The Role of Personality in Advertising Perception: An Eye Tracking Study

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ABSTRACT

The goal of this study was to examine associations between broad personality traits and gazing behavior when viewing car advertisements. As stimulus material, 12 different car advertisement pictures were selected from magazines; these depicted a car and varied in pricing with accompanying text. Two major areas of interest (AOIs) in the advertisements where analyzed in participants' ($N = 61$) gazing: the car and price/text. The eye movement parameters number of fixations, mean fixation duration, and total dwelling time in the two AOIs were predicted from participants' Big Five traits (measured with the NEO-FFI). Findings yielded that participants generally focused more on the car rather than the price/text and that neuroticism and extraversion were associated with more fixations on the car while neuroticism and conscientiousness with less fixations on the price/text. Findings are discussed regarding their implications for personality-congruent advertisement.

Keywords

Advertisement – Gazing – Personality – Perception – Eye Tracking

Advertising is ubiquitous in our modern world: Whether on a building, on busses, or on web pages, there is always a shiny car, a face smiling, or delicious food. Advertisement and its reception constitutes a major part of our daily lives and it is plausible to assume that people – depending on their personalities – process and react to advertisements differently. Indeed, it has already been shown that there are individual differences in processing visual information which are also related to personality (e.g. Avisar, 2011; Kaspar & König, 2011). Thus, personality should also manifest in how we perceive advertisements. In the current work, we examined people's eye movements with eye-tracking methodology to shed light on how major dimensions of personality are related to processing meaningful stimuli in visual advertisements.

1 Literature Review

1.1 Links between advertisement and gazing

Attention is allocated where the eyes go (Rayner, 1995) and thus gazing behavior provides reliable information about consumers' visual attention to advertisements (Krugman, Fox, Fletcher, Fischer & Rojas, 1994; Rosbergen, Pieters & Wedel, 1997). Especially pictures attract our attention (Pieters & Wedel, 2004) and thus provoke thinking about and evaluation of the represented product (Mitchell & Olson, 1981). Therefore, Chowdhury, Olsen and Pracejus (2011) stated that pictures are a prerequisite for effective advertisement, which has been empirically supported by a number of studies (e.g. Childers & Houston, 1984, Edell & Staelin, 1983; Keller, 1987). However, Rayner et al. (2001) demonstrated that people spent more time examining text rather than pictures. Thus different findings of where people look when viewing advertisements exist. To reconcile both positions, we incorporated in

the present study both text and pictures into advertisement stimuli and tracked perceivers' gazing behaviors with an eye-tracking system. With the exception of the aforementioned studies, results concerning gazing behavior and advertisement are rather rare (e.g. Batra, Myers & Aaker 1996; Rossiter & Percy, 1983; Wedel & Pieters, 2008).

1.2 Links between personality and gazing

Several studies have shown that personality is associated with eye movement patterns. Matsumoto, Shibata, Seiji, Mori and Shioe (2010) demonstrated that perceivers' openness was related to increased fixations to the eyes of an opposite individual. Rauthmann, Seubert, Sachse and Furtner (2012) showed with abstract stimuli that perceivers' neuroticism was related to longer durations of fixations; perceivers' extraversion to a shorter dwelling time and higher number of fixations; and perceivers' openness to longer mean fixation durations and dwelling times. Risko, Anderson, Lanthier and Kingstone (2012) illustrated that perceptual curiosity was a strong predictor of eye movement behavior while exploring a natural scene. Stenberg, Rosen and Risberg (1990) could show that introversion was related to a narrower focus of attention. Althaus, Gomarus, Wijers, Mulder, van Velzen and Minderaal (2005) demonstrated that extraversion was related to better blinding out irrelevant information. Szymura and Necka (1998) showed that extraversion was related to fewer failures under difficult circumstances, whereas introversion to better and faster performance on easier tasks.

Together, these findings suggest that primarily „temperamental" traits – such as extraversion and neuroticism (Clark & Watson, 2008) – are related to individual differences in gazing. As Rauthmann et al. (2012) have pointed out, individual differences in gazing can manifest in two areas: (a) *how* a person gazes (i.e. individual differences in oculomotoric activity) and (b) *where* a person gazes to (i.e. individual differences in selective attention to circumscribed stimuli). Both forms of individual differences have been successfully linked to personality as we have outlined above with our cursory literature review. In the current research, we focused on both aspects and its relations to the broad personality traits of the Big Five (John & Srivastava, 1999) in the context of advertisements.

1.3 Eye-tracking methodology

Most advertisements use visual content to provoke attention. Visual perception relies on sequences of information input via complex patterns of eye, head and body movements (Furtner & Sachse, 2008). High-resolution visual information input occurs only at so-called fixation points which are fixated with the fovea (Posner, 1980, 1995). Eye-tracking data make it possible to gather information about visual attention (Eliana, Cuddihy, Goldberg & Ramey, 2008) and fixations may be recorded with three different types of eye-trackers: remote or table-mounted systems (e.g. Furtner, Rauthmann & Sachse, 2009; Goldberg & Wichansky, 2003; Jacob & Karn, 2003), head-mounted systems (e.g. Duchowsky, 2007) and eye-tracking glasses (e.g. Bulling & Gellersen, 2010). Data is usually recorded with the pupil center corneal reflection method (Ohno, Mukawa & Yoshikawa, 2002) where the eyes' position and movement direction are related to a vector (visual axis) spanning from the corneal Purkinje reflection (captured with infrared light) to the center of the pupil.

Many different eye movement parameters can be analyzed (e.g. saccades, smooth pursuits, number of fixations, mean fixation duration, dwelling time; see Joos, Rötting & Velichkovsky, 2003). A meta-analysis has shown that the three most widely used parameters are number of fixations, mean fixation duration and dwelling time (Jacob & Karn, 2003; see also Joos et al., 2003). These all refer to fixations and can be sampled with the pupil center corneal reflection method (Ohno & Mukawa, 2004). Since eye-tracking provides objective measurement and offers quantitative data which are easy to combine with subjective assessment (Chin, Lee & Ramey, 2005; Tsai, Viirre, Strychacz, Chase & Jung, 2007), we make use of this method in the current work.

2 The Current Study

The present research aimed to examine relationships between broad personality traits (the Big Five) and gazing behavior when viewing car advertisements as meaningful stimuli with topical information. Therefore, we used different images of advertised cars that included a price and some text. Based on the studies mentioned above, we hypothesized that personality would be broadly associated with different eye gazing parameters (e.g. number of fixations) as well as the fixation of specific topical information. However, to date (and to the best of our knowledge), no study has examined how the Big Five traits *differentially* manifest in gazing behavior when viewing car advertisements. In line with previous research (see Introduction) we expected to find evidence that the temperamental traits neuroticism and extraversion as well as also openness/intellect would be related to different eye movement parameters.

3   Methods

3.1   Participants

Data from $N = 61$ students (32 women; age: $M = 24.69$, $SD = 5.26$, range: 19-49 years) were gathered. All participants had normal or corrected-to-normal vision. Verbal consent was given prior to the study. Participation took place voluntarily and no remuneration was offered.

3.2   Instruments

A Pentium IV computer with a graphics card NVIDIA GeForce 4 MX 4000 was used. Stimuli were presented on a 17-inch computer monitor with a display refresh rate of 75 Hz in Power Point (full-screen). Visual recording of gazing behavior was collected using two binocular cameras which where mounted beneath the monitor and had 0.4° accuracy. NYAN 2.0 software from Interactive Minds Dresden (IMD) was used for the table-mounted Eyegaze Analysis System from LC Technologies Inc., which allowed recording (with a sample rate of 8.5 ms) and analyzing participants' fixations (minimum duration: 100 ms). Two observing monitors ensured that the right and left eye could be monitored in real time while testing (to correct participants' sitting posture to recalibrate during recording if necessary). Utilizing the pupil center corneal reflection method, three eye movement parameters (dependent variables) were sampled: absolute number of fixations, mean fixation duration (in ms) and total dwelling time (total time of all fixation durations in ms). Calibrations were accepted if fixation accuracy showed an average drifting error of maximally 0.25" or smaller.

3.3   Measures and Materials

Personality: The NEO-FFI (Costa & McCrae, 1992; German version: Borkenau & Ostendorf, 1993) with 60 items (12 items per scale) on a five-point Likert-type scale (0 *strongly disagree* – 4 *strongly agree*) was used. Means across items were computed to form the Big Five scales of Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness.

Presented stimuli: Twelve advertisement pictures of cars were selected from various magazines and then randomly presented to the participants, all were of the same size. These cars varied in price levels (low vs. medium vs. high) to represent a wide range of offerings (8.990 € – 72.650 €; range values: 8.990 € – 17.990 €, 19.400 € – 24.990 €, 29.690 € – 72.650 €). As common in car advertising, each of them presented the automobile as central element while price/text was positioned below or above. The presented cars were a mixture of various brands (e.g. Dacia as a low price brand, VW as a medium price brand and Jaguar as a high price brand).

Procedure: First, participants were seated in front of the computer monitor and the table-mounted eye-tracking system. Subsequently, they were instructed to carefully view each presented image. We then adjusted the cameras for each person using a calibration program. As soon as the visual adjustment was successful, the stimuli were presented. Each picture was displayed for 8 seconds. After the presentation ended, a questionnaire including the NEO-FFI and various demographical variables was administered.

Data-analytical plan: Each price category (low vs. medium vs. high) contained four cars, and an average score for each eye movement parameter across the four cars was computed. Thus, 18 average scores were obtained for each person: average number of fixations on car and average number of fixations on price/text for the low, medium, and high price category separately; average mean fixation duration on car and average mean fixation on price/text for the low, medium, and high price category separately; and average dwelling time on car and average dwelling time on price/text for the low, medium, and high price category separately. Importantly, however, each participant was presented in a within-subjects design with all stimuli so that eye movement parameters per car (aggregated) category were nested within participants. Since it has repeatedly been discussed that using linear models for studying multilevel problems might lead to delusive results (Boyd & Iverson, 1979; Haney, 1980; Burstein, 1980; Raudenbush & Bryk, 1986), we address the nested data structure by using multi-level modeling (Raudenbush & Bryk, 2002) with the mixed command in SPSS. Specifically, we predicted the three z-standardized averaged eye movement parameters number of fixations, mean fixation duration, and total dwelling time, obtained from two major areas of interest (i.e. cars vs. price/text), from participants' Big Five trait scores. Additionally, we included sex as a covariate.

4   Results

Descriptive statistics can be found in Table 1. Table 2 displays the multi-level findings. As can be seen, only Neuroticism, Extraversion, and Conscientiousness showed statistically significant (i.e. $p < .05$) effects. Neuroticism was positively associated with number of fixations ($p = .000$) and total dwelling time ($p = .033$) on the car, while negatively associated with number of fixations ($p = .003$), mean fixation duration ($p = .010$), and total dwelling time ($p = .005$) on the price/text. Extraversion was positively associated with number of fixations ($p = .036$) on the car, and negatively with total dwelling time ($p = .034$) on the price/text. Consci-

Table 1: Descriptive statistics.

Variables	M	SD	α
Price categories			
Low price			
AOI Car			
NF	16.73	5.30	
MFD	217.77	51.98	
DT	3660.34	1466.05	
AOI price/text			
NF	1.78	1.75	
MFD	95.82	77.28	
DT	280.09	381.87	
Average price			
AOI Car			
NF	16.21	5.40	
MFD	207.11	42.99	
DT	3389.61	1375.17	
AOI price/text			
NF	1.85	1.75	
MFD	106.10	81.78	
DT	307.98	389.33	
High price			
AOI Car			
NF	19.34	5.09	
MFD	213.41	41.93	
DT	4141.30	1346.94	
AOI price/text			
NF	1.13	1.23	
MFD	61.13	66.76	
DT	132.52	260.61	
Big Five scores			
Neuroticism	2.65	0.74	.90
Extraversion	3.56	0.53	.80
Openness	3.69	0.44	.59
Agreeableness	3.48	0.59	.80
Conscientiousness	3.57	0.55	.81

Note. N = 61.

AOI = areas of interest, NF = number of fixations, MFD = mean fixation duration in ms, DT = total dwelling time in ms.

entiousness was negatively associated with number of fixations ($p = .032$), mean fixation duration ($p = .008$) and total dwelling time ($p = .046$) on the price/text. To summarize, the price was generally neglected. Neuroticism was an important positive predictor of fixating the car, and Neuroticism, Extraversion and Conscientiousness were negative predictors of fixating the price/text.

5　Discussion

The current study yielded four main findings. First, although not directly tested, it appeared that participants generally fixated less on price/text (and more on the car), which seems to be independent of Big Five personality dimensions (see Table 2 for significant values and Table 1 for differences in means). This finding is opposed to the results of Rayner et al. (2001) and supports the assumption that pictures are more important than text in car advertisements. This could be explained by the results of Mueller and Jablonski (1970) who found that pictures can be remembered better than words because of dual coding: they are encoded both as images and verbal traces (Paivio, 1969; Paivio, Rogers & Smythe, 1968). As already mentioned, studies examining personality and gazing behavior in advertisement seem to be generally neglected. The current study was able to make a novel contribution to this area of research: personality positively predicted gazing parameters when looking at pictures, and negatively when looking at price/text. This leads to the question if, or to what extent, text sections are able to contribute to appealing print advertisements. For this purpose, further studies should focus even more on differences between text and picture to examine the ideal relation for advertising.

Second, it could be shown that individuals who score high on trait neuroticism generally focused more on the car as a meaningful object while neglecting price/text. Rauthmann et al. (2012) suggest that individuals who score high on trait neuroticism might take longer in processing complex stimuli because they try to validate their value to prevent themselves from potential harm (e.g. doubtful cars). This is in accordance with the finding of Perlman et al. (2009) who found that the time spent looking at the eyes of fearful faces was positively related to neuroticism. Moreover, this supports the assumption that individuals who score high on trait neuroticism are looking for negative aspects of a stimulus (anxious vigilance) and is in accordance with anxiety being a core aspect of neuroticism (Costa & McCrae, 1992). Combining our results with those previously mentioned, the suggestion of Byrom and Murphy (2013) that neuroticism is associated with altered information processing seems corroborated. Hence, such generally altered information processing in neuroticism may also play a role in advertisement processing. This finding can support the area of application in consumer psychology: automobile companies with a focus on security aspects (which should be especially interesting for individuals who score high on trait neuroticism because of safety reasons) should focus stronger on the picture of the car itself when using advertisements and thus enable support of the different information processing instead of distracting with price and text too much. In addition, we recommend using single-colored backgrounds in car-advertisements to avoid any further distraction and to ease processing for more neurotic persons.

Third, extraversion was associated with higher numbers of fixation on the car, while mean fixation duration on the car was shorter. These results replicate and corroborate the findings of Rauthmann et al. (2012). Since extraverted people seek stimulation more actively and are better in finding the optimal level of arousal (H. J. Eysenck, 1981; M. W. Eysenck, 1982), it seems plausible that they focus stronger on the car than on the price/text. A car may be, after all, represented in our minds as a dynamic object with

Table 2: Multilevel model of Big Five personality traits predicting eye movement parameters.

Big Five predictors	Car						Price/Text					
	NF		MFD		DT		NF		MFD		DT	
	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE
Neuroticism	.33***	.09	−.13	.09	.19*	.09	−.26**	.08	−.23*	.09	−.29**	.10
Extraversion	.17*	.08	−.16†	.08	.04	.08	−.01	.08	−.05	.08	−.20*	.09
Openness	−.00	.08	−.04	.08	−.04	.08	.09	.07	.04	.08	.16†	.08
Agreeableness	.15†	.08	.01	.08	.12	.09	−.13†	.08	−.11	.08	.06	.09
Conscientiousness	.06	.08	.02	.08	.07	.09	−.17*	.08	−.22**	.08	.17*	.08

Note. N = 61 participants and N = 183 eye-tracking parameters (from 3 car categories: low vs. medium vs. high price).
Car = area of interest „car", price/text = area of interest „price/text".
NF = number of fixations, MFD = mean fixation duration, DT = total dwelling time.
*Three different eye movement parameters (NF, MFD, DT) were computed for two different areas of interest (car vs. price/text). Sex was treated as a covariate. *** p < .001, ** p < .01, * p < .05, † p < .10*

many different aspects (e.g. color, design, size), which offers more information to examine than a plain text. The conclusion can be drawn that advertisements should focus on the different aspects of the car itself (e.g. different perspectives) to draw more attention to it and to offer extraverted persons more stimuli to look at. This could be driven further by more complex surroundings or by more colorful advertising.

Fourth, conscientiousness unexpectedly showed negative associations with number of fixations, mean fixation duration, and dwelling time. These findings may seem at odds with the general description of conscientious people (e.g. Costa & McCrae, 1992) who should (be motivated to) read price/text because that may lead to an informed decision. Thus, the associations uncovered are difficult to explain conceptually. Further research is needed that replicates these effects and may zero in on how and why they have occurred.

In summary, the present study was able to shed light on the relationship between gazing behavior in car advertisements and personality traits. Since marketers are capable of influencing cognitive processing opportunities via advertising medium and its content (Wood & Swait, 2002), the present results about the role of personality in this matter can increase the potential of that capability.

Some limitations of this research are noted which point to fruitful directions of future research. First, we did not examine the reasons and underlying mechanisms behind gazing behavior and personality. Second, we only used the Big Five traits because of their wide acknowledgement and biologically grounded properties (Bouchard & McGue, 2002; DeYoung & Gray, 2009), but it is of course valuable to also include other constructs that are barely or not encompassed within the traditional five-factor model (e.g. sensation-seeking, narcissism, self-esteem etc.). Further, state-variables such as concurrent affect and mood should play an important role in eye gazing mechanisms since potential emotional responses triggered by meaningful stimuli may have an impact on oculomotoric behavior (e.g. Schmid, Schmid Mast, Bombari, Mast & Lobmair, 2011). Third, new mobile eye-tracker-systems will make it possible to study commercial-perception *in vivo*. This is important because laborately environments cannot fully simulate naturalistic behavior in the field. Since advertisement is present in everyday life (e.g. when driving home or running errands), future studies may equip participants with mobile eye-tracking devices to track their (individual differences in) everyday information processing of advertisements. Fourth, we have restricted our sample to university students who usually have a restricted income. Future studies should target people who are willing to buy a new car and thus in „purchasing mood" to replicate our findings. Moreover, participants' financial background and monthly salary should be sampled as these may act as potential moderators. Fifth, our stimulus material was restricted to still pictures while cars often obtain a dynamic aspect through video commercials with audio footage. Future research should thus examine whether our findings generalize to dynamic stimuli also such as in car TV spots. Lastly, future studies may also focus on the consequences of more fixations on cars rather than price/text. Specifically, it will be of interest to what extent this translates into actual purchase decisions.

6   Conclusion

In the context of personality traits, neuroticism and extraversion – the two temperamental traits – were associated with more fixations on the car, while neuroticism and conscientiousness with less fixations on the price/text. These findings indicate that eye gazing behavior, when viewing advertisements with topical information, may also be associated with broad traits. Thus, some forms of advertisement may benefit from tailoring them to specific „needs" associated with different personality and individual differences variables. In the current study, we found that the car trumps the price/text in terms of attention given by participants. Taken together, consumer psychology may profit from personality-congruent advertisement.

References

Althaus, M., Gomarus, H. K., Wijers, A. A., Mulder, L. J. M., van Velzen, J. L. & Minderaal, R. B. (2005). Cortical and autonomic correlates of visual selective attention in introverted and extraverted children. *Journal of Psychophysiology, 19*, 35-49.

Avisar, A. (2011). Which behavioral and personality characteristics are associated with difficulties in selective attention? *Journal of Attention Disorders, 15*, 357-367.

Batra, R., Myers, J. G. & Aaker, D. G. (1996). *Advertising Management*, (5th ed.), Upper Saddle River, NJ: Prentice Hall.

Borkenau, P. & Ostendorf, F. (1993). *NEO-Fünf-Faktoren Inventar* (NEO-FFI). Göttingen: Hogrefe.

Bouchard, T. J. & McGue, M. (2002). Genetic and environmental influences on human psychological differences. *Journal of Neurobiology, 54*, 4-45.

Boyd, L. H. & Iverson, G. R. (1979). *Contextual analysis: Concepts and statistical techniques*. Belmont, CA: Wadsworth.

Bulling, A. & Gellersen, H. (2010). Toward mobile eye-based human-computer interaction. *Pervasive computing, 10*, 1536-1268.

Burstein, L. (1980). The analysis of multi-level data in educational research and evaluation. *Review of Research in Education, 8*, 158-233.

Byrom, N. C. & Murphy, R. A. (2013). It's not just what we encode, but how we encode it: associations between neuroticism and learning. *Journal of Personality, 81*, 345-354.

Childers, T. L. & Houston, M. J. (1984). Conditions for a picture superiority effect on consumer memory. *Journal of Consumer Research, 11*, 643-654.

Chin, C., Lee, S. & Ramey, J. (2005). An orientation to eye tracking in usability studies. *Usability and Information Design*, 273-276.

Chowdhury, R. M. M. I., Olsen, G. D. & Pracejus, J. W. (2011). How many pictures should your print ad have? *Journal of Business Research, 64*, 3-6.

Clark, L. A. & Watson, D. (2008). Temperament: An organizing paradigm for trait psychology. In O. P. John & R. W. Robins (eds.), *Handbook of personality: Theory and research* (3rd ed.) (pp. 265-286). New York: Guilford Press.

Costa, P. T. & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five Factor Inventory. Professional Manual*. Odessa: Psychological Assessment Resources.

DeYoung, C. G. & Gray, J. R. (2009). Personality neuroscience. Explaining individual differences in affect, behavior, and cognition. In P. J. Corr & G. Matthews (eds.), *Cambridge handbook of personality* (pp. 323-346). New York: Cambridge University Press.

Duchowsky, A. T. (2007). *Eye tracking methodology: Theory and practice* (2nd ed.), London: Springer.

Edell, J. A. & Staelin, J. R. (1983). The information processing of pictures in print advertisements. *Journal of Consumer Research, 10*, 45-61.

Eliana, M., Cuddihy, E., Goldberg, E. & Ramey, J. (2008). *Uses of eye tracking technology in design*. Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting, New York.

Eysenck, H. J. (1981). General features of the model. In H. J. Eysenck (ed.), *A model for personality* (pp. 1-37). New York: Springer.

Eysenck, M. W. (1982). *Attention and arousal: Cognition and performance*. Berlin: Springer.

Furtner, M. R. & Sachse, P. (2008). The psychology of eye-hand coordination in human computer interaction. In D. Cunliffe (ed.), Proceedings of the *Third IASTED International Congress on Human Computer Interaction* (pp. 144-149). Anaheim: ACTA Press.

Furtner, M. R., Rauthmann, J. F. & Sachse, P. (2009). Nomen est omen: Investigating the dominance of nouns in word comprehension with eye movement analyses. *Advances in Cognitive Psychology, 5*, 91-104.

Goldberg, J. H. & Wichansky, A. M. (2003). Eye tracking in usability evaluation: A practitioner's guide. In J. Hyönä, R. Radach & H. Deubel (eds.), *The Mind's Eye: Cognitive And Applied Aspects Of Eye Movement Research* (pp. 493-516). Amsterdam: North-Holland.

Haney, W. (1980). Units and levels of analysis in large-scale evaluation. *New Directions for Methodology of Social and Behavioral Sciences, 6*, 1-15.

Joos, M., Rötting, M. & Velichkovsky, B. M. (2003). Die Bewegungen des menschlichen Auges: Fakten, Methoden und innovative Anwendungen. In G. Rickheit, T. Herrmann & W. Deutsch (eds.), *Psycholinguistik/Psycholinguistic. Ein internationales Handbuch/An International Handbook* (pp. 142-168). Berlin & NY: de Gruyter, Jacob & Karn.

John, O. P. & Srivastava, S. (1999). The Big Five Trait Taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (eds.), *Handbook of personality: Theory and research* (2nd ed.) (pp. 102-138). New York: Guilford.

Jacob, R. J. K. & Karn, K. S. (2003). Eye tracking in human-computer interaction and usability research: ready to deliver the promises. In J. Hyönä, R. Radach & H. Deubel (eds.), *The Mind's Eye: Cognitive And Applied Aspects Of Eye Movement Research* (pp. 573-605). Amsterdam: Elsevier.

Kaspar, K. & König, P. (2011). Overt attention and context factors: The impact of repeated presentations, image type, and individual motivation. *PLoS ONE, 6*, e21719. doi:10.1371/journal.pone.0021719.

Keller, K. L. (1987). Memory factors in advertising: The effect of advertising retrieval cues on brand evaluations. *Journal of Customer Research*, 14, 316-333.

Krugman, D. M., Fox, R. J., Fletcher, J. E., Fischer, P. M. & Rojas, T. H. (1994). Do adolescents attend to warnings in cigarette advertising? An eye-tracking approach. *Journal of Advertising Research, 34*, 39-52.

Matsumoto, K., Shibata, S., Seiji, S., Mori, C. & Shioe, K. (2010). Factors influencing the processing of visual information from non-verbal communications. *Psychiatry and Clinical Neurosciences, 64*, 299-308.

Mitchell, A. A. & Olson, J. C. (1981). Are product attribute beliefs the only mediator of advertising effects on brand attitude? *Journal of Marketing Research, 18*, 318-32.

Mueller, J. H. & Jablonski, E. M. (1970). Instructions, noun imagery, and priority in free recall. *Psychological Reports, 27*, 559-566.

Ohno, T. & Mukawa, N. (2004). A free head, simple calibration, gaze tracking system that enables gaze-based interaction. In *Proceedings of the 2004 symposium on eye tracking research and applications, Eye tracking research and application*, 115-122.

Ohno, T., Mukawa, N. & Yoshikawa, A. (2002). Freegaze: A gaze tracking system for everyday gaze interaction. In *Proceedings of the 2002 symposium on eye tracking research and applications, Eye tracking research and application*, 125-132.

Paivio, A. (1969). A mental imagery in associative learning and memory. *Psychological Review, 76*, 241-263.

Paivio, A., Rogers, T. B. & Smythe, P. C. (1968). Why are pictures easier to recall than words? *Psychonomic Science, 11*, 137-138.

Perlman, S. B., Morris, J. P., Vander Wyk, B. C., Green, S. R., Doyle, J. L. & Pelphrey, K. A. (2009). Individual differences in personality predict how people look at faces. *PLoS ONE 4*: e5952.

Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology, 32*, 3-25.

Posner, M. I. (1995). Attention in cognitive neuroscience. In M. S. Gazzaniga (ed.), *The Cognitive Neurosciences* (pp. 615-624). Cambridge: MIT Press.

Pieters, R. & Wedel, M. (2004). Attention capture and transfer in advertising: Brand, pictorial, and text-size effects. *Journal of Marketing, 68*, 36-50.

Raudenbush, S. W. & Bryk, A. S. (1986). A hierarchical model for studying school effects. *Sociology of Education, 59*, 1-17.

Raudenbush, S. W. & Bryk, A. S. (2002). *Hierarchical linear model* (2nd ed.). Thousand Oaks: Sage Publications.

Rauthmann, J. F., Seubert, C. T., Sachse, P. & Furtner, M. R. (2012). Eyes as windows to the soul: Gazing behavior is related to personality. *Journal of Research in Personality, 46*, 147-156.

Rayner, K. (1995). Eye movements and cognitive processes in reading, visual search, and scene perception. In J. M. Findlay, R. Walker & R. W. Kentridge (eds.), *Eye Movement Research: Mechanisms, processes and applications* (pp. 3-22). Amsterdam: Elsevier Science Publishers BV.

Rayner, K., Rotello, C. M., Stewart, A. J., Keir, J. & Duffy, S. A. (2001). Integrating text and pictorial information: Eye movements when looking at print advertisements. *Journal of Experimental Psychology: Applied, 7*, 219-226.

Risko, E. F., Anderson, N. C., Lanthier, S. & Kingstone, A. (2012). Curious eyes: individual differences in personality predict eye movement behavior in scene-viewing. *Cognition, 122*, 86-90.

Rosbergen, E., Pieters, R. G. M. & Wedel, M. (1997). Visual attention to advertising: A segment-level analysis. *Journal of Consumer Research, 24*, 305-314.

Rossiter, J. R. & Percy, L. (1983). Visual communication in advertising. In R. J. Harris (ed.), *Information Processing Research in Advertising* (p. 83-125). Hillsdale: Lawrence Erlbaum Associates.

Schmid, P. C., Schmid Mast, M., Bombari, D., Mast, F. W. & Lobmair, J. S. (2011). How mood states affect information processing during facial emotion recognition: An eye tracking study. *Swiss Journal of Psychology, 70*, 223-231.

Stenberg, G., Rosen, I. & Risberg, J. (1990). Attention and personality in augmenting/reducing of visual evoked potentials. *Personality and Individual Differences, 11*, 1243-1254.

Szymura, B. & Necka, E. (1998). Visual selective attention and personality: An experimental verification of three models of extraversion. *Personality and Individual Differences, 24*, 713-729.

Tsai, Y., Viirre, E., Strychacz, C., Chase, B. & Jung, T.-P. (2007). Task performance and eye activity: Predicting behavior relating to cognitive workload. *Aviation, space, and environmental medicine: Operational applications of cognitive performance enhancement technologies, 78*, B176-B185.

Wedel, M. & Pieters, R. (2008). A review of eye-tracking research in marketing. *Review of Marketing Research*, 123-147.

Wood, S. L. & Swait, J. (2002). Psychological indicators of innovation adoption: Cross-classification based on need for cognition and need for change. *Journal of Consumer Psychology, 12* (1), 1-13.

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