AN APPLICATION OF EYE-TRACKING TECHNOLOGIES TO STUDY CONSUMERS' ATTENTION TO PACKAGING SENSORY ATTRIBUTES

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Abstract

Among the array of techniques used to investigate consumers' perceptions, some collect consumers' behaviour via implicit measures, like the eye-tracking (ET) methodology, while others are more direct and involve in one way or another a more active participation of the consumers. ET yields more unconscious information that is mainly related to what grabs a consumer's attention at the point of purchase and what they might focus on when choosing between products. The aims of the present work were to gather information about consumers' perception of a set of packages (varying in multisensory stimulation degree) using ET and to examine the pattern of fixations on specific attributes of the packaging across the products, and to assess how this variability is related to the willingness to try the product.

Keywords*: eye tracking; product evaluation; users/consumers*

Resumen (in Spanish)

Entre la gama de técnicas utilizadas para investigar la percepción de los consumidores, algunas recogen medidas implícitas, como el eye-tracking (ET), mientras que otras involucran en una u otra manera una participación más activa de los consumidores. ET proporciona información más inconsciente que está principalmente relacionada con lo que llama la atención del consumidor en el punto de compra y en lo que podría centrarse en la hora de elegir entre productos. Los objetivos del presente trabajo son reunir información sobre la percepción del consumidor de un conjunto de envases (que varían en grado de estimulación multisensorial) con ET para examinar el patrón de las fijaciones de atributos específicos de los envases, y para evaluar cómo esta variabilidad está relacionada con la intención de probar el producto.

Palabras clave: *eye tracking; evaluación de productos; usuarios/consumidores*

1. Introduction

The packaging in which a food or beverage product is presented has long been understood to influence the consumer's attention, evaluation, and ultimately purchase decision (e.g., Crilly, Moultrie, & Clarkson, 2004; Fenko, Schifferstein, & Hekkert, 2010; Moskowitz, 1998; Murray & Delahunty, 2000; Spence & Piqueras-Fiszman, in press). However, a growing body of research has now started to focus on the influence of the sensory characteristics of the packaging (i.e., excluding any written information) on consumer expectations (Ares & Deliza, 2010; Mizutani, Dan, Kyutoku, Tsuzuki, Clowney, Kusakabe, Okamoto, & Yamanaka, 2012; Moskowitz, Reisner, Lawlor, & Deliza, 2009) and on the consumers' subsequent food experiences (Piqueras-Fiszman & Spence, 2011), at both the sensory-discriminative and hedonic levels.

Sensory marketers often claim that the more senses a product stimulates, the richer the consumers' overall product experience will be (Krishna, 2010; Lindstrom, 2005; Neff, 2000; Spence & Gallace, 2011). As such, it is not surprising that the last few years have seen an explosion of innovation in terms of novel packaging formats for a variety of food and drink items, not to mention fast-moving consumer goods (FMCGs; e.g., see Anon., 2010; Raine, 2007; Spence & Piqueras-Fiszman, in press). Although researchers working to innovate in terms of developing novel packaging formats have attempted to create novel multisensory packaging experiences, many of their attributes are initially – or in some situations, only – perceived through the visual modality. To date, very little research has been conducted in order to try and determine how the various visual elements that contribute to the overall multisensory percept (i.e., providing pictorial or descriptive information about the likely taste, texture, etc of the product) act upon consumer behaviour from a psychological perspective.

Both brand managers and consumers are sometimes unaware of just how much of an effect the attributes of a food or beverage product's packaging can have on a shopper's purchase behaviour, not to mention on their subsequent consumption experiences (see Cheskin & Ward, 1948; Masten, 1988; Spence, 2009). Given such observations, consumer panels and market research tests often fail to reveal the key factors (or sensory attributes) that may determine the effectiveness of a particular product, or its packaging (e.g., see Graves, 2010; Stander, 1973).

In this sense, one of the biggest potential benefits of experimental psychology and cognitive neuroscience, at least as far as its application to the rapidly-growing field of packaging design goes, is that they provide a range of more objective measures. These behavioural, psychophysical, and, on occasion, neuroimaging (e.g., Stoll, Baecke, & Kenning, 2008; Weinstein, 1981) measures help to highlight what sensory attribute(s) of the packaging are really doing the work of (hopefully) enhancing the consumer's response to a particular product (Morich, 1981). Among the array of techniques that have been used to investigate consumers' perceptions, some assess consumer behaviour via implicit measures, such as, for example, the implicit association test (IAT; e.g., Parise & Spence, 2012; Piqueras-Fiszman & Spence, 2011), and eye-tracking (ET; e.g., Bialkova & van Trijp, 2011; van Herpen & van Trijp, 2011.

ET is increasingly being applied in the fields of consumer research and marketing as a means of exploring how consumers process visual information in real-world (or, at the very least, more realistic) conditions (e.g., Gofman, Moskowitz, Fyrbjork, Moskowitz, & Mets, 2009; Pieters & Warlop, 1999; Rayner, Miller, & Rotello, 2008; Rayner, Rotello, Stewart, Keir, & Duffy, 2001; Russo & Leclerc, 1994; Wansink, 1996; Wedel & Pieters, 2007, 2008). Eye movements provide an objective indicator of where a person's overt (and typically also their covert) attention is focused (Hoffman & Subramaniam, 1995; Spence & Driver, 1994, 2004).1 They serve to filter (and potentially help organize) visual information and help prepare for action (Knudsen, 2007). As a consequence, several parameters of oculomotor behaviour (e.g., saccadic eye movements) are nowadays frequently used; in particular, the locus of an observer's visual fixations is perhaps the single most commonly used parameter in order to

assess where a consumer's attention might be focused. Fixations are defined as gaze patterns in which the eyes are relatively immobile, and during which the visual system is assumed to be gathering information (Pertzob, Avidan, & Zohary, 2009; Rayner, 1998); they are typically characterized and measured by their frequency and duration and have given rise to many studies concerning eye movements, attentional processes, and consumer behaviour (e.g., Pieters, Warlop, & Wedel, 2002; Reutskaja, Nagel, Camerer, & Rangel, 2011). ET yields information that the participant may potentially not be consciously aware of (and/or have difficulty in articulating). That information is mainly related to what grabs a consumer's attention at the point of purchase and what they might happen to focus on when choosing between products.

The aim of the present research reported in the present study was to gather information concerning consumers' perception of a set of food packages in a non-goal directed task. Jam jars were chosen for use in the present study, since it is considered a familiar item, and it already comes in a variety of formats. The aim was to use ET in order to examine the pattern of fixations on specific attributes of the packaging across the products, and to assess which attributes affect the consumers' self-reported willingness to try the product.

2. Materials and methods

2.1 Participants

Fifty Colombian participants (23 female, 32 male) with ages ranging from 18 to 55 years (M = 29.3 years: SD= 9.4) volunteered to take part in this study. All of the participants reported normal or corrected-to-normal vision, and no colour-blindness. The participants were recruited using a convenient, intentional, and reasoned sampling via an emailing recruitment list. In addition, they had to be regular (at least once a week) consumers of jam. The experimental procedure was approved by the Ethics Committee of the Faculty of Medicine at Javeriana University, Colombia.

2.2 Apparatus

An unobtrusive eye tracker that was capable of recording the position of the eyes at a sampling rate of 300hz (Tobii TX300, Tobii, Stockholm, Sweden), was used to assess visual fixations. This device allows participants to make large head movements, and to move freely and naturally in front of the screen, within an imaginary box in which they can move they head and still be tracked by the device. Hence the subjects did not have to be positioned in a chinrest in an unnatural position. Tobii studio 2.2 software was used to present the stimuli, to calibrate the eye tracker, to record the data, and to extract descriptive statistics.

2.3 Stimuli

As stimuli, various images of a jam jar were created with the aim of conveying sensory information by means of four different (and orthogonally-varying) design attributes: (1) The ingredients' details – photograph vs. text; (2) The written word 'natural' – present vs. absent; (3) The macrogeometric surface texture – smooth vs. ridged (e.g., Lederman, 1974; Roland & Mortensen, 1987); and (4) the jars' shape/ outline – rounded vs. squared (cylindrical). The 16 possible full-crossed combinations (2x2x2x2) were edited using Adobe Premier CS4. All of the images (860 x 600 pixels) were set to an equal mean luminance, and presented against a white background (1024 x 768 pixels) for individual presentation. The images of the products on the screen were 10 cm high and approximately matched the size of the real products. The images were randomly presented to the participants following a complete block experimental design (MacFie, Bratchell, Greenhoff, & Vallis, 1989).

2.4 Procedure

The study was conducted in a quiet room under standard illumination conditions. Each participant was seated 60 cm from the eye tracker and screen. After calibration (9-point calibration of the eye-movement monitor), the general instructions for the task were presented for 5000 ms on the screen. They read: “An image of a jam jar will appear in the screen for 2.5 seconds. Please look at it and then follow the task instructions presented on the screen thereafter. A total of 16 images will appear individually.” The experimenter also explained the procedure verbally in order to ensure that the participants fully understood the task that they were being asked to perform. After these instructions had been provided, a white screen was presented for 1000 ms and then the images were presented individually for 2500 ms each, followed by a white screen. The products were shown during 2500 ms, since this is, on average, the usual amount of time spent by consumers when looking at a package in a supermarket aisle. That said, it has been suggested that, in some contexts, consumers’ are able to make their first impressions within the first 50 ms of exposure to the product/ service (Lindgaard, Fernandes, Dudek, Brown, 2006). After each image, the participants were asked to rate their willingness to try the displayed product on a 9-point scale. The instructions indicated were: “Please rate how much would you be willing to try the product shown on the following scale”. When they clicked on the ‘Next’ button, the next image appeared on screen, and so on. The task lasted for approximately 10 minutes.

2.5 Data analyses

To analyse fixations and compare them across the 16 jam jars, four areas of interest (AOIs) were defined by jar. They were created on the basis of specific design elements that were part of the label and package. The AOIs were defined as follows: (1) The area with a photo of the fruits or with the text describing the product; (2) The border of the jar; (3) The brand name and logo; and (4) the flavour descriptor presented at the top of the label (see Figure 1). The measure that was taken into account in the analyses was the total fixation duration, which was calculated for each AOI. The total fixation duration is the sum of the duration (ms) of all of the fixations within an AOI.

Figure 1: Areas of Interest defined

To model the participants’ fixations and ‘willingness to try’ responses among the 16 multi-attribute alternatives, conjoint analysis was used. Since the early 1970’s this method has

been applied to a wide variety of product contexts to try and figure out what is going in the consumer's mind by quantifying the impact of the different product attributes and their combinations (Green & Srinivasan, 1978; Moskowitz & Silcher, 2006; Silayoi & Speece, 2007). It decomposes the consumer's responses to a given set of alternatives into mixtures of stimuli by means of modelisation (Gofman, 2006), indicating how the consumer implicitly evaluated the individual elements that make up the products. Conjoint measurements have been extensively used to study perceptions and preferences among products in the industrial design, packaging, and engineering sectors, and that has more recently also been applied to try to determine the drivers of consumer food choice. However, it has not been commonly applied directly to fixation data obtained from eye tracking. By doing so in this study, we determined how the individual elements contributed to the fixation being directed to each AOI, and to the participants' intention to try the product shown.

To determine which variations had a significant impact, ANOVAs were performed on the total fixation duration data for each of the four AOIs defined. An additional ANOVA on the 'willingness to try' ratings was also performed. For these analyses, the participant effect, the varying attributes of the jars (photo/text, smooth/ridged, rounded/squared, and natural/blank), and their significant interactions were considered as explanatory factors.

To define the final model and assess any synergies that rise from the elements (photo/text, smooth/ridged, rounded/squared, and natural/blank), a stepwise selection of the relevant interactions was conducted with forced main effects (significant or not) (Gofman, 2006). The criterion of selection was the AIC (with matching minimum F-values ranging from 2.5 to 3, as obtained from a model including all the interactions). From the resulting effects of the stepwise regression, the four linear effects and only those interactions that added significant predictability (set at $p < .1$) to the model were fitted in the final equation, for each AOI.

The ANOVA model was created on the original ratings (persuasion model; Gofman, 2006), so that the estimates (utility) of an element indicates the expected number of rating points (either milliseconds or scores) to be added or subtracted if that element were included in the package. The other results that the ANOVA provides are the importances. They are expressed in percentages and hence the sum of the importances of all the attributes is 100. The importance of an attribute *i* was mathematically obtained as follows.

$$I_i = \frac{\Delta U_{ij}}{\sum_{i=1}^{n} \Delta U_{ij}} \quad (1)$$

where ΔU_{ij} is the range of utilities of the attribute *i*, and $\sum_{i=1}^{n} \Delta U_{ij}$ is the sum of all the range of utilities for the *n* number of attributes present in the package.

All statistical analyses were performed using XLStat 2010 (Addinsoft, NY, USA).

3. Results

3.1 Impact of the elements on the fixation data

The attributes and their elements (variations) appear in Table 1, along with their utility values. These values represent the increase or decrease in the duration of time that participants would spend looking at each AOI present in the package (in columns). The results shown in Table 1 also highlight which elements interact with each other in order to generate positive synergies, and which terms interact to generate negative synergies. It can be seen that, on average, the most looked-at AOIs were the flavour label and the logo, then the photo/text

area, and finally the border region. However, what is interesting is to determine how each element variation contributed to the focusing of participants' attention on each AOI.

Table 1. Regression coefficients and relative importance of each AOI with variation for the total fixation duration data.

	Attributes and variations	Border	Photo/text	Flavour label	Logo
	Additive constant (ms)	61.5	364.7	443.2	370.2
Photo/Text	*Relative importance (%)*	12	43	18	21
	Photo	-5.9 ns	86.0***	-13.2 ns	5.2 ns
	Text	5.9ns	-86.0***	13.2 ns	-5.2 ns
Shape (outline)	*Relative importance (%)*	25	17	41	38
	Squared	12.5 *	23.5 ns	-30.7*	30.9*
	Rounded	-12.5*	-23.5 ns	30.7*	-30.9*
Texture	*Relative importance (%)*	48	34	32	1
	Ridged	24.2***	-47.2***	24.2 ns	-0.5 ns
	Smooth	-24.2***	47.2***	-24.2 ns	0.5 ns
Natural label	*Relative importance (%)*	15	6	9	40
	Blank	7.6 ns	-8.2ns	7.1 ns	-31.9*
	Natural	-7.6 ns	8.2 ns	-7.1 ns	31.9*
Photo/ Text*Natural	Photo*Blank		-52.9		-44.7
	Photo*Natural		0		0
	Text*Blank		52.9		44.7
	Text*Natural		0		0

Note: * Significant effect at p < .05.; ** Significant effect at p < .01.; *** Significant effect at p < .001.; ns Not significant (p > .05). Only significant interactions are shown (at p< .1).

For the Border area, which did not receive much attention as compared to the other AOIs (M= 61 ms), the two attributes that had a significant impact were the shape and the texture of the jars. The main element that appeared to direct participants' attention to the border would be a ridged surface as indicated by the high utility (24.2). A squared, as opposed to a rounded, shape also played an important role in attracting participants' attention to this area of the package. Including either a photo or a text or the word 'natural' played a much smaller role. Although it would not make a big difference, including text instead of an image, or not including the term 'natural' contributed slightly to people looking more at the border area, as indicated by the positive, but low, utilities of these elements.

The Photo/text AOI was one of the AOIs which participants spent more time looking at (M= 365 ms). Unsurprisingly, the variations in that same area had a significant effect. Presenting a picture attracted significantly more attention than presenting text in the label, increasing the average fixation duration by up to 86 ms. In addition, the surface texture also influenced significantly, while the ridged surface did not result in the participants' focusing their attention on the AOI in question. Although the 'natural' label itself was practically insignificant for this area, its interaction with the photo/text area was significant. Surprisingly, the inclusion of this interaction in the model revealed that when the photo was not presented with the term 'natural' participants tended to look less at this area (by around 53 ms less).

The Flavour label was the area that attracted the most attention (M= 443 ms) out of all the AOIs. From the utilities it can be observed which of the elements drove fixations to this "fixed" AOI. The sole attribute that had a significant effect on the attention directed to this AOI was the shape. Presenting the rounded-shaped jar increased the overt attention paid to this area by up to 31 ms, while the opposite trend was observed when it was presented it in a squared format. The other attributes had a more moderate effect, as shown in Table 1. Including a ridged surface, and including text instead of a picture in the label, also contributed positively to participants' focusing their attention on this AOI. Whether or not the word 'natural' was included did not seem to exert any effect at all.

Finally, the Logo was also one of the AOIs that was very effective in terms of attracting participants' attention (M= 370 ms). It can be seen from the last column of Table 1 that the shape and the term 'natural' (which appeared just next to it), had a significant impact on directing the participants' attention to this area. The squared shape and the word 'natural' increased the fixation duration on the logo by around 30 ms each. The texture had absolutely no impact, and similarly, including the picture of the berries or the text did not increase or decrease in any significant way the attention driven to the logo. However, the interaction photo/text*natural was significant, meaning that when the photo was presented without the word 'natural', the average attention to the logo decreased by as much as 45 ms, whereas, the text without the word 'natural' resulted in attention being driven to the logo (+45 ms).

3.2 Impact of the elements on participants' self-reported willingness to try ratings

Visual inspection of Table 2 reveals that it is the photo/text area that makes all the difference in terms of driving the participants' willingness to try the product. The photo/text element was the only one that had a significant effect ($p < .001$), with the ratings for the jars with a photo being significantly higher than those that had text instead (a 1.04 point difference). As for the rest of the attributes, the shape of the jam jar did not seem to matter, nor did the texture of the jar, nor whether or not the label included the term 'natural'. The interaction photo/text*texture was also significant indicating that when the photo was presented with the ridged surface, a negative synergy was created, decreasing the willingness to try, the opposite happened when the text was present instead.

Table 2. Regression coefficients and relative importance of each AOI with variation for the willingness to try ratings (on a 9-point scale).

Areas and variations	Willingness to try
Intercept	5.88
Photo/Text	
Relative importance (%)	79
Photo	0.66***
Text	-0.66***
Shape (outline)	
Relative importance (%)	8
Squared	-0.07 ns
Rounded	0.07 ns
Texture	
Relative importance (%)	5
Ridged	-0.04 ns
Smooth	0.04 ns
Natural label	
Relative importance (%)	8
Blank	-0.07 ns
Natural	0.07 ns
Photo/Text*Texture	
Photo*Ridged	-0.28
Photo*Smooth	0
Text*Ridged	0.28
Text*Smooth	0

Note: *** Significant effect at p < .001; ns Not significant (p > .05); Only significant interactions are shown (at p< .05).

4. Discussion and conclusions

The use of conjoint analysis provided a useful tool with which to determine the statistical contributions of each element to the attention paid to each AOI and to the willingness to try ratings. Gofman *et al.* (2009) also used conjoint analysis in an eye tracking study in which they showed to each respondent 27 wine boxes (on the same screens as in this study), each made of unique combinations of features. The eye movements of the participants were monitored while they inspected the images, rating their purchase intention, and selecting an emotion from a list of seven alternatives. With conjoint analysis, they determined how the individual features of the packages contributed to purchase intention and to the selection of each emotion. Separately, they analysed the fixation data obtained in detail, and determined how each of the packaging features drove the participants' eye to focus on a single AOI, or to move around the package. Therefore, a direct link of the fixation duration, with the purchase intention and the emotions was not made. In this paper, we drew a direct link by analysing the fixation data directly with conjoint analysis.

Ideally, a company/ brand would want the consumer to inspect as many elements of its product's package as possible, not only to one, since each conveys different information (mostly in food products). The results of the present study demonstrated that certain elements of the packaging can be used to drive attention to this or that element. For instance, the ridged surface of the jars spread the gaze to other areas, like the border or the flavour label; a rounded jar also seemed to direct the attention to the flavour label, perhaps because it was located in a centred area. The photo seemed to monopolize the participants' attention almost exclusively. This information should be taken into account when designing the packaging having marketing strategies in mind: in certain cases, it might be more convenient to strike with only one element, whereas in others it would be more convenient to drive consumers' attention to multiple elements. However, capturing the attention to only one element might deliver more meanings, depending on which element it is. In this study, as

mentioned before, the photo conveyed more associations related to the sensory qualities of the product and more positive-hedonic terms (in so doing, positively influenced the participants' willingness to try the product; Simmons, Martin, & Barsalou, 2005), while the text, that spread the gaze around the AOIs of the packaging, resulted in the jars conveying a more diverse range of associations to participants, although many were related to the element itself and to other general concepts (such as *other conserves*). This result may be taken to suggest that the covert visual attention of participants was directed to these areas. The key is to know how to combine the appropriate design elements to engineer the gaze pattern that conveys the aimed message/s.

Looking at the willingness to try results, it can be seen that most of the packaging elements performed rather poorly in terms of their ability to influence the participants' willingness to try the product shown, and that mainly the photo had a strong positive impact, although when the text was combined with a ridged surface a moderate positive synergy could also be observed. The fact that one strong design element influenced consumers' willingness to try or to buy is a typical result that has been observed previously in packaging design studies (Gofman *et al.* 2009).

It is important to point out, given the exploratory nature of this study, that there are a number of limitations with it. The AOI variation that captured more attention was the flavour label, followed by the logo, and then the photograph. It is, however, possible that the fixation duration of certain areas of the product packaging depended on their complexity and size as well, and not necessarily solely on the interest generated by the AOIs. In addition, if the shapes or surfaces would have been more distinct or differentiated, the border area might well have captured more attention, and would have elicited a more widespread range of associations, not mainly shape/texture-related (see Spence & Gallace, 2011). This is also a limitation imposed by presenting the stimuli as flat images on screens, where the shape and texture cannot be fully appreciated (that is, they cannot be touched), hence the effects of these potentially touch-inviting elements were diminished.

In any case, although most of the literature reports that the information that is better attended to is also more likely to drive decisions (e.g., Bialkova & van Trijp, 2011), to date, there is still no clear formulation that can explain the meaning of higher fixation durations and its impact on product attention, perception, choice, and preference (Milosavljevic, Navalpakkam, Koch, & Rangel, 2011). However, it is worth remembering that, in the present study, participants did not have any choice-based or goal-driven task. As such, the overt attention maps documented here were likely stimulus-driven (i.e., reflecting bottom-up, or exogenous, attention) and not directed toward an area because it was meaningful for specific goals (i.e., top-down, or endogenous attention), such as when trying to assess the nutritional information of a particular product, which can be really different (Connor, Egeth, & Yantis, 2004; Spence & Santangelo, 2009; Yantis, 2000).

Further research should therefore be carried out in order to help relate attentional data (from eye movement studies) to specific elements within the design of the packaging with different types of "immediate" associations, and preference or willingness to try/buy, overall in more ecologically-valid contexts and with more distinctive (or 3D) stimuli, overall if one want to capitalise on the tactile attributes to enhance the sensory information delivered.

5. References

Anon. (2010). Maximum appeal. *Active and Intelligent Packaging World*, *9(3),* 4-8.

Ares, G., & Deliza, R. (2010). Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis. *Food Quality and Preference, 21*, 930-937.

Bialkova, S., & van Trijp, H. (2011). An efficient methodology for assessing attention to and effect of nutrition information displayed front-of-pack. *Food Quality and Preference, 22,* 592-601.

Cheskin, L., & Ward, L. B. (1948). Indirect approach to market reactions. *Harvard Business Review*, *26*, 572-580.

Connor, C. E., Egeth, H. E., & Yantis, S. (2004). Visual attention: Bottom-up vs. top-down. *Current Biology, 14*, 850-852.

Crilly, N., Moultrie, J., & Clarkson, P. J. (2004). Seeing things: Consumer response to the visual domain in product design. *Design Studies, 25*, 547-577.

Fenko, A., Schifferstein, H. N. J., & Hekkert, P. (2010). Shifts in sensory dominance between various stages of user-product interactions. *Applied Ergonomics, 41*, 34-40.

Gofman, A. (2006). Emergent scenarios, synergies, and suppressions uncovered within conjoint analysis. *Journal of Sensory Studies, 21,* 373-414.

Gofman, A., Moskowitz, H., Fyrbjork, J., Moskowitz, D., & Mets, T. (2009). Rule developing experimentation to perception of food packages with eye tracking. *The Open Food Science Journal, 3*, 66-78.

Graves, P. (2010). *Consumer.ology: The market research myth, the truth about consumers and the psychology of shopping*. London: Nicholas Brearly Publishing.

Green, P. E., & Srinivasan, V. (1978). Conjoint analysis in consumer research: Issues and outlook. *Journal of Consumer Research, 5*, 103-123.

Hoffman, J., & Subramaniam, B. (1995). The role of visual attention in saccadic eye movements. *Perception & Psychophysics, 57*, 787-795.

Knudsen, E. (2007). Fundamental components of attention. *Annual Review of Neuroscience*, *30*, 57-78.

Krishna, A. (2010). *Sensory marketing: Research on the sensuality of products*. London: Routledge.

Lederman, S. J. (1974). Tactile roughness of grooved surfaces: The touching process and effects of macro- and microsurface structure. *Perception & Psychophysics*, *16*, 385-395.

Lindgaard, G., Fernandes, G. J., Dudek, C., & Brown, J. (2006). Attention web designers: You have 50 milliseconds to make a good first impression. *Behaviour & Information Technology, 25*, 115-126.

Lindstrom, M. (2005). *Brand sense: How to build brands through touch, taste, smell, sight and sound*. London: Kogan Page.

MacFie, H. J., Bratchell, N., Greenhoff, K., & Vallis, L. V. (1989). Designs to balance the effect of order of presentation and first-order carry-over effects in hall tests. *Journal of Sensory Studies, 4*, 129-148.

Masten, L. D. (1988). Packaging's proper role is to sell the product. *Marketing News*, *22(2),* 16.

Milosavljevic, M., Navalpakkam, V., Koch, C., & Rangel, A. (in press). Relative visual saliency differences induce sizable bias in consumer choice. *Journal of Consumer Psychology*, dx.doi.org/10.1016/j.jcps.2011.10.002.

Mizutani, N., Dan, I., Kyutoku, Y., Tsuzuki, D., Clowney, L., Kusakabe, Y., Okamoto, M., & Yamanaka, T. (2012). Package images modulate flavors in memory: Incidental learning of fruit juice flavors. *Food Quality and Preference, 24*, 92-98.

Morich, D. (1981). Using tachistoscope, semantic differential and preference tests in package design assessment. In W. Stern (Ed.), *Handbook of package design research* (pp. 125-140). New York: Wiley Interscience.

Moskowitz, H. R. (1998). The relationships between sensory, liking and image attributes: The case of soap. *Journal of Sensory Studies, 13*, 13-27.

Moskowitz, H. R., Reisner, M., Lawlor, J. B., & Deliza, R. (2009). *Packaging research in food product design and development*. Ames: Wiley-Blackwell.

Moskowitz, H. R., & Silcher, M. (2006). The applications of conjoint analysis and their possible uses in sensometrics. *Food Quality and Preference, 17,* 145-165.

Murray, J. M., & Delahunty, C. M. (2000). Mapping consumer preference for the sensory and packaging attributes of Cheddar cheese. *Food Quality and Preference, 11*, 419-435.

Neff, J. (2000). Product scents hide absence of true innovation. *Advertising Age*, *February 21*, 22.

Parise, C., & Spence, C. (2012). Assessing the associations between brand packaging and brand attributes using an indirect performance measure. *Food Quality & Preference, 24,* 17-23.

Pertzob, Y., Avidan, G., & Zohary, E. (2009). Accumulation of visual information across multiple fixations. *Journal of Vision, 9*, 1-12.

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*, 1-16.

Pieters, R., Warlop, L., & Wedel, M. (2002). Breaking through the clutter: Benefits of advertisement originality and familiarity for brand attention and memory. *Management Science, 48,* 765-781.

Piqueras-Fiszman, B., & Spence, C. (2011). Crossmodal correspondences in product packaging: Assessing color-flavor correspondences for potato chips (crisps). *Appetite, 57,* 753-757.

Raine, T. (2007). Multisensory appeal. *Packaging News*, *May*, 36-37.

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124,* 372-422.

Rayner, K., Miller, B., & Rotello, C. M. (2008). Eye movements when looking at print advertisements: The goal of the viewer matters. *Applied Cognitive Psychology, 22*, 697-707.

Rayner, K., Rotello, C. M., Stewart, A., 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.

Reutskaja, E., Nagel, R., Camerer, C. F., & Rangel, A. (2011). Search dynamics in consumer choice under time pressure: An eye-tracking study. *The American Economic Review, 101*, 900-926.

Roland, P. E., & Mortensen, E. (1987). Somatosensory detection of microgeometry, macrogeometry and kinesthesia in man. *Brain Research Reviews*, *12*, 1-42.

Russo, J. E., & Leclerc, F. (1994). An eye-fixation analysis of choice processes for consumer nondurables. *Journal of Consumer Psychology, 21,* 274-290.

Silayoi, P., & Speece, M. (2007). The importance of packaging attributes: A conjoint analysis approach. *European Journal of Marketing*, *41,* 1495-1517.

Simmons, W. K., Martin, A., & Barsalou, L. W. (2005). Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cerebral Cortex, 15,* 1602-1608.

Spence, C. (2009). Measuring the impossible. In *MINET Conference: Measurement, sensation and cognition* (pp. 53-61). Teddington, UK: National Physical Laboratories.

Spence, C. [J.], & Driver, J. (1994). Covert spatial orienting in audition: Exogenous and endogenous mechanisms. *Journal of Experimental Psychology: Human Perception and Performance*, *20,* 555-574.

Spence, C., & Driver, J. (Eds.). (2004). *Crossmodal space and crossmodal attention*. Oxford: Oxford University Press.

Spence, C., & Gallace, A. (2011). Multisensory design: Reaching out to touch the consumer. *Psychology & Marketing*, *28*, 267-308.

Spence, C., & Piqueras-Fiszman, B. (in press). The multisensory packaging of beverages. In M. G. Kontominas (Ed.), *Food packaging: Procedures, management and trends*. Hauppauge NY: Nova Publishers.

Spence, C., & Santangelo, V. (2009). Auditory attention. In C. Plack (Ed.), *Auditory perception* (pp. 249-270). Oxford: Oxford University Press.

Stander, D. M. (1973). Testing new product ideas in an 'Archie Bunker' world. *Marketing News*, *7(10),* 1-12.

Stoll, M., Baecke, S., & Kenning, P. (2008). What they see is what they get? An fMRI-study on neural correlates of attractive packaging. *Journal of Consumer Behaviour*, *7*, 342-359.

van Herpen, E., & van Trijp, H. C. M. (2011). Front-of-pack nutrition labels. Their effect on attention and choices when consumers have varying goals and time constraints. *Appetite, 57,* 148-160.

Wedel, M., & Pieters, R. (2007). A review of eye-tracking research in marketing. *Review of Marketing Research, 4,* 123-147.

Wedel, M., & Pieters, R. (2008). *Visual marketing: From attention to action*. New York: Lawrence Erlbaum Associates.

Weinsten, S. (1981). Brain wave analysis: The beginning and future of package design research. In W. Stern (Ed.), *Handbook of package design research* (pp. 492-504). New York: Wiley Interscience.

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