, visual area of advertising, visual area of body text, visual area of brand, visual area of headline, visual area of label, visual area nutritional information, visual area of pictorial, visual area of price and visual area of traffic light system. Finally, 258 effects size were not used because they did not have at least three equal variables for the calculations in the meta-analysis.

The articles were extracted from scientific works from the period 1989 to 2018, and the data collection evidenced in the primary articles was carried out in 30 different countries. The scenes in which the theory of attention to visual marketing were analyzed occurred in several areas of marketing: display (o = *301*), print advertising (o = 230), web advertising (o = 131), package design (o = 98) and brand (o = 21).

3.2 Meta-analytic procedure

The effect size metric for the meta-analysis is the correlation coefficient. Since it is a meta-analysis in which the primary data were collected through experiments, we followed the procedures suggested by Hedges and Olkin (1985) for the conversion to *Pearson correlation r*. The *Student T* and *F Ratio* statistics were converted based on the formulas suggested by Hunter and Schmidt (2004).

Once the effect sizes of each relation were collected, they were corrected by the sample size (Hedges and Olkin, 1985), and the effect-size random effect was applied, as suggested by Hunter and Schmidt (2004). In this sense, the correlations were transformed for *Fisher Z*. The upper and lower confidence interval index was also analyzed at 95% level that comprises an estimate of the mean range of corrected weighted correlations (Hunter and Shmidt, 2004).

To analyze the level of heterogeneity of the studies, the Q and I^2 tests were used. The first, called *Cochran's Q*, verifies whether the data found in a primary study refute the null hypothesis, i.e., if the null hypothesis is confirmed ($p > .05$) the studies are considered homogeneous (Lau et al., 1998). The I^2 statistic is obtained through the Q statistic and can range from 0 to 100%. Studies with a 25% index show low heterogeneity, studies with 50% values show moderate heterogeneity and over 75% high heterogeneity (Higgns et al., 2003).

Finally, in the significant direct relationships, the Fail Safe Number index (FSN) was analyzed. This estimate allows us to evaluate the number of non-significant or unpublished studies that are necessary to refute the findings in this research (Rosenthal, 1979). This analysis allows evaluating if the effects observed in the relations are sufficiently robust (Borenstein et al., 2009). For this calculation, the formulas suggested by Rosenthal (1979) and Orwin (1983) were used. The Rosenthal (1979) parameter asks how many hidden works are needed to make the non-significant effect rather than investigating the number of unpublished studies that reduce the effect to the point of making it non-significant. In contrast, the Orwin parameter (1983) proposes a variant of the Rosenthal formula, allowing the researcher to stipulate how many missing studies would bring the overall effect to a specified nonzero level.

4. Results

The results of this meta-analysis are presented from the perspectives *HOMA* The *HOMA method* (Hedges-Okin Meta-Analysis) comprises the steps described above concerning the conversion of the values to the correlation level and their corrections from the transformation of the effect in Fisher Z. (Geyskens et al., 2009).

4.1 HOMA results of top-down factors

The random-effects HOMA were evaluated in eight constructs of the top-down factors: consumer motivations, brand familiarity, health consciousness, knowledge, memory performance, product involvement, recall, and recognition.

Table 1 - Homa results and projection of the failsafe number of top-down factors

	Summarizing the study characteristics			Describing Effect Size Distributions					Heterogeneity tests		Coefficients of robustness	
Consumer motivations	*k*	6	*N*	*Effect r*	*ICI (95%)*	.328	*Z*	6,484	*Q*	*104.51*	*FSN**	1134
	O	23	2,459	.453	*ICS (95%)*	.562	*p-value*	.000	I^2	*84.69*	*FSN***	138
Brand familiarity	*k*	15	*N*	*Effect r*	*ICI (95%)*	-.271	*Z*	1.263	*Q*	*667.07*	*FSN**	NC
	O	22	5,603	-.108	*ICS (95%)*	.060	*p-value*	.207	I^2	*96.85*	*FSN***	NC
Health consciousness	*k*	3	*N*	*Effect r*	*ICI (95%)*	.028	*Z*	2,111	*Q*	*197.94*	*FSN**	357
	O	6	1,558	.375	*ICS (95%)*	.640	*p-value*	.035	I^2	*97.47*	*FSN***	55
Knowledge	*k*	4	*N*	*Effect r*	*ICI (95%)*	-.004	*Z*	1.943	*Q*	*143.42*	*FSN**	NC
	O	5	243	.458	*ICS (95%)*	.759	*p-value*	.052	I^2	*97.21*	*FSN***	NC
Memory performance	*k*	9	*N*	*Effect r*	*ICI (95%)*	.252	*Z*	7.119	*Q*	*34.47*	*FSN**	474
	O	13	1,586	.342	*ICS (95%)*	.425	*p-value*	.000	I^2	*65.16*	*FSN***	66
Product involvement	*k*	11	*N*	*Effect r*	*ICI (95%)*	.373	*Z*	6.229	*Q*	*438.89*	*FSN**	3297
	O	18	3,697	.517	*ICS (95%)*	.637	*p-value*	.000	I^2	*96.35*	*FSN***	120
Recall	*k*	16	*N*	*Effect r*	*ICI (95%)*	.259	*Z*	11.09	*Q*	*794.33*	*FSN**	5557
	O	34	10,540	.312	*ICS (95%)*	.362	*p-value*	.000	I^2	*95.84*	*FSN***	11
Recognition	*k*	12	*N*	*Effect r*	*ICI (95%)*	.212	*Z*	4.891	*Q*	*145.93*	*FSN**	496
	O	15	1,169	.344	*ICS (95%)*	.464	*p-value*	.000	I^2	*90.40*	*FSN***	6

*Note: (k) number of studies used from the analysis; (o) number of observations taken from the analysis of the studies; (N) number of accumulated samples of the assessed studies; Effect r = correlation found in the studies; ICI (95%) = confidence interval lower; ICS (95%) = confidence interval higher; p-value = degree of significance of the effect size (*p < .10; **p < .05; ***p < .01); Z = Standard score; Q = test of heterogeneity at the individual; I^2 = scale-free index of heterogeneity; Expectation Supported = + positive relationship (compared with base level); − negative relationship; -/+ ambiguous relationship, N.A. stands for not applicable ; FSN Rosenthal parameters = number of items needed for a false result; FSN Orwin parameters = number of items needed for a false result; NC = Not calculated because the effect size was not significant (p >.05).*

In the first relationship the HOMA results provide evidence that consumer motivations have a positive impact on visual attention ($r = .453$; $p < .001$). This relationship appears to be consistent with their findings ($FSN_{Rosenthal} = 1,134$; $FSN_{Orwin} = 138$) indicating that individual's propensity for experiential motivations for shopping may directly impact visual attention.

The Brand familiarity construct has been shown to have a negative and significant relationship with visual attention ($r = -.108$; $p < .001$). This result indicates that consumer's direct and indirect experience with a brand reduces the number of fixations in a scene (Clement et al., 2013).

From the random-effects HOMA, we conclude that there is an overall significant and positive relationship between health consciousness and visual attention ($r = .357$; $p < .05$), which is non-negligible (Ran et al., 2017). This result is consistent ($FSN_{Rosenthal} = 357$; $FSN_{Orwin} = 55$) indicating that the propensity to have a lifestyle oriented towards the prevention of health problems can increase the visual perception of the consumer about a product.

In addition, the HOMA results provide evidence that memory performance ($r = .342$; $p < .001$) and product involvement ($r = .517$; $p < .001$) interfere positively with visual attention. The relationship between knowledge and visual attention had a positive but not significant effect ($r = -.458$; $p = .052$).

Overall, we also find more positive and statistically significant sizes for the constructs recall ($r = .312$; $p < .001$) and recognition ($r = .344$; $p < .001$). These results indicate that abilities to correctly retrieve from memory and ability to remember something of the past can directly interfere with the ability of visual attention (Rosbergen et al., 1997; Chandon et al., 2009).

4.2 HOMA results of bottom-up factors

The systematic review has detected sixteen constructs associated with the bottom-up factors: amount of time spent, visual complexity, number of acquisition, perceived amount of information, the competition for attention, the size of the product, time pressure condition, visual area of advertising, visual area of body text, visual area of brand, visual area of headline, visual area of label, visual area nutritional information, visual area of pictorial, visual area of price and visual area of traffic light system.

Table 2 - Homa results and projection of the failsafe number of bottom-up factors

	Summarizing the study characteristics		Describing Effect Size Distributions					Heterogeneity tests		Coefficients of robustness	
Amount of time spent	*k* 11 *O* 19	*N* 2,662	*Effect r* .336	*ICI (95%)* *ICS (95%)*	.222 .441	*Z* *p-value*	5.538 *.000*	*Q* I^2	*150.00* *88.00*	*FSN** *FSN***	1388 153
Visual complexity	*k* 8 *O* 20	*N* 1,914	*Effect r* .644	*ICI (95%)* *ICS (95%)*	.617 .670	*Z* *p-value*	32.94 .000	*Q* I^2	*735.80* *97.41*	*FSN** *FSN***	3445 286
Number of acquisition	*k* 7 *O* 15	*N* 2,935	*Effect r* .489	*ICI (95%)* *ICS (95%)*	.229 .684	*Z* *p-value*	3,472 .000	*Q* I^2	*892.58* *98.43*	*FSN** *FSN***	2257 127
Perceived amount of information	*k* 10 *O* 19	*N* 1,687	*Effect r* .493	*ICI (95%)* *ICS (95%)*	.345 617	*Z* *p-value*	5,865 .000	*Q* I^2	*216,92* *91.70*	*FSN** *FSN***	1616 148
The competition for attention	*k* 6 *O* 11	*N* 2,315	*Effect r* -.323	*ICI (95%)* *ICS (95%)*	-.545 -.060	*Z* *p-value*	-2.38 .000	*Q* I^2	*548.65* *97.08*	*FSN** *FSN***	416 32
The size of the product	*k* 8 *O* 10	*N* 970	*Effect r* .476	*ICI (95%)* *ICS (95%)*	.320 .607	*Z* *p-value*	5,443 .000	*Q* I^2	*68.24* *86.81*	*FSN** *FSN***	634 107
Time pressure condition	*k* 10 *O* 15	*N* 766	*Effect r* .495	*ICI (95%)* *ICS (95%)*	.172 .723	*Z* *p-value*	2,878 .000	*Q* I^2	*352.72* *96.03*	*FSN** *FSN***	708 127
Visual area of advertising	*k* 13 *O* 43	*N* 4,843	*Effect r* .340	*ICI (95%)* *ICS (95%)*	.228 .443	*Z* *p-value*	5.686 .000	*Q* I^2	*4100.2* *98.97*	*FSN** *FSN***	6729 40
Visual area of body text	*k* 18 *O* 33	*N* 9,642	*Effect r* .469	*ICI (95%)* *ICS (95%)*	.391 .540	*Z* *p-value*	10,43 .000	*Q* I^2	*7856.28* *99.59*	*FSN** *FSN***	10,003 232
Visual area of brand	*k* 20 *O* 32	*N* 4,668	*Effect r* .291	*ICI (95%)* *ICS (95%)*	.228 .351	*Z* *p-value*	8.689 .000	*Q* I^2	*526.12* *94.10*	*FSN** *FSN***	3,344 25
Visual area of headline	*k* 4 *O* 12	*N* 710	*Effect r* .380	*ICI (95%)* *ICS (95%)*	371 .388	*Z* *p-value*	79.21 .000	*Q* I^2	*2308.6* *99.62*	*FSN** *FSN***	5,536 84
Visual area of label	*k* 13 *O* 36	*N* 2,548	*Effect r* .250	*ICI (95%)* *ICS (95%)*	.149 .346	*Z* *p-value*	4.758 .000	*Q* I^2	*378.56* *91.01*	*FSN** *FSN***	1,694 95
Visual area nutritional information	*K* 7 *O* 13	*N* 761	*Effect r* .592	*ICI (95%)* *ICS (95%)*	.416 .725	*Z* *p-value*	5.622 .000	*Q* I^2	*115.69* *99.62*	*FSN** *FSN***	983 157
Visual area of pictorial	*k* 23 *O* 49	*N* 6,751	*Effect r* .390	*ICI (95%)* *ICS (95%)*	.318 .458	*Z* *p-value*	9,736 .000	*Q* I^2	*6106.4* *99.22*	*FSN** *FSN***	5,273 55
Visual area of price	*K* 21 *O* 33	*N* 4,647	*Effect r* .381	*ICI (95%)* *ICS (95%)*	.297 .459	*Z* *p-value*	8.261 .000	*Q* I^2	*290.13* *88.97*	*FSN** *FSN***	4,420 199
Visual area of traffic light system	*k* 3 *O* 10	*N* 467	*Effect r* .302	*ICI (95%)* *ICS (95%)*	-.36 .764	*Z* *p-value*	.0879 .379	*Q* I^2	*485.73* *98.14*	*FSN** *FSN***	NC NC

From the random-effects HOMA, we can infer that there is an overall significant and positive relationship between the amount of time spent and visual attention ($r = .336; p < .001$). This implies that the greater the amount of time the consumer spends on a product, display or brand, the greater his/her visual attention (Zander and Hamm, 2010). Likewise, the relationship between visual complexity and visual attention has demonstrated a positive and significant relationship ($r = .664; p < .001$). This result indicates that the greater the complexity of a scene the greater the visual attention of the consumer (Pieters et al., 2010).

The number of acquisition has been shown to have a positive and significant influence on visual attention ($r = .489; p < .001$). This finding indicates that the quantity of products that a consumer wants to acquire will directly influence the quantity of saccades and fixations of a consumer. Similar to this, the perceived amount of information has also had a positive and significant effect on visual attention ($r = .493; p < .001$), which is non-negligible (Pieters, and Warlop, 1999). The available quantity of product information in labels, website, and display directly influences the visual attention.

The competition for attention variable has been shown to have an inverse relationship with visual attention ($r = -.323; p < .001$). The results show that the higher the level of competition for lower attention will be the visual attention of the consumer (Nordfält, 2011). Regarding the variables the size of the product ($r = .476; p < .001$) and time pressure condition ($r = .495; p < .001$) the HOMA results demonstrated a positive and significant relationship with the visual attention. These relationships have proved to be very consistent failsafe number values.

The down-top factors evaluated nine variables that measured the visual area's influence on increased visual attention. Of these relationships, only the visual area of traffic light system did not have a significant relation with visual attention ($r = .302; p = .379$). All other relationships have demonstrated positive, meaningful and consistent relationships with visual attention: visual area of advertising ($r = .34; p < .001; FSN_{Rosenthal} = 6{,}729; FSN_{Orwin} = 40$), visual area of body text ($r = .469; p < .001; FSN_{Rosenthal} = 10{,}003; FSN_{Orwin} = 232$), visual area of brand ($r = .291; p < .001; FSN_{Rosenthal} = 3{,}344; FSN_{Orwin} = 25$), visual area of headline ($r = .38; p < .001; FSN_{Rosenthal} = 5{,}536; FSN_{Orwin} = 84$), visual area of label ($r = .25; p < .001; FSN_{Rosenthal} = 1{,}694; FSN_{Orwin} = 95$), visual area nutritional information ($r = .592; p < .001; FSN_{Rosenthal} = 983; FSN_{Orwin} = 157$), visual area of pictorial ($r = .39; p < .001; FSN_{Rosenthal} = 5{,}273; FSN_{Orwin} = 55$) and visual area of price ($r = .381; p < .001; FSN_{Rosenthal} = 4{,}200; FSN_{Orwin} = 199$).

5. Discussion

This meta-analysis examines the convergences and divergences of previous research that are encompassed within the theory of visual marketing, testing and applying the understanding between the effects of visual attention with top-down and bottom-up factors and different types of evaluations of consumers. This study promoted an ordered synthesis of the different types of empirical results involving visual attention in the marketing area. Eye-tracking studies that directly analyze visual attention are composed of experiments that initially demonstrate particularly complex relationships.

Prior research has found that there are individual differences for the top-down and bottom-up factors (Janiszewski, 1998; Chandon et al., 2009; Lindström et al., 2016). However, these researches did not bother to describe at the same time all these relations verifying their possible effect size. This meta-analysis proposes a clearer description of top-down and bottom-up factors and thus a better understanding of the theory of attention to visual marketing.

Our research deepens and describes the interference of these two factors in the visual attention demonstrating the difference between the variables that compose them. For example, in the top-down factors, it was possible to verify that the variable that has the greatest impact on visual attention is product involvement and the variable that has the least significant impact is the recall. In the bottom-up factors, the variable that has a greater positive and significant impact on visual attention is the visual complexity, and the variable with the least impact is the visual area of the label.

6. Implications for researchers and managers

The meta-analysis of visual attention described in this paper provides objective evidence of the effect of top-down and bottom-up factors on attention. Also, visual attention tends to influence consumer evaluations at the time of purchase. Unlike the previous published reviews of eye-tracking technique, this meta-analysis systematically retrieved all studies that supported the strong argument that consumers' evaluations can be explained by the theory of attention to visual marketing.

In addition to providing insight into visual attention and its possible relationships found in academic marketing studies, the present research classifies the size of the effect sizes under a variety of study conditions. In other words, the results provide empirical evidence as to what constitutes visual attention effect size in selected research situations (small, medium or large). Thus, researchers and students investigating the theory of attention to visual marketing now have an updated table of the effects size produced by visual attention to compare and evaluate their research.

Marketing scholars identify several relationships that analyze the relationship between visual attention and retail conditions (visual complexity, number of acquisition, perceived amount of information, the competition for attention, the size of the product and time pressure condition). Our meta-analysis allows us to generalize the effects of visual attention on the retail environment.

Managing this meta-analysis assists the sensory strategies of product exposure and development of packaging and labels. Managers need different implementation strategies when it comes to attracting consumers' eyes to their products. Managers should also be aware that visual attention can be originated by characteristics of a store or product (bottom-up factors) as well as by construction of long-term visual memory (top-down factors).

7. Limitation and directions for further research

This meta-analysis has limitations in its data collection and analysis. As far as data collection is concerned, this meta-analysis is limited by the variables provided in the primary studies. Also, it is not possible to add to the calculations articles considered as biographical reviews. Another point to be cautious is that the variables that relate to visual attention were defined and operationalized differently in the different experiments used for the primary data. Respect for data analysis should be cautious because the direct relationships demonstrate a high degree of heterogeneity.

In general, we have also shown for future research that there is a proliferation of items that measure relationships in current visual attention studies, hindering theoretical integration. In spite of these limitations, this meta-analysis contributes in an important way to the understanding of the existing relations in the theory of attention to visual marketing. We found direct relationships integrated between top-down and bottom-up factors and visual attention. Also, we demonstrate that visual attention impacts consumers' evaluations.

References

Aaker, A. (1991). Managing brand equity. New York: Free Press.
Alba, J.W., & Hutchinson, J.W. (1987). Dimensions of consumer expertise. Journal of consumer research, 13(4), 411-454.
Babin, B.J., Darden, W.R., & Griffin, M. (1994). Work and/or fun: measuring hedonic and utilitarian shopping value. Journal of consumer research, 20(4), 644-656.
Batra, R., & Ahtola, O. T. (1991). Measuring the hedonic and utilitarian sources of consumer attitudes. Marketing letters, 2(2), 159-170.
Bettman, J. R., Luce, M. F., & Payne, J. W. (1998). Constructive consumer choice processes. Journal of consumer research, 25(3), 187-217.
Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2009). Front matter (chapter 30 – publication bias). Chichester: John Wiley & Sons, Ltd.
Chandon, P. J.; Hutchinson, W.; Bradlow, E.T. & Young, S.H (2009). Does In-Store Marketing Work? Effects of the Number and Position of Shelf Facings on Brand Attention and Evaluation at the Point of Purchase. Journal of Marketing, 73(1), 1-17
Cian, L., Krishna, A., & Elder, R. S. (2014). This logo moves me: Dynamic imagery from static images. Journal of Marketing Research, 51(2), 184-197.
Clement, J. (2007). Visual influence on in-store buying decisions: an eye-track experiment on the visual influence of packaging design. Journal of marketing management, 23(9-10), 917-928.
Coulter, K. S. (2007). The effects of digit-direction on eye movement bias and price-rounding behavior. Journal of Product & Brand Management, 16(7), 501-508.
Dholakia, U.M. (2001). A motivational process model of product involvement and consumer risk perception. European Journal of marketing, 35(11/12), 1340-1362.
Folkes, V., & Matta, S. (2004). The effect of package shape on consumers' judgments of product volume: attention as a mental contaminant. Journal of Consumer Research, 31(2), 390-401.
Geyskens, I., Krishnan, R., Steenkamp, J. B. E., & Cunha, P. V. (2009). A review and evaluation of meta-analysis practices in management research. Journal of Management, 35(2), 393-419.
Godes D, Mayzlin D. Using online conversations to study word-of-mouth communication. Marketing Science 2004; 23(4):545–60.
Hedges, L.V & Olkin, I. (1985). Statistical methods for meta-analysis. Orlando, FL: Academic Press.
Holbrook, M. B., & Schindler, R. M. (1991). Echoes of the dear departed past: Some work in progress on nostalgia. ACR North American Advances.
Hunter, J. E., & Schmidt, F. L. (2004). Methods of meta-analysis: Correcting error and bias in research findings. Sage.
Lang, M., Kelley, J., & Moore, K. (2016). Simulated Attention-Tracking Methodologies: An Examination of Measurement Efficacy. Journal of food products marketing, 22(8), 872-890.
Lau, J., Ioannidis, J. P., & Schmid, C. H. (1998). Summing up evidence: one answer is not always enough. The lancet, 351(9096), 123-127.
Lindström, A., Berg, H., Nordfält, J., Roggeveen, A. L., & Grewal, D. (2016). Does the presence of a mannequin head change shopping behavior? Journal of Business Research, 69(2), 517-524.
Janiszewski, C. (1998). The influence of display characteristics on visual exploratory search behavior. Journal of Consumer Research, 25(3), 290-301.
Keller, K.L. (1987). Memory factors in advertising: The effect of advertising retrieval cues on brand evaluations. Journal of Consumer Research, 14(3), 316-333.

Kim, M., & Lennon, S. (2008). The effects of visual and verbal information on attitudes and purchase intentions in internet shopping. Psychology & Marketing, 25(2), 146-178.
Hartmann, P., Apaolaza, V., & Alija, P. (2013). Nature imagery in advertising: Attention restoration and memory effects. International Journal of Advertising, 32(2), 183-210.
Häubl, G., & Trifts, V. (2000). Consumer decision making in online shopping environments: The effects of interactive decision aids. Marketing science, 19(1), 4-21.
Huddleston, P., Behe, B.K., Minahan, S., & Fernandez, R.T. (2015). Seeking attention: an eye tracking study of in-store merchandise displays. International Journal of Retail & Distribution Management, 43(6), 561-574.
Meißner, M., Musalem, A., & Huber, J. (2016). Eye tracking reveals processes that enable conjoint choices to become increasingly efficient with practice. Journal of Marketing Research, 53(1), 1-17.
Morrison, D.G. (1979). Purchase intentions and purchase behavior. The Journal of Marketing, 65-74.
Nordfält, J. (2011). Improving the attention-capturing ability of special displays with the combination effect and the design effect. Journal of Retailing and Consumer Services, 18(3), 169-173.
Orquin, J.L., & Loose, S.M. (2013). Attention and choice: A review on eye movements in decision making. Acta psychologica, 144(1), 190-206.
Orwin, R.G. (1983). A fail-safe N for effect size in meta-analysis. Journal of educational statistics, 8(2), 157-159.
Pieters, R., & Warlop, L. (1999). Visual attention during brand choice: The impact of time pressure and task motivation. International Journal of research in Marketing, 16(1), 1-16.
Pieters, R., Rosbergen, E., & Wedel, M. (1999). Visual attention to repeated print advertising: A test of scanpath theory. Journal of marketing research, 424-438.
Pieters, R., Wedel, M., & Batra, R. (2010). The stopping power of advertising: Measures and effects of visual complexity. Journal of Marketing, 74(5), 48-60.
Ran, T., Yue, C., & Rihn, A. (2017). Does nutrition information contribute to grocery shoppers' willingness to pay?. Journal of Food Products Marketing, 23(5), 591-608.
Rosbergen, E., Pieters, R., & Wedel, M. (1997). Visual attention to advertising: A segment-level analysis. Journal of consumer research, 24(3), 305-314.
Rosenthal, R. (1979). The file drawer problem and tolerance for null results. Psychological bulletin, 86(3), 638.
Russo, J.E., & Leclerc, F. (1994). An eye-fixation analysis of choice processes for consumer nondurables. Journal of consumer research, 21(2), 274-290.
Sharma, N., & Patterson, P.G. (2000). Switching costs, alternative attractiveness and experience as moderators of relationship commitment in professional, consumer services. International journal of service industry management, 11(5), 470-490.
Siegrist, M., Leins-Hess, R., & Keller, C. (2015). Which front-of-pack nutrition label is the most efficient one? The results of an eye-tracker study. Food Quality and Preference, 39, 183-190.
Theeuwes, J. (2010). Top–down and bottom–up control of visual selection. Acta Psychologica, 135(2), 77–99.
Wedel, M., & Pieters, R. (2000). Eye fixations on advertisements and memory for brands: A model and findings. Marketing science, 19(4), 297-312.
Zander, K., & Hamm, U. (2010). Consumer preferences for additional ethical attributes of organic food. Food quality and preference, 21(5), 495-503.