https://doi.org/10.24867/GRID-2022-p61 Original scientific paper

INFLUENCE OF PACKAGING DESIGN ON THE QUALITY PERCEPTION OF CHOCOLATE PRODUCTS

Jurica Dolić, Melita Petrić, Jesenka Pibernik, Lidija Mandić
University of Zagreb, Faculty of Graphic Arts, Zagreb, Croatia

Abstract: *It is well established that the consumers can often judge the qualities of enclosed products solely based on the information obtained from the packaging. The shape, size and weight of the container, materials, visual design, and information influence the consumer's perception of the product and purchasing decisions. In the context of consumer's browsing through store shelves, the appearance of the packaging container can be the crucial factor for selecting a specific product for closer inspection and, therefore, can have the major role in purchasing process and consumers' decisions. The majority of chocolate bar packaging feature rectangular physical shape of the container. Therefore, using materials, finishing and, most importantly, visual design elements, the designers strive to differentiate the product from the competition on the store shelves while also communicating desired qualities of the product. The research in this paper is focused on the influence of colour and basic shape elements applied on packaging on the perception of quality attributes of chocolate products. In the first part of the research semantic differential questionnaire was used to evaluate perception of colours and basic shape elements in regard to pragmatic and hedonic quality aspects of confectionery products. For this part of the research, the stimuli were displayed outside of the context of packaging. For the main part of the research, both physical prototypes and digital simulations of the packaging were developed, with variations in dominant colours and basic shapes used for visual design of the packaging. AttrakDiff questionnaire was used for subjective evaluation of physical stimuli. Digital simulations, combined with eye-tracking equipment, were used to assess the visual inspection of stimuli when the participants were asked to search for a specific taste related property of the product. Fixation count and fixation duration were measured to establish which packaging designs gathered the most attention during the visual search for specific product traits.*

Key words: packaging design, colour, quality, visual design elements

1. INTRODUCTION

In today's world of abundance, many consumers are daily faced with buying decision. Variety of choices can make this decision a complex task, requiring significant cognitive and time investment. Therefore, most consumers aren't willing to invest themselves equally for every product they seek to purchase. Consumer food packaging is considered low involvement for majority of consumers, with many of the consumers feel no need to carefully consider product characteristics, thus making the packaging visual design a driver in the purchasing decision process (Silayoi & Speece, 2004).

Due to limitations of the packaged products, potential buyers are deprived of available sensory information which would help them form a judgment about the product they are trying to buy. In the case of food products, consumers are often unable to access the product and even visually inspect it. Smell, taste, and even tactile information is not available before making the purchase decision. So, the information obtained from the packaging is often the only measure of quality. Perceived quality is a cognitive responsive to a product, which influence product purchase decisions (Kumar et al., 2009). Although people pay most attention to visual properties of the product package in the retail environment, perception of taste is the second most important aspect for food products (Schifferstein et al., 2013). Therefore, information about taste properties is often present on food packaging through explicit or implicit cues.

Unlike explicit cues, such as brand logos, labels, statements or claims, which explicitly convey meaning to consumers in a deliberate, direct manner, implicit design cues comprise references that cannot be readily distinguished but can "make sense" when used in the right context (Karjalainen, 2007). Cues like shape, colour or even sound can modify consumer's perception of a product (Spence, 2012). Although the cues are visible to consumers, their effects and influence on the perception are often subconscious (Spence, 2012; Becker et al., 2011; Piqueras-Fiszman et al., 2011),

Influence of implicit design cues packaging on consumer perception and buying decisions has received a noticeable amount of research interest in recent years. It is well established that packaging or container colour has an influence on the perceived product qualities, including of taste (Piqueras-Fiszman et al.,

2011; Baptista et al., 2021; Van Doorn et al., 2014). The hue of the colour can be associated with certain taste properties or can impact the intensity of the product's taste when consuming the product (Van Doorn et al., 2014). Increasing the saturation of certain hues can also lead to perception of increase in taste intensity (Spence, 2016). Baptista et al. (2021) investigated the effect of colour of chocolate packaging on perception of flavour, taste, and liking. The Results show that yellow and pink were associated with sweetness, while the participants associated black with bitterness. However, stimuli used for research were simplistic versions of packaging, featuring only coloured wrapper and visible product, thus omitting most visual elements that can usually be found on chocolate packaging, with the authors stressing the need for additional research on more realistic packaging design.

Shape cue influence on packaging was often researched in the context of the properties of the physical container (Spence, 2012; Marques de rosa et al., 2019; Velasco et al., 2014), label shape (Spence, 2012; Marques de rosa et al., 2019) and typography (Kovač et al., 2013). Rounded container shapes are associated with sweetness while angular shape is associated with bitterness (Velasco et al., 2014). Becker et al. (2011) demonstrate that the container shape influences taste intensity, with products from angular packaging tasting more intense compared to rounded packaging. There is also a general preference of rounded over angular forms (Bar & Neta, 2006; Spence, 2012)

2. PROBLEM STATEMENT

Previous studies of the implicit effects of colour and shape of food packaging on consumer perception and expectations were mostly focused on the properties of the container or label shape (Spence, 2012; Marques de rosa et al., 2019), reducing or completely omitting visual design elements regularly featured on packaging (Baptista et al., 2021; Velasco et al., 2014). However, there are many cases where changes of the container shape are not practical of feasible. Studies which focused on visual design properties, featured a limited number of cues (Westerman et al., 2013; Kovač et al., 2019) or varied multiple design cues at the same time (Gunaratne, 2019).

In the present study, we investigate the influence of implicit packaging design cues of visual shapes and colour on the visual search for specific chocolate taste properties and perception of overall pragmatic quality, hedonic quality aspects of the product. The study consists of two experiments that are equivalent in procedure and differ in stimuli design cues that were varied. The goal of this research is to establish whether the use of different shape or colour visual cues impact consumers attention when searching for specific traits and whether the change in the implicit visual cues has an impact on the overall perceived quality of the packaging.

3. EXPERIMENT

3.1 Participants

Participants were randomly recruited amongst students and faculty staff at the University of Zagreb, Faculty of Graphic Arts. A total of 20 people participated in this study, 9 men and 11 women, with the participants' age ranging from 20 to 40 years old.

3.2 Stimuli

The stimulus material consisted of nine different mock-ups of chocolate bar packaging, divided into two groups. The basic form of the packaging is rectangular, which is widely used for chocolate bar packaging. Visual design of the primary display panel features centrally positioned logotype on a basic white shape, pattern constructed of basic shape elements and solid colour background. Impact of explicit packaging cues was kept at minimum, so the logotype was generic.

In the first stimulus group (shape group) the independent variable in the design was the shape of the pattern elements and the logotype background element (Figure 1). Four basic shapes were used across the samples: circle, square, rectangle and triangle. The approximate position and number of the elements were consistent across the designs. The colour used for pattern was orange (CMYK: 0, 34, 85, 0; RGB: 250, 179, 50), and the background colour was brown (CMYK: 35, 81, 63,31; RGB: 136, 69, 52) across all samples in this group.

Figure 1: Sample designs for the shape stimuli group

In the second stimuli group (colour group), the independent variable was background and pattern colours (Figure 2). Five different hues were used for background (Table 2), with pattern elements featuring a lighter tint of the background hue. Circular pattern was used across all samples in this group.

Table 1: Colours used for samples in the colour stimuli group

Name	Crimson red	Green	Blue	Brown	Orange
CMYK	17, 100, 37, 7	85, 10, 79, 20	85, 50, 0, 0	50, 90, 80, 50	0, 42, 78, 0
RGB	193, 0, 88	0, 132, 80	29, 113, 184	93, 36, 33	247, 165, 70
HEX	#C10058	#008450	#1D71BB	#5D2421	#F7A546

Figure 2: Sample designs for the colour stimuli group

Physical mock-ups were created for the purpose of subjective evaluation, while the digital simulations were used for the eye-tracking experiment. On the digital simulations, mock-ups were placed in a two-row grid, with two instances of every design sample presented at the same time to better reflect the scenario of browsing product shelves in the supermarket. The placement of samples in the grid was different for every stimulus.

3.3 Method and design

The research was divided into two parts and was conducted in a controlled laboratory environment. In the first part, participants visual search behaviour was observed when tasked with finding a specific taste quality of chocolate. Tobii X60 eye-tracking apparatus was used to track participant eye gaze data. The test was run and recorded using Tobii Studio 3.2.2. software. The stimuli were reproduced on a computer display in front of the subject at a distance of 60 (+/-3) cm. The dimensions of the viewing area were 32,5 cm x 52 cm and the display resolution was 1920 x 1080 pixels. After the introduction to the experiment

and the calibration process, the participants were shown the examples of both shape and colour stimuli. Then they were tasked to find a product with a specific taste, after which the stimulus was shown. Participants were exposed to each stimulus for the duration of 7 seconds. One round of the experiment had a total of four tasks, which differed only by taste which the participants needed to search for: sweet, salty, bitter, and sour. Each participant completed two rounds of four tasks, one for each stimulus group. Measured was gaze duration to determine on which design participants focused the most when searching for specific product taste. The results were analyzed using SPSS software.
The second part of the research was subjective evaluation of the general product qualities and user experience. For this experiment AttrakDiff questionnaire was used. AttrakDiff (Hassenzahl et al, 2003) is a questionnaire based on the semantic differential method and designed to measure pragmatic and hedonic qualities of interactive products, as well as the product's overall attractiveness. The condensed version of the questionnaire, called AttrakDiff Short, which was used for this experiment, consists of 10 bipolar word pairs which are used to evaluate following dimensions of design: Pragmatic Quality (PQ), Hedonic Quality (HQ) and Attractiveness (ATT). For each word pair, the participants evaluate the product on the Likert scale with range from 1 to 7. Stimuli were presented in X-Rite The Judge II Viewing Booth, under the "daylight" light source preset (6500K CIE D65). All samples within each of the stimuli group evaluated were presented at the same time.

4. RESULTS AND DISCUSSION

4.1 Eye tracking experiment results and discussion

Prior to inferential statistics of the eye-tracking data, we have evaluated the data for normality with Shapiro-Wilk test which showed that the fixation duration datasets are non-normally distributed for both stimuli groups across all tasks. Therefore, only non-parametric statistical tests were used in the analysis. Total fixation duration (TFD) between samples in the stimuli group were compared by applying the Kruskal-Wallis test.

Table 2: Shape stimuli total fixation duration results

Task	Sample	N	Mean	Std. Error	Std. Deviation
bitter	circle	20	1.0610	.13571	.60693
	square	20	1.7820	.24807	1.10941
	rectangle	20	1.2480	.20927	.93586
	triangle	20	1.0055	.17946	.80256
sour	circle	20	1.0185	.14935	.66790
	square	20	1.0925	.14744	.65937
	rectangle	20	1.3840	.23030	1.02991
	triangle	20	1.6765	.29141	1.30321
salty	circle	20	.8365	.14295	.63928
	square	20	1.0970	.13910	.62208
	rectangle	20	1.2985	.22007	.98420
	triangle	20	2.1710	.27920	1.24862
sweet	circle	20	2.0505	.24760	1.10732
	square	20	1.0845	.12368	.55311
	rectangle	20	1.2600	.13123	.58686
	triangle	20	.9125	.17929	.80179

Table 3: Kruskal Wallis test results for the shape stimuli group tasks

	Bitter	Sour	Salty	Sweet
H	7,656	3,183	16,067	18,060
df	3	3	3	3
p	0,054	0,364	0,001	< 0,001

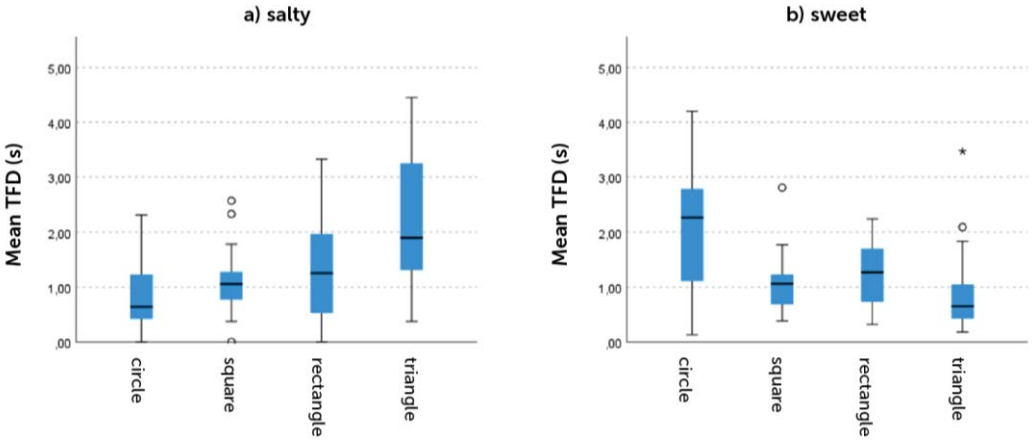

Figure 3: Boxplots showing mean total fixation duration for the shape stimuli group in the a) salty taste search task and b) sweet taste search task

Table 4: colour stimuli total fixation duration results

Task	Sample	N	Mean TFD (s)	Std. Error	Std. Deviation
bitter	crimson	20	.6875	.17991	.80458
	orange	20	.8785	.18085	.80878
	blue	20	.8055	.13589	.60772
	brown	20	2.2615	.42589	1.90462
	green	20	.5600	.12042	.53856
sour	crimson	20	1.0305	.25061	1.12076
	orange	20	1.3545	.25352	1.13377
	blue	20	.8390	.14515	.64915
	brown	20	.4125	.10092	.45131
	green	20	1.7410	.27380	1.22447
salty	crimson	20	.6715	.15224	.68085
	orange	20	1.3570	.25815	1.15446
	blue	20	1.4255	.33524	1.49926
	brown	20	.9785	.20291	.90745
	green	20	1.1290	.20118	.89971
sweet	crimson	20	.8405	.18279	.81748
	orange	20	.9895	.16128	.72128
	blue	20	1.2040	.16722	.74781
	brown	20	1.7745	.24423	1.09223
	green	20	.4765	.10021	.44813

For the shape stimuli group, there was statistically significant results of the total fixation duration for the salt(H(3) = 16,067, p = 0,001) and sweet(H(3) = 18,06, p < 0,001) taste search tasks (Table 3). *Post-hoc* Kruskal-Wallis test results indicate that there is statistically significant difference for the circle-triangle (p < 0.001) and circle-square (p = 0,031) pairs for the sweet taste search task, with circle having longer TFD in both cases (Table 2, Figure 3). There was no statistically significant difference for other pairs in this task. For the salt taste search task (Table 2, Figure 3), there is statistically significant difference for circle-triangle (p = 0,001) and square-triangle (p = 0,041), with triangle having longer TFD in both cases. Results for other pairs in this task show no statistically significant difference.

Table 5: Kruskal Wallis test results for the colour stimuli group tasks

	Bitter	Sour	Salty	Sweet
H	14,604	19,644	6,123	22,585
df	4	4	4	4
p	0,006	< 0,001	0,190	< 0,001

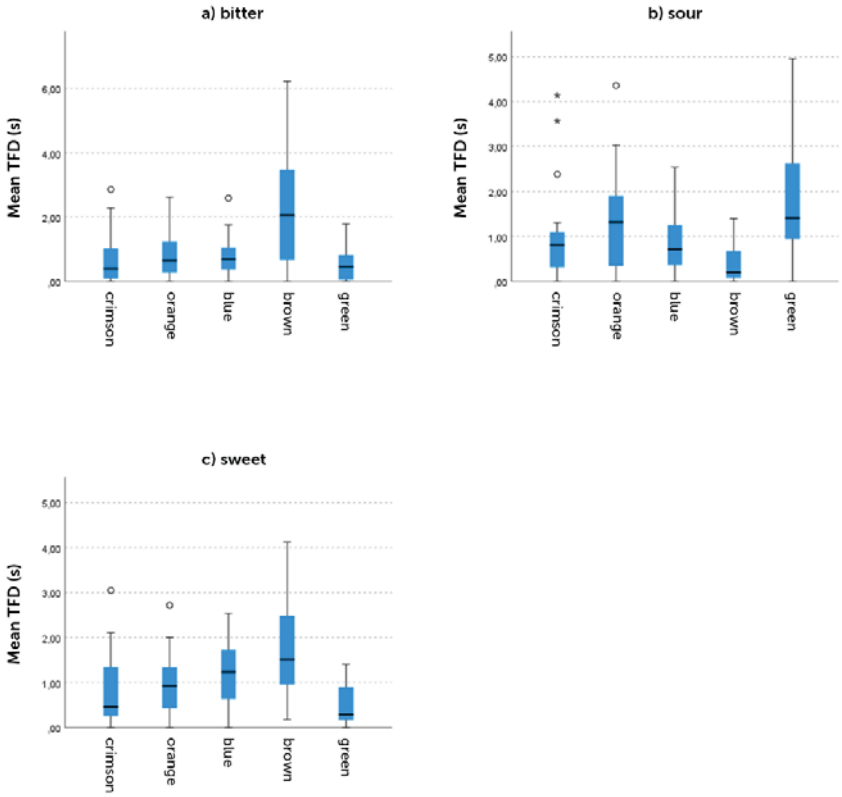

Figure 4: Boxplots showing mean total fixation duration for the colour stimuli group in the a) bitter taste search task, b) sour taste search task and c) sweet taste search task

For the colour stimuli group, Kruskal-Wallis test results indicate statistically significant results of the TFD for the bitter (H(4) = 14,604, p = 0,006), sour (H(4) = 19,644, p < 0,001) and sweet (H(4) = 22,585, p < 0,001) taste search tasks (Table 5). *Post-hoc* Kruskal-Wallis test results for bitter taste search task indicate statistically significant difference for the green-brown (p = 0,007) and crimson-brown (p = 0.013) with brown having a longer TFD in both cases (Figure 4, Table 4). For the sour search task there is statistically significant difference between brown and green (p < 0,001) and brown and orange (P = 0,014) with brown having shorter TFD in both cases (Figure 4, Table 4). Sweet taste task results show statistically significant difference for three colour pairs: green-blue (p=0,016), green-brown (p < 0,001), where the green had shorter TFD in both cases, and crimson-brown, where crimson had shorter TFD (Figure 4, Table 4). There was no statistically significant difference for other colour pairs.

Results indicate that difference in shape cues used for visual design of the packaging can have significant impact on visual search for sweet or salty chocolate taste. Round shapes were perceived as sweeter compared to angular shapes of square and triangle, while triangle gathered more visual attention compared to circle and square patterns. However, search for bitter and sour did not produce significant results, which could indicate that it's harder to associate those taste properties with specific shape cues.
Although colour cues also have significant impact on visual search in case of sweet, sour, and bitter taste, the relationship between colour pairs and taste are more complex. In both bitter and sweet search task, brown had significantly higher fixation duration compared to both green and crimson. This might be due to participants associating these taste properties with the colour closest to the colour of the chocolate bar itself. However, green had significantly higher TFD compared to brown when the participants searched for sour taste property.

4.2 Subjective evaluation results and discussion

Results from the subjective evaluation were analysed using AttrakDiff online analysis tool.

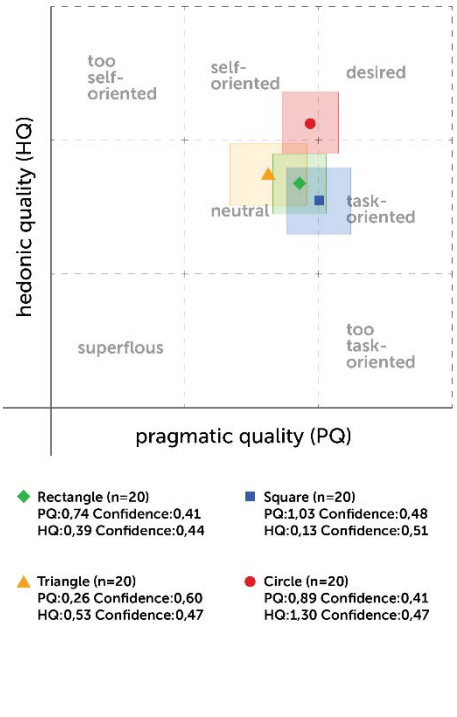

Figure 5: AttrakDiff results for shape stimulus group

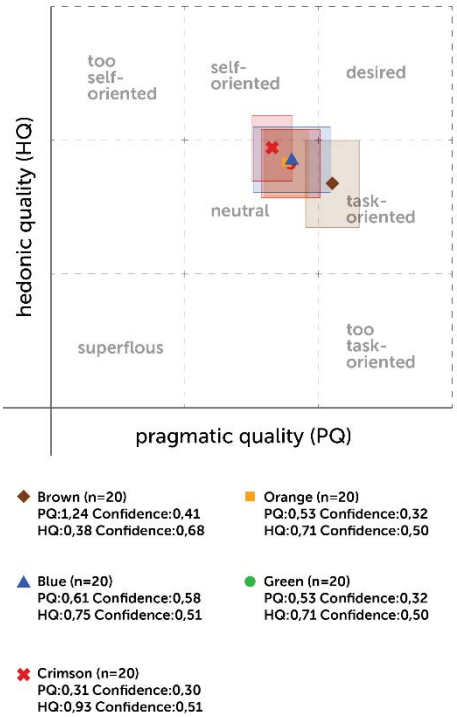

Figure 6: AttrakDiff results for colour stimulus group

In the shape stimuli group (Figure, there is significant difference between in the perceived hedonic quality of the circle-square and circle-rectangle, with higher score for circle sample in both cases (HQ = 1,30). Overall score puts the circle sample nearest to the "desired" character-region, as defined by AttrakDiff (Figure 5). This indicates that rounded shapes on visual design have higher overall preference compared to angular shapes, which is in line with existing research (Bar & Neta, 2006; Spence, 2012).
Results for the colour stimuli group are more clustered together compared to the ones for the shape group (Figure 6), with the significant difference being for the pragmatic quality rating between brown and crimson (PQ = 0,31) red sample (PQ = 1,24).
Although there are differences in scores between certain samples, all the samples in both evaluations have positive scores for both pragmatic and hedonic quality dimensions.

5. CONCLUSION

The results of this research indicate that implicit use of shape and colour on product packaging can have significant effect on attention when searching for specific taste properties but can also influence subjective perception of the overall pragmatic or hedonic qualities of the product. There was statistically

significant difference in total fixation duration between designs with circular, square, and triangular patterns when participants searched for sweet and salty products. For sweet taste, most attention was on the product with circular pattern, while the participants focused on the design with triangular pattern when tasked with search for salty taste.
Although there was statistically significant difference between certain colour pairs, the influence of colour cues on visual search for product taste is not as clear. Brown colour gathered more attention compared to green and crimson for both bitter and sweet search tasks, although participants were more focused on the green packaging, as opposed to brown, when searching for sour taste property.
Results also indicate that change of shape cues in visual design impacts perceived hedonic quality of the product, with design featuring circular pattern having higher score than designs with square or rectangular cues. In the case of colour cues, only significant difference was in the higher pragmatic quality score for brown packaging compared to packaging in crimson red colour.
The results provide practical guidelines for designers, enabling them to adjust packaging design for desired taste properties, but also to consider how these changes can reflect on the perception of the overall pragmatic and hedonic quality of the product.

6. REFERENCES

Baptista, I., Valentin, D., Saldaña, E. & Behrens, J. (2021) Effects of packaging color on expected flavor, texture and liking of chocolate in Brazil and France. *International Journal of Gastronomy and Food Science.* 24, 100340. Available from:doi: 10.1016/j.ijgfs.2021.100340

Bar, M. & Neta, M. (2006) Humans prefer curved visual objects. *Psychological Science.* 17, 645 – 648.

Becker, L., Van Rompay, T. J. L., Schifferstein, H. N. J. & Galetzka, M. (2011) Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. *Food Quality and Preference*. 22 (1), 17 - 23. Available from:doi: 10.1016/j.foodqual.2010.06.007

Gunaratne, N. M., Fuentes, S., Gunaratne, T. M., Torrico, D. D., Ashman, H., Francis, C., Gonzalez Viejo, C. & Dunshea, F. R. (2019) Consumer acceptability, eye fixation, and physiological responses: A study of novel and familiar chocolate packaging designs using eye-tracking devices. *Foods.* 8 (7), 253. Available from: doi: 10.3390/foods8070253

Hassenzahl, M., Burmester, M. & Koller, F. (2003) AttrakDiff: Ein Fragebogen zur Messung wahrgenommener hedonischer und pragmatischer Qualität. In: Ziegler, J. & Szwillus, G. (eds.) *Mensch & Computer 2003*. Vieweg+Teubner Verlag, pp. 187 – 196.

Karjalainen, T. M. (2007) It looks like a Toyota: Educational approaches to designing for visual brand recognition. *International Journal of Design*. 1 (1), 67 - 81

Kovač, A., Kovačević, D., Bota, J. & Brozović, M., (2019) Consumers' preferences for visual elements on chocolate packaging. *Journal of Graphic Engineering and Design*. 10 (1), 13 – 18. Available from: doi: 10.24867/JGED-2019-1-013

Kumar, A., Lee, H. J. & Kim, Y. K. (2009) Indian consumers' purchase intention toward a United States versus local brand. *Journal of Business Research*. 62 (5), 521 - 527. Available from: doi: 10.1016/j.jbusres.2008.06.018

Marques da Rosa, V., Spence, C. & Miletto Tonetto, L. (2019) Influences of visual attributes of food packaging on consumer preference and associations with taste and healthiness. *International Journal of Consumer Studies*. 43, 210 – 217. Available from: doi:10.1111/ijcs.12500

Piqueras-Fiszman, B., Alcaide, J., Roura, E. & Spence, C. (2011) Is it the plate or is it the food? The influence of the color and shape of the plate on the perception of the food placed on it. *Food Quality & Preference*. 24 (1), 205 - 208. Available from: doi:10.1016/j.foodqual.2011.05.009

Piqueras-Fiszman B. & Spence C. (2012) The influence of the colour of the cup on consumers' perception of a hot beverage. *Journal of sensory studies.* 27 (5), 324 - 331. Available from: doi:10.1111/j.1745-459X.2012.00397.x

Schifferstein, H. N. J., Fenko, A., Desmet, P. M. A., Labbe, D. & Martin, N. (2013) Influence of package design on the dynamics of multisensory and emotional food experience. *Food Quality and Preference*. 27 (1), 18 – 25. Available from: doi:10.1016/j.foodqual.2012.06.003

Silayoi, P. & Speece, M. (2004) Packaging and purchase decisions. *British Food Journal*. 106, 607 – 628. Available from: doi:10.1108/00070700410553602

Spence, C. (2012) Managing sensory expectations concerning products and brands: Capitalizing on the potential of sound and shape symbolism. *Journal of Consumer Psychology*. 22, 37 – 54. Available from: doi: 10.1016/j.jcps.2011.09.004

Spence, C. (2016) Multisensory packaging design: Color, shape, texture, sound, and smell. In: Burgess, P. (ed.) *Integrating the Packaging and Product Experience in Food and Beverages: A Road-Map to Consumer Satisfaction*. Woodhead Publishing, pp. 1 – 22.

Van Doorn, G. H., Wuillemin, D. & Spence, C. (2014) Does the colour of the mug influence the taste of the coffee? *Flavour*. 10 (3). Available from: doi:10.1186/2044-7248-3-10

Velasco, C., Salgado-Montejo, A., Marmolejo-Ramos, F. & Spence, C. (2014) Predictive packaging design: Tasting shapes, typefaces, names, and sounds. *Food Quality and Preference*. 34, 88 – 95. Available from: doi:10.1016/j.foodqual.2013.12.005

Westerman, S. J., Sutherland, E. J., Gardner, P. H., Baig, N., Critchley, C., Hickey, C., Mehigan, S., Solway, A. & Zervos, Z. (2013) The design of consumer packaging: Effects of manipulations of shape, orientation, and alignment of graphical forms on consumers' assessments. *Food Quality and Preference*. 27 (1), 8 – 17. Available from: doi:10.1016/j.foodqual.2012.05.007