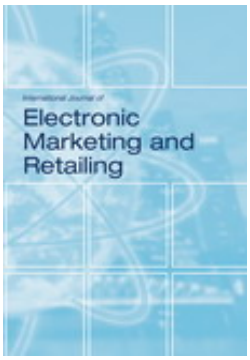

International Journal of Electronic Marketing and Retailing

ISSN online: 1741-1033 - ISSN print: 1741-1025
https://www.inderscience.com/ijemr

Differences in attitude and purchase intention for multisensory stimuli in online stores with decreasing product congruence in terms of super additivity and cross-modal correspondence

David Weber, Mandy Nuszbaum, Carmen María Carrillo González

DOI: 10.1504/IJEMR.2022.10052273

Article History:
Received: 26 October 2021
Accepted: 14 January 2022
Published online: 18 December 2023

Differences in attitude and purchase intention for multisensory stimuli in online stores with decreasing product congruence in terms of super additivity and cross-modal correspondence

David Weber*

Universidad Católica San Antonio de Murcia
Av. de los Jerónimos, 135,
30107 Guadalupe de Maciascoque, Murcia, Spain
Köllmannstr. 2, 45276 Essen, Germany
Email: david.weber2@fom-net.de
*Corresponding author

Mandy Nuszbaum

FOM University of Applied Sciences – Campus Muenster
Martin-Luther-King-Weg 30/30a, 48155 Münster, Germany
Email: mandy.nuszbaum@fom.de

Carmen María Carrillo González

Universidad Católica San Antonio de Murcia
Av. de los Jerónimos, 135,
30107 Guadalupe de Maciascoque, Murcia, Spain
Email: cmcarrillo@ucam.edu

Abstract: This study aims to verify how the current findings related to multisensory marketing can be transferred to online stores, where the sensory stimuli are perceived through imagination, except for the visual sense. The authors conducted two web experiments. The subjects evaluated soft drinks, chocolates, and t-shirts, with a wide variety of sensory combinations using three semantic scales to examine attitude, purchase intention, and the sensory stimuli used. The results show that for a given product congruence, the effect of super additivity could not be observed, but that the effect of cross-modal correspondence could. With decreasing product congruence, observations became unambiguous as expected so that only the effect of product congruence can be applied in online stores even with a partial congruence. The paper shows that the previous findings are not necessarily transferable to a digital context.

Keywords: consumer behaviour; multisensory marketing; online marketing; attitude; purchase intention.

Reference to this paper should be made as follows: Weber, D., Nuszbaum, M. and González, C.M.C. (2024) 'Differences in attitude and purchase intention for multisensory stimuli in online stores with decreasing product congruence in terms of super additivity and cross-modal correspondence', *Int. J. Electronic Marketing and Retailing*, Vol. 15, No. 1, pp.89–106.

Biographical notes: David Weber has been a PhD student at UCAM Spain since October 2019. He is a marketing and sales consultant and he also work as a freelance lecturer at FOM for the fields of consumer psychology and empirical research methods. He has been engaged as a research fellow at the Institute of Business Psychology at FOM IN 2019. His research interests lie in persuasive consumer research with a focus on multisensory and implicit stimuli as well as attitude formation processes. He would like to tie future research more closely to biopsychological processes.

Mandy Nuszbaum is a Professor and Dean in Business Psychology at FOM. She works as a freelance consultant for psychological consumer and market research. Her research interest focuses on primary and methodological research as well as market and advertising psychology. Her research topics are multisensory marketing in digital contexts and implicit processes related to consumer psychology. She was most recently employed as Senior Manager in the Brand and Customer Experiences department at GfK SE Nuremberg and a freelancer at EURO FH. She has been headed of the Consumer Psychology Department at the Institute for Business Psychology at FOM in 2017.

Carmen María Carrillo González is an Assistant Professor at UCAM Spain, where she obtained her PhD in Neuromarketing. Her research interest focuses on consumer behaviour and advertisement. She has participated in numerous European research projects that have allowed her to establish networks with numerous researchers in different areas. She has different collaborations such as book publications, scientific committees, organisation and participation in congresses. Her importance of communication as a transmission tool in any field has allowed her to extrapolate her knowledge, coordinating international conferences on human rights, procedural law and criminology or cinema, literature, comics, among other forms of artistic expression.

This paper is a revised and expanded version of a paper entitled ‘Limits of multisensory marketing in online stores with decreasing product congruence’ presented at International Scientific Conference on the Occasion of the Hungarian Science Festival, Sopron, 4 November 2021.

1 Introduction

With the COVID-19 pandemic, consumer behaviour in e-commerce has changed. Interactions between consumers and companies have become more dynamic and frequent and a significant increase in sales can also be observed (Rosenbaum and Russell-Bennett, 2020). Due to the steadily increasing number of providers on platforms such as Amazon’s marketplace, the competitive situation continues to rise (Xu, 2018). So, the question is whether multisensory marketing is a way to bypass competitive conditions. Krishna and Elder (2021) emphasise that further research is needed to understand better how sensory imagery can influence perception and consumer behaviour, especially in a natural situation. Furthermore, there are interactions between specific combinations of senses so that a conglomerate of senses can be perceived more positively or more negatively by consumers regardless of the evaluation of the individual sensory stimulus and this is described as an effect of cross-modal correspondence (Spence et al., 2014). In scientific studies, the desire to buy is often related to haptic senses; thus, the purchase

probability is significantly higher if the seller touches the customer because of an increased oxytocin level (Morhenn et al., 2008). Furthermore, consciously perceived haptic stimuli in product designs can also influence the willingness to buy (Kampfer et al., 2017). A recent study shows that products are perceived more positively when advertised by pleasant scents (Ruzeviciute et al., 2020). In terms of the effect of cross-modal correspondence, well researched are combinations with acoustic stimuli (Lowe et al., 2018). For example, music as an acoustic stimulus can influence the perceived taste of wine (Velasco et al., 2018). Sunaga (2018) observed similar results and emphasised the importance of the congruency-fluency-evaluation chain. However, the perceived size of products can also be influenced by the effect of cross-modal correspondence through visual and auditory stimuli (L. Wang et al., 2020). The study by Simmonds et al. (2020) provides insightful results regarding audio and visual stimuli in videos. The scientists developed a dual-process model to derive a better understanding of these sensory combinations. Krishna et al. (2016) emphasises that congruence between the sensory stimuli and the object's function is essential in perception and purchase intention. Researchers like Ruzeviciute et al. (2020) also discuss the importance of product congruence.

Haase and Wiedmann (2018) have verified that multisensory marketing can also be effective in a digital context using a self-developed scale, the sensory perception item (SPI) set. The SPI (Haase and Wiedmann, 2018) is a scale to evaluate sensory stimuli based on four items, each sense. In an online-based quantitative study and field experiment, the researchers showed that a higher SPI leads to positive results in other variables of buying behaviour such as brand attitude, brand loyalty and buying intention. Super additivity is also discussed in science in the context of sensory marketing so that several senses lead to a better evaluation (Klemen & Chambers, 2012). The effect of super additivity is often attributed to Pavaio's (1969, 2009) dual coding system, as in the studies of Lwin et al. (2010), who verified this model using olfactory and visual sensory combinations. The dual coding model describes that object information is represented in verbal and imaginal coding systems, where the imaginal system represents sensory stimuli, among others (Paivio, 1969, 2009). In an exploratory study, Li et al. (2020) developed a scale, the MPPEMIS, which positively affects attitude and purchase intention based on experienced service performance in e-commerce. Multisensory marketing is considered in some recent studies in augmented reality or based on physically perceived stimuli. Javornik (2016), for example, observed a positive correlation between augmented reality and the attitude dimensions. Similar observations were made by the researchers Mishra et al. (2021), where in particular, the experience of being able to grasp something led to higher visual appeal, emotional appeal and purchase intention. Hwang et al. (2020) observed that background music influences attitude and purchase intention dimensions depending on the involvement level in e-commerce. Buzova et al. (2020) suggest that multisensory marketing, even without physically perceived stimuli, through narration, influence consumer behaviour. Based on their study, Tan et al. (2021) assumed that multisensory imagery has this effect because sensory information can be stored and retrieved by imagination.

Furthermore, many research papers have been published about multisensory imagery in recent years. Some of these papers were summarised by Petit et al. (2019), focussing

on online technologies. The researchers emphasise the im-portance of multisensory stimuli in the field of augmented reality as well as in the field of imagery, for example, by using product images in online stores. MacInnis and Price (1987) are often cited in the context of imagery, which describes imagery as a process in which sensory information is represented as working memory. Krishna and Elder (2021) also highlighted the importance of multisensory imagery based on a summary of several relevant scientific papers. Despite a large amount of research, some research questions remain still to be answered. It has not yet been conclusively researched how the effect of super additivity and the cross-modal correspondence effect in the context of imagery behaves on consumer behaviour, especially when these are examined in the context of realistic situations, which leads to the following hypotheses of this research. In addition, we will investigate the extent to which decreasing product congruence can lead to differences in outcomes.

H1 Based on the super additivity effect, attitude and purchase intention are higher with more sensory stimuli than with fewer sensory stimuli for products in online stores where only the visual sense is physically perceived.

H2 There are interactions, based on the cross-modal correspondence effect, between specific combinations of senses, so that an additional sensory stimulus, which by itself was perceived positive, can lead to a lower attitude and purchase intention for products in online stores where only the visual sense is physically perceived.

H3 Based on the congruence effect, decreasing product congruence leads to differences in observed outcomes regarding super additive and cross-modal correspondence related to attitude and purchase intention.

2 Material and methods

Within a one-factorial between-subject design framework, 16 products were evaluated in study 1, each with different sensory stimuli. Based on the effect of super additivity, each subject evaluated a product with one sense, a product with two senses, a product with three senses, a product with four senses and a product with five senses. The allocation of the products was randomised, taking the number of senses into account. Since all possible combinations of senses were evaluated at the end of the study, possible interactions in terms of cross-modal correspondence could also be investigated. In order to maintain a constant level of involvement based on low investment costs, convenience goods in the form of soft drinks were chosen as research material. One product contains no multisensory stimuli, only the visual sense, which is always involved in all products. For all other products, different senses are combined so that every possible combination of senses is considered. Different product designs were tested in a pre-test based on the SPI (Haase and Wiedmann, 2018) concerning the sensory stimuli, such as the flavour or the noisy foam. The research material was adapted and used in the actual study based on these results. The sense of taste is addressed by specific flavours such as ginger. Scents like lavender address the sense of smell. Ice cubes present the product variation ice on the bottle. Furthermore, it is described how a pleasant coolness runs through the body. This

aims out to involve the haptic sense. A sonorous sound foam addresses the auditory sense. The evaluation of the products is based on two subscales of the purchase intention scale by Spears and Singh (2004), where the German six-point scale by Knoll (2015) was used. One is the attitude scale, a six-point semantic differential with five items to measure the attitude regarding each item. The SPI (Haase and Wiedmann, 2018) was used to ensure that all sensory stimuli were perceived correctly by the subjects and was explicitly used to develop the research material in the pre-test. It is a five-point Likert scale and covers four adjectives per sense.

The study was conducted in an almost natural environment to evaluate the influence on attitude and purchase intention. A self-created website of the provider wix.com was integrated into the web experiment for each group. Each website presented a company with the fictitious name délieux and displayed its products. The website was intended to ap-pear authentic through the visual connection of an online shop, product descriptions and prices. At the beginning of the survey, the subjects were informed that the following survey was about a consumer research project. It was pointed out that it would not be possible to draw any conclusions about the person. The contact details of the researchers were provided in case of further questions, such as about the ethical guidelines. Furthermore, the subjects were informed about the survey's duration, compliance with data protection regulations and the procedure in general. Participation in the study was voluntary, anonymous and there was no compensation. Before reviewing the research material, a cover story was used. They are invited to a birthday party and have learned that the host likes the fictitious brand delicéux. Therefore, they visit the following website and try to form their own opinion. Since the products are quite expensive, the subject should choose three products and suggest them to their friends. Group-conforming behaviour without a defined group norm should reduce one's preference and a broad selection, as identified in studies by Ratner and Kahn (2002) and Ariely and Levav (2000). After the cover story, the website was displayed with the five products evaluated shortly after in a random order based on the attitude and purchase intention scale (Knoll, 2015; Spears and Singh, 2004) and the SPI (Haase and Wiedmann, 2018).

A second study was conducted in order to examine the third hypothesis. Therefore, the research material was extended to other product types to examine differences in the results if product congruence is partial or completely missing. These products are also convenience products, chocolate and t-shirt. The sounding foam was replaced in the case of the chocolate by a crackling sound in the mouth when consumed and in the case of the t-shirt by a particular crackling sound when the t-shirt is touched. The tastes and smells used, such as lavender, were taken from the research material of study 1. The gustatory sense was not considered for the t-shirt due to lack of applicability. As in the first study, the research material was pretested using the SPI (Haase and Wiedmann, 2018). It could be ensured that the evaluation of the respective sensory stimuli was comparable to the previous web experiment. The test subjects evaluated either five of the nine chocolate bars or five t-shirts each in random order. The procedure, as well as the statistical instruments, are identical to study 1.

3 Result

After eliminating inconsistent data, the results of 654 subjects were analysed in the first web experiment. The link to the study was shared via the social media platforms WhatsApp and Instagram and with students of the FOM University of Applied Sciences. Four hundred seventy-four subjects indicated they were female, 171 male, two diverse and one subject provided no information. 42.41 % of the subjects were younger than 26 years old, 48.32 % were younger than 36, 5.50 % were between the ages 36 and 46 and 27 subjects did not provide any information. 60.24 % of the subjects have a gross annual income lower than 40,000 EUR, 30.73 % between 40,000 EUR and 59,000 EUR and 8.56 % have an income higher than 60,000 EUR. 94.50 % of the subjects do not have an academic degree yet. The results of the SPI (Haase and Wiedmann, 2018) show that all senses used are in a positive range (M_{vision} = 3.34, SD_{vision} = 1.11, $M_{acoustic}$ = 3.17, $SD_{acoustic}$ = 1.10, M_{haptic} = 3.25, SD_{haptic} = 1.03, $M_{olfactory}$ = 3.50, $SD_{olfactory}$ = 1.14, $M_{gustatory}$ = 3.33, $SD_{gustatory}$ = 1.21). In the second web experiment, the data of 351 subjects could be analysed. Among them, 282 were women, 64 were men and five subjects did not provide any information. One hundred eighty-one subjects are aged between 18 and 25 years and 131 subjects are aged between 26 and 34 years, while 11.11 % of the subjects are older than 36 years. The gross annual income is between 10,000 and 19,000 EUR for 20.80 % of the subjects, between 20,000 and 39,000 EUR for 34.47 % of the subjects, between 40,000 and 59,000 EUR for 31.91 % of the subjects and over 60,000 EUR for 12.82 % of the subjects. In addition, 29 subjects have an academic degree. The results of the SPI (Haase and Wiedmann, 2018) show that all senses used are in a positive range for the chocolates (M_{vision} = 3.50, SD_{vision} = 0.97, $M_{acoustic}$ = 2.95, $SD_{acoustic}$ = 1.10, M_{haptic} = 3.25, SD_{haptic} = 0.99, $M_{olfactory}$ = 3.72, $SD_{olfactory}$ = 1.90, $M_{gustatory}$ = 3.47, $SD_{gustatory}$ = 1.24) and t-shirts (M_{vision} = 2.83, SD_{vision} = 1.10, $M_{acoustic}$ = 2.70, $SD_{acoustic}$ = 1.09, $M_{olfactory}$ = 3.39, $SD_{olfactory}$ = 0.98, $M_{gustatory}$ = 3.33, $SD_{gustatory}$ = 1.21).

In terms of the effect of super additivity, it was assumed that attitude and purchase intention increase with the cumulative addition of sensory stimuli within product imageries, seen in online stores where only the visual stimulus was physically perceived. To test the hypothesis, the results of the dependent variables were grouped according to the number of stimuli used and examined using a one-way ANOVA followed by post-hoc tests. According to Turkey (1977), all data with an IQR distance greater than 1.5 were identified as outliers and removed, causing the group size to vary. For the first study, the group with four sensory stimuli includes 640 subjects, while all other groups include 654 subjects. The mean value of the attitude tends to be in a positive range (M = 3.86, SD = 1.26). The mean value is slightly lower for purchase intention and the standard deviation higher (M = 3.39, SD = 1.38). Furthermore, the mean values increase with the number of sensory stimuli so that the product with only one sensory stimulus shows the lowest mean value for attitude (M = 3.39, SD = 1.25) as well as for purchase intention (M = 2.93, SD = 1.29) and the product with five stimuli shows the highest mean value for attitude (M = 3.39, SD = 1.25) as well as for purchase intention (M = 2.93, SD = 1.29). The results of Levene's test indicate a missing variance of homogeneity for attitude (F (4, 3,251) = 3.70, p = 0.005) and for the purchase intention (F (4, 3,251) = 5.80, p = < 0.001) , so the Welch-test was also conducted which indicate significant differences between the analysed groups based on attitude (F (4, 1625) = 46.86, p = < 0.001, est w^2 = 0.05) and purchase intention (F (4,1624) = 46.05, p = < 0.001, est w^2 = 0.05). In the second study, the average group size varied for the chocolates with n = 199 and for

the t-shirts with n = 175. As in the first study, the mean values for the chocolates are higher and the standard deviations are lower for the attitude (M = 4.21, SD = 1.15) than that of the purchase intention (M = 3.62, SD = 1.33). For t-shirts, the results are similar for attitude (M = 3.72, SD = 1.20) and purchase intention (M = 2.75, SD = 1.34). Based on a missing variance of homogeneity for attitude ($F_{chocolate}$ (4, 992) = 11.49, p = <.001, $F_{t\text{-}shirt}$ (3, 695) = 4.82, p = 0.002) and for the purchase intention ($F_{chocolate}$ (4, 3251) = 6.98, p = < 0.001, $F_{t\text{-}shirt}$ (3, 695) = 3.04, p = 0.028), the Welch-test was conducted which indicate significant differences between the analysed groups for the chocolates but not for the t-shirts based on attitude ($F_{chocolate}$ (4, 376) = 13.57, p = < 0.001, est w^2 = 0.06, $F_{t\text{-}shirts}$(3, 268) = 0.79, p = .501, est w^2 = 0.000) and purchase intention ($F_{chocolate}$ (4, 375) = 12.20, p = <.001, est w^2 = .05, $F_{t\text{-}shirts}$ (3, 265) = 1.54, p = 0.206, est w^2 = 0.002).

To test for super additivity effects, the results of the post-hoc tests, based on bootstrapping with 5,000 replicates, are considered in Table 1. For the soft drinks, two pairings do not show significant differences in both attitude ($p_{tukey\ five\ vs.\ four\ stimuli}$ = 1.00, 0.01, 95% CI [–0.13, 0.15], $p_{tukey\ three\ vs.\ two\ stimuli}$ = 0.678, 0.09, 95% CI [–0.05, 0.23]) and purchase intention ($p_{tukey\ five\ vs.\ four\ stimuli}$ = 0.990, -0.04, 95% CI [–0.19, 0.12], $p_{tukey\ three\ vs.\ two\ stimuli}$ = 0.953, 0.06, 95% CI [–0.09, 0.20]). Accordingly, there are no significant differences in attitudes and purchase intention based on soft drinks with two compared to three sensory stimuli and soft drinks with four compared to five sensory stimuli. All other pairings have fluctuating effect sizes based on Cohen's d in addition to significant p-values. Compared to soft drinks with one sensory stimulus, soft drinks with four and five sensory stimuli showed strong effects sizes. The results vary for products with partial and missing congruence. For example, in chocolates, the pairs of four stimuli compared to one stimuli or three stimuli com-pared to two stimuli do not show significant differences in both attitude ($p_{tukey\ four\ vs.\ one\ stimuli}$ = 0.999, –0.03, 95% CI [–0.28, 0.22], $p_{tukey\ three\ vs.\ two}$ = 0.995, –0.03, 95% CI [–0.12, 0.19]) and purchase intention ($p_{tukey\ four\ vs.\ one\ stimuli}$ = 0.710, –0.20, 95% CI [–0.51, 0.12], $p_{tukey\ three\ vs.\ two}$ = 0.931, –0.09, 95% CI [–0.31, 0.12]). For t-shirts, none of the pairs indicate significant differences. However, according to super additivity, all pairs should show significant differences where products with fewer and more sensory stimuli are compared.

According to these results, it can be observed that products with complete congruence and with more sensory stimuli compared to products with less sensory stimuli do not always lead to a significant difference in attitude and purchase intention. Thus, the hypothesis that the effect of super additivity based on multisensory imagination exists in online stores with complete congruence must be rejected. The missing significance can be explained by small differences in attitude and purchase intention when the number of sensory stimuli is low. If the difference of the number of sensory stimuli is higher, significant differences can be observed for attitude ($p_{tukey\ five\ vs.\ one\ stimulus}$ = < 0.001, 0.80, 95% CI [0.66, 0.94] and purchase intention ($p_{tukey\ five\ vs.\ one\ stimuli}$ = < 0.001, 0.82, 95% CI [0.66, 0.96]. Likewise, hypothesis 3, that decreasing product congruence leads to differences in observed outcomes regarding super additivity, related to attitude and purchase intention, will be rejected since the effect was not observable.

Table 1 Bootstrapped post-hoc comparisons – super additivity

		95% bca† CI								
		Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p tukey*	
First study – complete congruence – soft drinks										
Attitude										
Five, stimuli	Four, stimuli	0.005	–0.13	0.147	0.07	5.732e –5	0.089	0.005	1	
	One, stimulus	0.799	0.656	0.939	0.072	–0.001	11.469	0.62	< 0.001	***
	Three, stimuli	0.362	0.222	0.504	0.071	–3.357e –4	5.201	0.281	< 0.001	***
	Two, stimuli	0.455	0.31	0.594	0.072	2.636e –5	6.522	0.348	< 0.001	***
Four, stimuli	One, stimulus	0.792	0.655	0.924	0.068	–0.001	11.317	0.653	< 0.001	***
	Three, stimuli	0.356	0.22	0.492	0.068	–3.930e –4	5.083	0.293	< 0.001	***
	Two, stimuli	0.449	0.313	0.579	0.068	–3.096e –5	6.397	0.364	< 0.001	***
One, stimuli	Three, stimuli	–0.436	–0.571	–0.296	0.07	9.489e –4	–6.268	–0.348	< 0.001	***
	Two, stimuli	–0.345	–0.481	–0.202	0.071	0.001	–4.946	–0.271	< 0.001	***
Three, stimuli	Two, stimuli	0.092	–0.049	0.23	0.071	3.620e –4	1.321	0.072	0.678	
Purchase intention										
Five, stimuli	Four, stimuli	–0.035	–0.193	0.12	0.079	0.001	–0.467	–0.025	0.99	
	One, stimulus	0.815	0.659	0.958	0.077	7.471e –4	10.649	0.587	< 0.001	***
	Three, stimuli	0.447	0.287	0.599	0.079	–1.198e –4	5.845	0.31	< 0.001	***
	Two, stimuli	0.502	0.344	0.656	0.08	7.102e –4	6.562	0.351	< 0.001	***
Four, stimuli	One, stimulus	0.849	0.703	0.992	0.074	–4.570e –4	11.058	0.645	< 0.001	***
	Three, stimuli	0.48	0.34	0.637	0.076	–0.001	6.281	0.351	< 0.001	***
	Two, stimuli	0.535	0.389	0.691	0.077	–4.940e –4	6.994	0.394	< 0.001	***
One, stimuli	Three, stimuli	–0.368	–0.507	–0.213	0.074	–8.669e –4	–4.804	–0.271	< 0.001	***
	Two, stimuli	–0.311	–0.46	–0.169	0.074	–3.695e –5	–4.086	–0.233	< 0.001	***
Three, stimuli	Two, stimuli	0.055	–0.093	0.203	0.076	8.300e –4	0.717	0.039	0.953	

Notes: ** $p < 0.01$, *** $p < 0.001$.
† Bias corrected accelerated.
Bootstrapping based on 5,000 successful replicates.
Cohen's d does not correct for multiple comparisons.
The mean Difference estimate is based on the median of the bootstrap distribution.
P-value and confidence intervals adjusted for comparing a family of 5 estimates (confidence intervals corrected using the Tukey method).

Table 1 Bootstrapped post-hoc comparisons – super additivity (continued)

		95% bca† CI								
		Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p tukey*	
Second study – partial congruence – chocolate										
Attitude										
Five stimuli	Four stimuli	0.653	0.409	0.88	0.121	–2.311e –4	5.477	0.566	< 0.001	***
	One stimulus	0.619	0.36	0.872	0.132	–0.002	4.542	0.633	< 0.001	***
	Three stimuli	0.12	–0.083	0.317	0.102	–7.088e –4	1.06	0.127	0.827	
	Two stimuli	0.154	–0.052	0.358	0.104	–0.002	1.297	0.177	0.693	
Four stimuli	One stimulus	–0.034	–0.278	0.224	0.128	–0.002	–0.274	–0.027	0.999	
	Three stimuli	–0.534	–0.725	–0.335	0.099	–4.777e –4	–6.07	–0.491	< 0.001	***
	Two stimuli	–0.496	–0.703	–0.299	0.102	–0.002	–5.186	–0.463	< 0.001	***
One stimulus	Three stimuli	–0.48	–0.722	–0.285	0.112	0.001	–4.537	–0.513	< 0.001	***
	Two stimuli	–0.464	–0.685	–0.244	0.112	5.033e –5	–3.98	–0.503	< 0.001	***
Three stimuli	Two stimuli	0.034	–0.119	0.188	0.078	–0.001	0.399	0.038	0.995	
Purchase intention										
Five stimuli	Four stimuli	0.701	0.371	1.014	0.163	8.430e –4	4.48	0.485	< 0.001	***
	One stimulus	0.5	0.16	0.856	0.18	–0.003	2.822	0.376	0.039	*
	Three stimuli	0.04	–0.251	0.32	0.147	0.001	0.265	0.03	0.999	
	Two stimuli	–0.05	–0.364	0.238	0.152	9.746e –4	–0.339	–0.043	0.997	
Four stimuli	One stimulus	–0.195	–0.506	0.119	0.159	–0.004	–1.27	–0.136	0.71	
	Three stimuli	–0.657	–0.907	–0.423	0.121	4.438e –4	–5.741	–0.478	< 0.001	***
	Two stimuli	–0.749	–0.995	–0.507	0.125	1.316e –4	–5.986	–0.563	< 0.001	***
One stimulus	Three stimuli	–0.458	–0.754	–0.188	0.143	0.004	–3.223	–0.354	0.011	*
	Two stimuli	–0.555	–0.836	–0.262	0.146	0.004	–3.643	–0.454	0.003	**
Three stimuli	Two stimuli	–0.093	–0.305	0.123	0.107	–3.122e –4	–0.798	–0.073	0.931	

Notes: ** p < 0.01, *** p < 0.001.
† Bias corrected accelerated.
Bootstrapping based on 5,000 successful replicates.
Cohen's d does not correct for multiple comparisons.
The mean Difference estimate is based on the median of the bootstrap distribution.
P-value and confidence intervals adjusted for comparing a family of 5 estimates (confidence intervals corrected using the Tukey method).

Table 1 Bootstrapped post-hoc comparisons – super additivity(continued)

			95% bca† CI						
		Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p tukey*
Second study – missing congruence – t-shirt									
Attitude									
Four stimuli	One stimulus	–0.063	–0.343	0.209	0.142	0.004	–0.449	–0.06	0.97
	Three stimuli	0.113	–0.203	0.427	0.16	0.001	0.765	0.092	0.87
	Two stimuli	0.075	–0.192	0.334	0.132	0.003	0.605	0.063	0.93
One, stimuli	Three stimuli	0.177	–0.087	0.463	0.14	–0.003	1.206	0.168	0.623
	Two stimuli	0.14	–0.071	0.339	0.104	–0.001	1.144	0.129	0.663
Three stimuli	Two stimuli	–0.037	–0.297	0.206	0.128	0.002	–0.331	–0.035	0.987
Purchase intention									
Four stimuli	One stimulus	–0.066	–0.408	0.277	0.175	7.363e –5	–0.384	–0.051	0.981
	Three stimuli	0.122	–0.249	0.484	0.185	0.003	0.687	0.084	0.902
	Two stimuli	0.198	–0.107	0.485	0.15	0.001	1.371	0.144	0.518
One, stimuli	Three stimuli	0.192	–0.163	0.51	0.17	0.003	1.064	0.144	0.712
	Two stimuli	0.263	–0.002	0.512	0.132	0.001	1.821	0.203	0.264
Three stimuli	Two stimuli	0.072	–0.202	0.365	0.145	–0.002	0.528	0.056	0.952

Notes: ** $p < 0.01$, *** $p < 0.001$.
† Bias corrected accelerated.
Bootstrapping based on 5,000 successful replicates.
Cohen's d does not correct for multiple comparisons.
The mean Difference estimate is based on the median of the bootstrap distribution.
P-value and confidence intervals adjusted for comparing a family of 5 estimates (confidence intervals corrected using the Tukey method).

Table 2 Bootstrapped post-hoc comparisons – cross-modal correspondence

		95% bca† CI							
	Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p key*	
First study – complete congruence – soft drinks									
Attitude									
v, a	–0.023	–0.217	0.157	0.096	–0.001	–0.239	–0.019	1	
v, h	–0.653	–0.879	–0.406	0.119	–0.002	–5.392	–0.521	< 0.001	***
v, g	–0.37	–0.562	–0.165	0.101	8.052e –5	–3.814	–0.291	0.013	*
v, o	–0.55	–0.833	–0.283	0.142	0.001	–4.203	–0.437	0.003	**
v, g, o	0.341	0.064	0.619	0.14	–0.001	2.618	0.27	0.386	
v, o, h	–0.633	–0.86	–0.403	0.115	–3.859e –4	–5.037	–0.512	< 0.001	***
v, o, a	–0.447	–0.683	–0.215	0.119	–8.772e –4	–3.699	–0.357	0.02	*
v, a, g	–0.645	–0.857	–0.406	0.114	–0.002	–4.902	–0.522	< 0.001	***
v, a, h	–0.453	–0.693	–0.197	0.127	–0.004	–3.372	–0.361	0.06	
v, g, h	–0.777	–1.029	–0.505	0.134	4.219e –4	–5.897	–0.618	< 0.001	***
v, g, h, o	–0.819	–1.073	–0.552	0.133	8.722e –5	–6.102	–0.656	< 0.001	***
v, a, g, h	–0.934	–1.092	–0.767	0.083	–0.002	–9.703	–0.778	< 0.001	***
v, g, o, a	–0.328	–0.599	–0.036	0.144	1.841e –4	–2.588	–0.254	0.407	
v, o, h, a	–0.892	–1.063	–0.712	0.09	–0.002	–8.894	–0.733	< 0.001	***
v, g, h, o, a	–0.8	–0.939	–0.66	0.071	–0.002	–11.623	–0.62	< 0.001	***
Purchase intention									
v, a	–0.02	–0.229	0.179	0.103	0.002	–0.193	–0.016	1	
v, h	–0.737	–0.961	–0.488	0.12	3.968e –4	–5.548	–0.574	< 0.001	***
v, g	–0.305	–0.515	–0.087	0.109	0.001	–2.885	–0.23	0.223	
v, o	–0.38	–0.696	–0.09	0.155	0.002	–2.661	–0.292	0.357	

Notes: v = vision, g = gustatory, a = acoustic, o = olfactory, h = haptic.
P-value and confidence intervals were adjusted for comparing a family of 9 estimates (confidence intervals corrected using the Tukey method). The mean Difference estimate is based on the median of the bootstrap distribution.
Cohen's d does not correct for multiple comparisons.
Bootstrapping based on 5000 successful replicates.
†Bias corrected accelerated.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2 Bootstrapped post-hoc comparisons – cross-modal correspondence (continued)

		95% bca† CI							
	Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p key*	
First study – complete congruence – soft drinks									
Purchase intention									
v, g, o	0.659	0.334	0.924	0.148	0.003	4.551	0.497	< 0.001	***
v, o, h	–0.52	–0.785	–0.257	0.134	7.695e –4	–3.779	–0.401	0.015	*
v, o, a	–0.481	–0.727	–0.233	0.127	1.200e –4	–3.621	–0.371	0.026	*
v, a, g	–0.643	–0.882	–0.389	0.125	7.640e –4	–4.476	–0.503	< 0.001	***
v, a, h	–0.476	–0.757	–0.21	0.139	0.003	–3.278	–0.371	0.079	
v, g, h	–0.699	–1.013	–0.412	0.153	0.004	–4.879	–0.535	< 0.001	***
v, g, h, o	–0.823	–1.114	–0.512	0.152	7.549e –4	–5.588	–0.628	< 0.001	***
v, a, g, h	–0.936	–1.133	–0.734	0.101	7.462e –4	–8.886	–0.727	< 0.001	***
v, g, o, a	–0.785	–1070	–0.505	0.144	–5.534e –4	–5.697	–0.597	< 0.001	***
v, o, h, a	–0.804	–0.996	–0.592	0.104	–0.001	–7.289	–0.616	< 0.001	***
v, g, h, o, a	–0.81	–0.967	–0.669	0.076	0.002	–10.786	–0.587	< 0.001	***
Second study – partial congruence – chocolate									
Attitude									
v, a	–0.277	–0.514	–0.028	0.125	–0.001	–2.143	–0.285	0.444	
v, o	–0.665	–0.906	–0.428	0.121	–6.869e –4	–5.102	–0.72	< 0.001	***
v, h, a	–0.075	–0.348	0.191	0.138	–0.004	–0.558	–0.068	1	
v, o, g	–0.733	–0.976	–0.494	0.124	–8.121e –4	–5.65	–0.781	< 0.001	***
v, o, h	–0.691	–0.945	–0.457	0.122	–5.014e –4	–5.328	–0.745	< 0.001	***
v, h, a, o	–0.458	–0.714	–0.205	0.128	–0.001	–3.522	–0.471	0.013	*
v, h, a, g	0.485	0.192	0.8	0.157	–0.003	3.822	0.402	0.004	**

Notes: v = vision, g = gustatory, a = acoustic, o = olfactory, h = haptic.
P-value and confidence intervals were adjusted for comparing a family of 9 estimates (confidence intervals corrected using the Tukey method). The mean Difference estimate is based on the median of the bootstrap distribution.
Cohen's d does not correct for multiple comparisons.
Bootstrapping based on 5000 successful replicates.
†Bias corrected accelerated.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2 Bootstrapped post-hoc comparisons – cross-modal correspondence (continued)

		95% bca† CI							
	Mean difference	*Lower*	*Upper*	*SE*	*bias*	*t*	*Cohen's d*	*p key*	
Second study – partial congruence – chocolate									
Attitude									
v, o, g, h, a	–0.62	–0.879	–0.368	0.131	–0.003	–4.744	–0.633	< 0.001	***
Purchase intention									
v, a	–0.367	–0.701	–0.033	0.168	1.957e –4	–2.166	–0.292	0.429	
v, o	–0.75	–1.075	–0.44	0.162	0.004	–4.377	–0.614	< 0.001	***
v, h, a	0.058	–0.305	0.411	0.183	0.002	0.321	0.041	1	
v, o, g	–0.814	–1.134	–0.467	0.173	0.001	–4.736	–0.632	< 0.001	***
v, o, h	–0.634	–0.948	–0.296	0.162	–0.002	–3.678	–0.517	0.008	**
v, h, a, o	–0.337	–0.673	0.015	0.176	1.687e –4	–1.95	–0.258	0.579	
v, h, a, g	0.684	0.321	1.04	0.184	–0.003	4.059	0.488	0.002	**
v, o, g, h, a	–0.501	–0.855	–0.151	0.182	0.006	–2.913	–0.376	0.087	
Second study – missing congruence – t-shirt									
Attitude									
v, a	0.176	–0.05	0.401	0.114	–0.002	1.374	0.171	0.645	
v, o	0.06	–0.205	0.343	0.141	–0.003	0.427	0.06	0.993	
v, o, h	0.176	–0.088	0.464	0.142	–0.002	1.206	0.168	0.748	
v, a, h, o	0.065	–0.218	0.36	0.147	–0.002	0.448	0.06	0.992	
Purchase intention									
v, a	0.293	0.019	0.571	0.139	–0.002	1.931	0.235	0.302	
v, o	0.198	–0.14	0.518	0.17	–3.594e –4	1.122	0.152	0.795	
v, o, h	0.19	–0.165	0.511	0.168	9.972e –4	1.063	0.144	0.825	
v, a, h, o	0.07	–0.269	0.397	0.171	0.002	0.383	0.051	0.995	

Notes: v = vision, g = gustatory, a = acoustic, o = olfactory, h = haptic.
P-value and confidence intervals were adjusted for comparing a family of 9 estimates (confidence intervals corrected using the Tukey method). The mean Difference estimate is based on the median of the bootstrap distribution.
Cohen's d does not correct for multiple comparisons.
Bootstrapping based on 5000 successful replicates.
†Bias corrected accelerated.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The effect of cross-modal correspondence would be present if interactions between different sensory combinations could be observed in terms of attitude and purchase intention. For example, if the sensory combination visual and auditory as well as visual and olfactory showed significant differences to the control group, but the combination of all these three senses together did not. As before, a single-factor ANOVA was performed, followed by post-hoc tests. Bootstrapping was also performed, but this time for all 16 combinations of senses, allowing a total of 120 pairings to be tested for significance for study 1. The group size ranges from $n = 100$ to $n = 200$ per group, except for the groups with one and five senses; for these groups n = 654. The mean value of the attitude is in a positive range ($M = 3.88$, $SD = 1.23$). For purchase intention, as before, the mean value is slightly lower and the standard deviation higher ($M = 3.41$, $SD = 1.35$). No variance homogeneity is present for attitude (F (15, 4,255) = 4.23, $p = < 0.001$) and purchase intention (F (15, 3,240) = 3.24, $p = < 0.001$). The Welch test indicate significant differences between the analysed groups based on attitude (F (15, 810) = 19.71, $p = < 0.001$, est $w^2 = 0.08$) and purchase intention (F (15, 810) = 18.44, $p = < 0.001$, est $w^2 = 0.07$). In the second study, after removing all outliers, the average group sizes for the chocolates were $n = 111$ and the *t-shirt* $n = 140$. The Levene-test indicate a missing variance of homogeneity for attitude ($F_{chocolate}$ (8, 988) = 11.60, $p = < 0.001$, $F_{t\text{-}shirt}$ (4, 694) = 4.24, $p = 0.002$) and for the purchase intention (Fchocolate (8, 988) = 3.98, $p = < 0.001$, $F_{t\text{-}shirt}$ (4, 694) = 2.57, $p = 0.037$). The Results of the Welch test indicate significant differences between the analysed groups for the chocolates but not for the t-shirts based on attitude ($F_{chocolate}$ (8, 411) = 16.03, $p = < 0.001$, est $w^2 = 0.01$, $F_{t\text{-}shirts}$ (4, 307) = 0.80, $p = 0.526$, est w2 = 0.000) and purchase intention ($F_{chocolate}$ (8, 411) = 13.90, $p = < 0.001$, est $w^2 = 0.01$, $F_{t\text{-}shirts}$ (4, 306) = 1.23, $p = 0.275$, est $w^2 = < 0.001$). For reasons of comprehensibility, only those pairs that were compared in the post-hoc test with the control group, the product containing only one sensory stimulus, were presented in Table 2.

The effect of cross-modal correspondence can be observed for the soft drinks using several pairs. Thus, the two pairs of vision and gustatory ($p_{tukey} = 0.013$, -0.37, 95% CI [–0.56, –0.17]) and vision and olfactory ($p_{tukey} = 0.003$, –0.55, 95% CI [–0.83, –0.28]) show a significant difference with moderate effect sizes to the control group on attitude ($DV, _g = –0.29$, $DV, _o = –0.44$). However, the conglomerate where all these three stimuli are included, vision, olfactory and gustatory, does not show significant differences to vision ($p_{tukey} = 0.386$, 0.34, 95% CI [–0.06, –0.62]). The positive mean difference shows that the attitude towards the control group was higher than towards the product with the three senses, which also indicates the cross-modal correspondence effect. These pairs behave differently about the purchase intention. Here, the pairs vision and gustatory ($p_{tukey} = 0.223$, –0.31, 95% CI [–0.52, –0.09]) as well as vision and olfactory ($p_{tukey} = 0.357$, –0.38, 95% CI [–0.70, –0.09]) show no significant differences to vision. However, the conglomerate of these three senses indicates significant differences to vision ($p_{tukey} = < 0.001$, 0.66 ,95% CI [0.33, 0.92]) with a moderate effect size ($d = 0.50$). Also, in this case, the positive mean difference indicates that the purchase intention is higher towards the control group than towards the product with the three senses, representing interactions in terms of the cross-modal correspondence effect. For chocolates, the cross-modal correspondence effect can be observed using the combination vision, hap-tic, acoustic, gustatory for attitude ($p_{tukey\ v,h,a,g} = 0.004$, 0.49, 95% CI [0.19, 0.80]) and purchase intention ($p_{tukey\ v,h,a,g} = 0.002$, 0.68, 95% CI [0.32, 1.04]). This combination has a positive main difference since the subjects evaluated the

chocolate without multisensory stimuli better. All other combinations in which these sensory stimuli were included, the chocolate with multisensory stimuli were evaluated better. None of the sensory combinations for the t-shirts indicate a significant difference from the product without multisensory stimuli so that the effect of cross-modal correspondence cannot be observed here. However, this was to be expected in the context of the third hypothesis since product congruence is mostly absent in the case of t-shirts. The null hypothesis will not be falsified. Accordingly, it can be observed that the cross-modal correspondence effect is no longer present without product congruence. However, these observations also lead to the assumption that the cross-modal correspondence effect is present in the case of existing and partial product congruence in online stores, where only the visual sense is physically perceived.

4 Conclusions

In two web experiments, the effects of super additivity and cross-modal correspondence were examined using three product types, soft drinks, chocolate and t-shirts. Based on the complete research material, the hypothesis that the effect of super additivity is present in an online store where only the visual sense is physically perceived must be rejected. In their study, Lwin et al. concluded that Pavio's dual coding model could explain the effect of super additivity in the context of multisensory marketing (Krishna, 2011; Lwin et al., 2010; Paivio, 1969, 2009). According to this, multi-sensory stimuli are represented in the imaginal coding system. With each sensory sense, further information is encoded, positively affecting consumer behaviour, such as brand attitude or product attitude. With given congruence, it was observed that both in attitude and purchase intention, higher mean values could be observed for products with a higher number of sensory stimuli. However, the differences in the mean values were only significant for products where the difference in the number of sensory stimuli was at least two. With given congruence, the cumulative increase in mean differences seems to indicate that the effect of super additivity is present but too weak and therefore the results are not significant. The results could lead to the assumption that imagination is present and thus the results support the assumptions of Tan et al. (2021), but the effect of multisensory stimuli on consumer behaviour based on imagination is weaker than by physical perception. All sensory stimuli were evaluated with a positive tendency using the SPI (Haase and Wiedmann, 2018) and the mean score of attitude and purchase intention was consistently higher for products with more sensory stimuli than for products with fewer sensory stimuli but not significant. In partial congruency, super additivity did not apply to products with four compared to one stimulus and to products with three compared to two sensory stimuli. No significant results were observed with missing congruence. Similarly, no cumulative increase in mean difference was observed in the case of partial and missing congruence. However, this contradicts the assumptions of the dual coding system. Accordingly, it could be assumed that with decreasing congruence, the products are perceived as an undifferentiated conglomerate and thus the respective sensory stimuli are not encoded independently. Researchers have already discussed the negative influence of a lack of congruences, such as Ruzeviciute et al. (2020) and Krishna (2016) and the results also verify these findings in the context of this experimental study to online stores. According

to the results, it can be cautiously postulated that a lack of congruence seems to influence the recipients' perception.

The cross-modal correspondence effect can be observed using soft drinks in study one and chocolates in study two. Since no sensory combination resulted in significant differences for the t-shirt stimulus material, the effect cannot be observed for products with missing congruence. The results seem to be much more supportive of Krishnas' (2016) and Ruzeviciutes' (2020) statements regarding product congruence as well and represent one of the most important findings. Although the subjects positively evaluated all sensory stimuli of the research material, not all sensory stimuli were typical for the respective products. While carbonated beverages generally produce sounds, it is already more unnatural that chocolate causes particular noise when consumed or has pleasant scents and even more unnatural or not congruent seem t-shirts with a particular noise. In the presence of product congruence, results suggest that the effect of super-additivity did not show significant differences in the experimental design, but the effect of cross-modal correspondence did. Accordingly, the interpretation of the super additivity results is not unrestrictedly applicable to the effect of cross-modal correspondence since this effect was observable with decreasing congruence. This leaves room for several assumptions. One explanation could be that the results are random and cannot be replicated, even if the sample size counteracts this. Another likely reason could be that the dual coding system is unsuitable for describing attitude formation processes when congruence decreases. Studies such as by Sunaga (2018), Tan et al. (2021) and Wang et al. (2020) have already outlined other aspects of multisensory marketing and attitude formation processes. Petty and Brinol (2014) discuss the connection of metacognitive processes in their scientific paper in connection with attitude formation following the Elaboration Likelihood Model. In this context, five different meta-cognitive processes are discussed that could influence attitude formation processes. As a follow-up to this study, it would be essential to under-stand the extent to which one or more of these processes may alter outcomes with soft drinks and t-shirts using the same sensory stimuli to investigate the influence of product congruence further. Thus, this model discusses that attitude can influence whether emotions become salient before or after information processing. Likewise, perceived attempts to be influenced can affect the attitude formation processes. It would be interesting to see to what extent the results of these experiments change according to one of these metacognitive conditions. An experiment like this could reveal the importance of emotions and language-generated attitudes based on multisensory persuasive stimuli. However, also further knowledge concerning product congruence could be gained.

Certain limitations constrain both studies. Most of the subjects were female, part-time students and with a low to moderate gross annual income. The representativeness should be critically questioned in this respect, despite the high number of participants. Furthermore, the research material should be further evaluated using qualitative methods to under-stand the results better. T-shirts, for example, could be associated with few multisensory experiences in online stores because they can easily send back to the retailer after trying on. The relevance of multisensory stimuli could be irrelevant for purchase decisions and thus influence the results obtained. Likewise, the aspect of reactivity should be critically scrutinised. Even though the experimental design was founded to generate a realistic situation as possible using the online store, which was also designed for mobile devices, the subjects knew they were taking part in a study. After all, reactivity can also influence the evaluation of products (Wilson and Schooler, 1991).

References

Ariely, D. and Levav, J. (2000) 'Sequential choice in group settings: taking the road less traveled and less enjoyed', *The Journal of Consumer Research*, Vol. 27, No. 3, pp.279–290.

Buzova, D., Cervera-Taulet, A. and Sanz-Blas, S. (2020) 'Exploring multisensory place experiences through cruise blog analysis', *Psychology & Marketing*, Vol. 37, No. 1, pp.131–140.

Haase, J. and Wiedmann, K. (2018) 'The sensory perception item set (SPI): An exploratory effort to develop a holistic scale for sensory marketing', *Psychology & Marketing*, Vol. 35, No. 10, pp.727–739.

Hwang, A.H., Oh, J. and Scheinbaum, A.C. (2020) 'Interactive music for multisensory e-commerce: The moderating role of online consumer involvement in experiential value, cognitive value and purchase intention', *Psychology & Marketing*, Vol. 37, No. 8, pp.1031–1056.

Javornik, A. (2016) 'It's an illusion, but it looks real!' Consumer affective, cognitive and behavioural responses to augmented reality applications', *Journal of Marketing Management*, Vol. 32, Nos. 9–10, pp.987–1011, https://DOI.org/10.1080/0267257X.2016.1174726

Kampfer, K., Ivens, B. and Brem, A. (2017) 'Multisensory innovation: Haptic input and its role in product design', *IEEE Engineering Management Review*, Vol. 45, No. 4, pp.32–38.

Klemen, J. and Chambers, C.D. (2012) 'Current perspectives and methods in studying neural mechanisms of multisensory interactions', *Neuroscience & Biobehavioral Reviews*, Vol. 36, No. 1, pp.111–133, https://DOI.org/10.1016/j.neubiorev.2011.04.015

Knoll, J. (n.d.) 'Persuasion in sozialen medien: der einfluss nutzergenerierter inhalte auf die rezeption und wirkung von onlinewerbung', in *Persuasion in sozialen Medien*, 2015th ed., Springer Fachmedien Wiesbaden, Deutschland.

Krishna, A. (2011) 'Sensory marketing: research on the sensuality of products', in *Sensory Marketing*, Taylor and Francis, New York.

Krishna, A., Cian, L. and Sokolova, T. (2016) 'The power of sensory marketing in advertising', *Current Opinion in Psychology*, Vol. 10, pp.142–147, https://DOI.org/10.1016/j.copsyc.2016.01.007

Krishna, A. and Elder, R.S. (2021) 'A review of the cognitive and sensory cues impacting taste perceptions and consumption', *Consumer Psychology Review*, Vol. 4, No. 1, pp.121–134.

Li, P., Wu, C. and Spence, C. (2020) 'Multisensory perception and positive emotion: exploratory study on mixed item set for apparel e-customization', *Textile Research Journal*, Vol. 90, Nos. 17–18, pp.2046–2057.

Lowe, M., Ringler, C. and Haws, K. (2018) 'An overture to overeating: the cross-modal effects of acoustic pitch on food preferences and serving behavior', *Appetite*, Vol. 123, pp.128–134, https://DOI.org/10.1016/j.appet.2017.12.013

Lwin, M.O., Morrin, M. and Krishna, A. (2010) 'Exploring the superadditive effects of scent and pictures on verbal recall: An extension of dual coding theory', *Journal of Consumer Psychology*, Vol. 20, No. 3, pp.317–326.

MacInnis, D.J. and Price, L.L. (1987) 'The role of imagery in information processing: review and extensions', *The Journal of Consumer Research*, Vol. 13, No. 4, pp.473–491.

Mishra, A., Shukla, A., Rana, N. P. and Dwivedi, Y. K. (2021) 'From 'touch' to a 'multisensory' experience: the impact of technology interface and product type on consumer responses', *Psychology & Marketing*, Vol. 38, No. 3, pp.385–396.

Morhenn, V.B., Park, J.W., Piper, E. and Zak, P.J. (2008) 'Monetary sacrifice among strangers is mediated by endogenous oxytocin release after physical contact', *Evolution and Human Behavior*, Vol. 29, No. 6, pp.375–383, https://DOI.org/10.1016/j.evolhumbehav.2008.04.004

Paivio, A. (1969) 'Mental imagery in associative learning and memory', *Psychological Review*, Vol. 76, No. 3, pp.241–263.

Paivio, A. (2009) 'Allan paivio's response to delprato's review of mind and its evolution: a dual-coding theoretical approach', *The Psychological Record*, Vol. 59, No. 2, pp.301–311.

Petit, O., Velasco, C. and Spence, C. (2019) 'Digital sensory marketing: integrating new technologies into multisensory online experience', *Journal of Interactive Marketing*, Vol. 45, pp.42–61, https://DOI.org/10.1016/j.intmar.2018.07.004

Ratner, R.K. and Kahn, B.E. (2002) 'The impact of private versus public consumption on variety-seeking behavior', *The Journal of Consumer Research*, Vol. 29, No. 2, pp.246–257.

Rosenbaum, M.S. and Russell-Bennett, R. (2020) 'Editorial: service research in the new (post-COVID) marketplace', *The Journal of Services Marketing*, Vol. 34, No. 5, pp.1–5.

Ruzeviciute, R., Kamleitner, B. and Biswas, D. (2020) 'Designed to s (m) ell: When scented advertising induces proximity and enhances appeal', *Journal of Marketing Research*, Vol. 57, No. 2, pp.315–331.

Simmonds, L., Bogomolova, S., Kennedy, R., Nenycz-Thiel, M. and Bellman, S. (2020) 'A dual-process model of how incorporating audio-visual sensory cues in video advertising promotes active attention', *Psychology & Marketing*, Vol. 37, No. 8, pp.1057–1067.

Spears, N. and Singh, S.N. (2004) 'Measuring attitude toward the brand and purchase intentions', *Journal of Current Issues and Research in Advertising*, Vol. 26, No. 2, pp.53–66.

Spence, C., Puccinelli, N.M., Grewal, D. and Roggeveen, A. L. (2014) 'Store atmospherics: a multisensory perspective: store atmospherics', *Psychology & Marketing*, Vol. 31, No. 7, pp.472–488.

Sunaga, T. (2018) 'How the sound frequency of background music influences consumers' perceptions and decision making', *Psychology & Marketing*, Vol. 35, No. 4, pp.253–267.

Tan, H., Zhou, Y., Tao, Q., Rosen, J. and van Dijken, S. (2021) 'Bioinspired multisensory neural network with crossmodal integration and recognition', *Nature Communications*, Vol. 12, No. 1, pp.1120–1120, https://DOI.org/10.1038/s41467-021-21404-z.

Tukey, J.W. (1977) *Exploratory Data Analysis*, Addison-Wesley, USA.

Velasco, C., Obrist, M., Petit, O. and Spence, C. (2018) 'Multisensory technology for flavor augmentation: a mini-review', *Frontiers in Psychology*, Vol. 9, No. 26, pp.1–6.

Wang, L., Qian, D. and Li, O. (2020) 'The cross-modal interaction between sound frequency and color saturation on consumer's product size perception, preference and purchase', *Psychology & Marketing*, Vol. 37, No. 7, pp.876–899.

Wang, Z., Yu, L., Xu, J., Stein, B.E. and Rowland, B.A. (2020) 'Experience creates the multisensory transform in the superior colliculus', *Frontiers in Integrative Neuroscience*, Vol. 14, p.18, https://DOI.org/10.3389/fnint.2020.00018

Wilson, T. D. and Schooler, J. W. (1991) 'Thinking too much: introspection can reduce the quality of preferences and decisions', *Journal of Personality and Social Psychology*, Vol. 60, No. 2, pp.181–192.

Xu, H. (2018) 'To compete or to take over? An economic analysis of new sellers on e-commerce marketplaces', *Information Systems and E-Business Management*, Vol. 16, No. 4, pp.817–829.