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Co-creating multisensory e-commerce experiences: An exploratory study case on luxury products

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ABSTRACT

This research aims to investigate whether giving customers control over the sensory cues can drive a higher willingness-to-pay (WTP) for luxury products in an online retail context. We assume that luxury brands can increase their consumers' WTP through two pathways: 1) by increasing the number of sensory cues of the online store interface, 2) by providing consumers with control over the given sensory cues. In order to test these assumptions, we conducted an online survey experiment. We found empirical evidence suggesting that giving participants control over the audiovisual cue (i.e., brightness and volume interplay) yields a higher WTP than the visual cue (i.e., brightness) alone. The findings contribute to bridging the gap between the fields of multisensory marketing and customer co-creation, as well as providing managerial insights on implementing the visual and auditory components in the online retail context.

Keywords: Multisensory Marketing; Sensory Stimuli; Multisensory Integration; Co-creation; Sensory Control; Online Retail; Willingness-to-Pay; Luxury Brands

1. INTRODUCTION

In recent years, the marketplace has seen an unprecedented rise in enhanced technology-driven products and experiences. As a consequence, marketing trends and consumer needs are progressively evolving, even disrupted by global events such as the Covid-19 pandemic (Donthu & Gustafsson, 2020). Therefore, marketers have resorted to leveraging new technologies and data-driven models to sharpen the management of their customer experience (Holmlund et al., 2020; Shankar et al., 2020; Zaki & Neely, 2018). However, with an inexorable shift towards digital interactions (Evanschitzky et al., 2020; Velasco & Obrist, 2020) and an ever-growing competition among industry players, having highly customized products is no longer sustainable by itself. With a holistic approach to the customer experience in mind (Bellos & Kavidias, 2020) and a growing emphasis on the customers' sensorial perceptions (Mahr, Stead, & Odekerken-Schröder, 2019), interest in customer co-creation and sensory marketing has grown substantially in both business and academic fields.

The innovative field of experiential marketing has gained interest among marketers as it offers the opportunity to deliver holistic and interactive multisensory experiences (Forbes, 2020; Petit, Velasco, & Spence, 2019; Spence, Puccinelli, Grewal, & Roggeveen, 2014). Philips Hue Entertainment systems exemplify the surge of new experiential technologies, providing its users with the possibility to tailor their lightning system to their daily routines, audio, and video displays, in a way that creates "spatial awareness and immersiveness to a whole new level" (Philips Hue, 2020). In the servicescape, The Singleton's *Sensorium* experience illustrates an instance where technology meets the senses, with a whiskey-tasting experience in a room designed for customers to play with sights, smells, and sounds by the manipulation of various atmospheric cues (Velasco, Jones, King, & Spence, 2013).

Aware of the importance of multisensory marketing, academic researchers have examined the roles and effects of single sensory cues (e.g., visual, auditory, olfactory, gustatory, haptic) on customer behavior (Helmefalk & Hultén, 2017; Spence et al., 2014; Krishna, 2012). However, the current literature lacks insights on the individual and joint effect among two or more sensory cues in the retail and online environments (Helmefalk & Berndt, 2018; Baker, Parasuraman, Grewal, &

Voss, 2002). The evaluation of this contrast is important, as the weight and impact of unimodal cues vary and be subject to additional external stimuli (Arnold, Petrie, Murray, & Johnston, 2019; Driver & Noesselt, 2007). Therefore, the exposure to multiple senses in interplay may result in various additive effects, while others may potentially lead to sensory overload (Stevens, Maclaran, & Brown, 2019; Spence et al., 2014). As the shopping experience is a complex network of interactions, analyzing sensorial elements is necessary to define the conditions that presumably drive consumers' purchase behavior, such as their willingness-to-pay (WTP). Hence, the following research question was developed:

> ***RQ$_1$****: Would multisensory cues in interplay enhance customers' purchase behaviors when compared to single sensory cues?*

Equally important to the elaboration of a multisensory experience is the involvement of the customers in the creation of their experiential values (Diefenbach et al., 2018). Customers' active participation in the shopping process provides them with enhanced feelings of empowerment and the sense of control (Auh, Menguc, Katsikeas, & Sung Jung, 2019). In the digital environment in particular, the growing range of customization choices (e.g., web atmospherics) grants greater autonomy to online buyers in modeling their experience, resulting in positive purchase behaviors (Tu, Neuhofer, Viglia, 2018; Acar & Puntoni, 2016).
In order to merge multisensory experience and customer participation, forward-thinking marketers are designing immersive digital-retail experiences (e.g., Starbucks' immersive experience, 2017). However, customers' increased control and autonomous interactions with technology could lead to a co-destruction of the experiential value and undesirable behaviors (Kirova, 2020). Thus, the sensorial co-creation and control equilibrium has important implications for marketers. However, among the current customer experience strategies, none have explored the impact of letting customers control the nature and exposure of the sensory cues encountered in their shopping experience. As a consequence, it would be of special interest to investigate the following research question:

> ***RQ$_2$****: Would letting customers control their multisensory interactions enhance their purchase behaviors when compared to a no control setting?*

The aim of this research is twofold. First, to extend the research on multisensory marketing by evaluating the individual and joint effects of visual and auditory cues on the customers' WTP. Second, to evaluate the effect of customer control over the visual and auditory cues design on their WTP. The goal is to complement the current theories on sensory marketing and customer co-creation by exploring their integrated impact on online luxury customers' WTP.

2. LITERATURE REVIEW

2.1. Luxury experiences in the digital era

In the luxury industry, companies are actively exploring ways to remain competitive in the delivery of customer experience, notably by leveraging the concepts of co-creation and multisensory marketing. (Holmqvist, Wirtz, & Fritze, 2020; Holmqvist, Visconti, Grönroos, Guais, & Kessous, 2020; Wiedmann, Hennigs, Klarmann, & Behrens, 2013). Hence, for the purpose of this research, we will focus our scope of study on the field of the luxury industry.

Sensory gratification is at the center of the luxury experience (Atwal & Williams, 2017). Indeed, the consumption of luxury goods is likely driven by the hedonic and sensorial meanings it holds for the customers, rather than for the utilitarian attributes it offers (Wirtz, Holmqvist, & Fritze, 2020). Therefore, luxury companies resort to the use of multisensory components throughout the customer journey in order to convey images and information about the luxury dimensions of the brand (Velasco & Spence, 2019; Hultén, 2011). Such an experiential approach is particularly prominent in the retail environment. For instance, Givenchy elaborated a sensory experience combining scent and flavor by creating cocktails reflecting the signature scents of their L'Atelier Collection fragrances (Luxury Launches, 2016). Likewise, Johnnie Walker created a sensory house concept where luxury customers could play with haptic, auditory, and visual installations evoking the taste of the famous whisky (Luxury Society, 2015). The multisensory experience is therefore central and essential in the brand management and elaboration of product experience for luxury firms (Wiedmann, Labenz, Haase, & Hennigs, 2018).

So far, the investment in technologies for multisensory marketing has been highly prevalent in the physical retail context (Grewal, Noble, Roggeveen, & Nordfalt, 2020; Willems, Smolders, Brengman, Luyten, & Schöning, 2017). However, with the increased use of digital channels and the development of multisensory-enabling devices, the elaboration of effective online sensory designs is fundamental to satisfy customers' demands and needs (Petit et al., 2019; Obrist et al., 2016). In particular, luxury marketers have been reluctant to accept the opportunities of the digital revolution, despite having the financial resources to sustain a digital multisensory strategy (Velasco & Spence, 2019). Indeed, such reluctance stemmed from the assumption that the online channels would undermine the perceived exclusivity of the brands and intense sensory experiences (Batat, 2019; Kluge & Fassnacht, 2015; Kapferer & Vincent, 2012). However, with the rapid growth of e-commerce sales and online luxury buyers (McKinsey, 2020; McKinsey 2018) luxury marketers must embrace the digital revolution and its experiential opportunities in order to create desired customer purchase behaviors. Thus, setting the path for experiential e-luxury consumption is crucial for the future of the industry.

In addition to the complexity of conveying virtual sensory experiences, the online environment unveils the challenges of co-creation (Lember & Brandsen, 2019) in particular for luxury consumers (Quach & Thaichon, 2017). Indeed, luxury brands work on the dimensions of dominance, exclusivity, and distance with the customers (Batat, 2019; Turunen, 2017; Kapferer & Bastien, 2009), with evidence suggesting a positive relationship to their WTP (Ward & Dahl, 2014). As virtual media becomes more democratized and accessible, this separative approach which is often marked by the firm's total control over the experiential interactions prompts a delicate question about customer involvement (Cillo et al., 2016; Kapferer & Bastien, 2012). Indeed, as technologies and markets evolve, consumers' behavior shifts from passive guests to co-creators in the unfolding of their experiences (Ramaswamy & Ozcan, 2016). However, such manifestation and its impact on customer purchase behavior (e.g., WTP) remains to be explored further in the case of online luxury multisensory experiences.

The digital world empowers luxury consumers and changes their expectations concerning their e-commerce consumption and interactions with luxury brands (Acar & Puntoni, 2016; Armstrong, Schwarz, & Richards, 2015). In response, some luxury companies start leveraging new technologies (e.g., 3D, Virtual Reality, Augmented Reality, AI chatbots) to answer emerging online consumption demands and to inspire experiential momentum. Indeed, the use of these technologies is still immature in providing powerful, co-created brand experiences (Batat, 2019).

Therefore, a digital sensory blueprint balancing the power of luxury brands with the autonomy of consumers remains to be elaborated. This could potentially be achieved by exploring an online design that provides customer control over a limited number of sensorial cues and investigates the subsequent outcome in their purchase attitudes. In the next section, we discuss how the sensory mechanisms affect customers' behaviors, with a particular focus on WTP.

2.2. Multisensory integration: Are the effects of multisensory stimuli always larger than those of unisensory stimuli?

2.2.1. The concept of multisensory integration and WTP

In our everyday lives, we are continuously surrounded by multiple sensory cues: we hear, smell, touch, see, taste, and are much more grounded in our environments (Velasco & Obrist, 2020). In contrast to the common assumption that each sense is presented as a separate component, our different senses are simultaneously receiving correlated information from the same objects or occurrences. Rather than processing the information from all senses independently, our brain integrates them to reduce sensory uncertainty (Alais & Burr, 2004) and generate multimodal interpretations (Driver & Spence, 2000; Cornelio, Velasco & Obrist, 2021). Consequently, we are able to interpret the convergent inputs from our environment and respond to them (Feldman, Dunham, Cassidy, Wallace, & Woynaroski, 2018). For instance, in a noisy environment, an individual usually combines the visual signals (e.g., facial motion) with the auditory cues (e.g., speed and tone of speech) to enhance his or her comprehension (Ross, Saint-Amour, Leavitt, Javitt, & Foxe, 2009).

The concept of multisensory integration provides a good elaboration of how multisensory cues are perceived. Multisensory integration (MI) is defined as the process by which the brain merges the convergent information from multisensory modalities (e.g., vision and audition) as a response to environmental stimuli (Miller, Stein & Rowland, 2017). In this complex process, the senses are connected by reciprocal relations (Mari & Poggesi, 2013), meaning that the presence of one sense can influence the information received from another sense in interchangeable ways (Spence, 2011; Bertelson, 1999; McGurk & MacDonald, 1976). Indeed, a review from Koelewijn, Bronkhorst, and Theeuwes (2010) on the multiple stages of MI demonstrates that MI activates different regions of the brain at different information-processing stages.

Hence, MI can evoke sensory interactions with attention on different levels. In this case, the interpretation of the effects of MI is greater than the mere accumulation of its unisensory components (Schreuder, Van Erp, Toet, & Kallen, 2016). The seminal principles of MI posit that an individual's neural responses towards multimodal interactions can be additive, super-additive, and sub-additive (Drugowitsch, DeAngelis, Angelaki, & Pouget, 2014). We denote the response to auditory stimuli as A, to visual as V, and to audiovisual interplay as AV. If $A + V = AV$, the response is additive; if $A + V > AV$, the response is super-additive; and if $A + V < AV$, the response is sub-additive. Moreover, the principles also demonstrate that multisensory stimuli tend to merge more effectively when the strongest unisensory response is relatively weak (Dahl, Logothetis, & Kayser, 2009).

Applied to the retailing context, the concept of MI can guide marketers in the management of their customer experience. Indeed, the shopping experience should be considered as a dynamic process, as consumers are mobilizing all senses concurrently to evaluate the external environment (Lemon & Verhoef, 2016). Analogous to the principles of MI, this process cannot be completely comprehended on a sense-by-sense basis, but rather as a whole. The multisensory customer experience can be used by marketers as an alternative way to engage with customers by influencing their perceptions, judgments, and behaviors through the stimulation of their senses (Krishna, 2012). Hitherto, a considerable body of empirical research has confirmed consumers' positive behavioral response to the presence of multisensory cues in retailing settings, such as enhancements in customer satisfaction (Kumar, 2014), and individual spending (Lwin, Morrin, Chong, & Goh, 2016).

However, considering that different effects may occur under the MI process, it is essential for retailers to select the right combination of sensory cues to optimize its positive impact on consumers' behavior (Schreuder et al., 2016). The super-additive effect usually occurs when multisensory cues are congruent. Yet, this effect can be eroded by a cue incongruency, leading to harming both an individual's effective appraisals and purchase behaviors (Schreuder et al., 2016). Therefore, consumers generally find the environment more pleasant and engaging when surrounded by congruent sensory cues relative to non-congruent ones (Spence et al., 2014). The cue congruency hereby is defined as the fit between two sensory stimuli regarding one specific characteristic (e.g., loud music and intense scent) (Krishna, Elder, & Caldara, 2010). Previous research on the effects between the multisensory cues suggests that introducing congruent cues can accelerate the reaction time to received information, enhance the quality of information processing, and evoke positive product evaluation of an individual (Imschloss & Kuehnl, 2017; Krishna et al., 2010; Spangenberg et al., 2005; Mattila & Wirtz, 2001). Hence, it is of great interest to investigate the extent to which unimodal cues (i.e., visual, auditory cues) vs. congruent multimodal congruent cues (i.e., audiovisual cues) impact consumers' behavior.

Finally, prior studies have indicated that introducing multisensory cues in the shopping experience can evoke positive customer behavioral responses (Gilovich & Kumar, 2015; van Boven & Gilovich, 2003). Notably, it had been argued that sensory stimuli can potentially increase an individual's WTP by creating hedonic values for the shopping experience (Gilovich & Gallo, 2019; Yoganathan, Osburg, & Akhtar, 2019; Cornil & Chandon, 2016). WTP refers to the maximum amount that a buyer is willing to pay for a given good or service (Franke & Schreier, 2008). Additionally, previous literature posits a strong positive correlation between customer satisfaction and WTP (Homburg, Koschate, & Hoyer, 2005). Expressed differently, the more satisfied a customer is, the more they are willing to pay a higher price for a product. Following this logic, we assume that introducing multisensory cues – as opposed to single sensory cues – can increase consumers' hedonic experience and subsequently yield a positive WTP. In this study, we will empirically test how the visual and auditory cues influence consumers' WTP, as well as the MI mechanism that occurs during the audiovisual interplay.

2.2.2. Impact of visual and auditory cues on WTP

Among all senses, visual cues have long been portrayed as the most common way to convey a message as our eyes are constantly bombarded with stimuli throughout the day (Helmefalk & Berndt, 2018). Through the stimulation of customers' vision, marketers may seek to raise awareness in some cases, and in others, they may seek to subconsciously influence consumer emotions and purchase behaviors. As a result, visual cues are frequently taken into account when constructing and designing retail store environments (Turley & Milliman, 2000).

Accordingly, visual cues predominantly appealed to researchers' interests, due to their direct positive impact on consumers' behavior (Spence et al., 2014). For instance, one study by Policastro, Harris, and Chapman (2019) finds that a sensory-rich description of a small serving of chocolate cake can lead to the same WTP as compared to what an individual would like to pay for a larger one. The experiment also finds that participants shift their attention from the serving size (reduced) to the sensory qualities (added) when evaluating their WTP. In this process, the presence of the visual cue (i.e., descriptive text) accounts for the deficiency in the serving size, resulting in the same level of satisfaction for a smaller size compared to a larger one. The same mechanism is found in another study by Cornil and Chandon (2016), which reveals that the pleasure brought by sensory imagery (i.e., vividly imagining the taste, smell, and texture of selected objects) can conceal the reduced serving size of hedonic foods.

As visual stimulations are prominent in influencing consumers' behaviors, marketers and researchers have explored ways to manipulate this sense through its dimensions. A notable visual dimension perceived by the human eyes is brightness, defined as the absolute intensity of the light reflected in an individual's eyes by a subject (Glichrist, 2007). It has been regarded as an important visual cue in the retail setting, as it can influence consumers' purchase behavior and their decision-making process (Custers, De Kort, Ijsselsteijn, & De Kruiff, 2010; Park & Farr, 2007). In addition, the proper range of brightness can lead to positive emotions and increased sales (Hultén, 2012). In the digital environment, companies are exploring the introduction of the so-called "Dark Mode" in their virtual interfaces. The study from Eisfeld & Kristallovich (2020) indicates that consumers tend to use Dark Mode for a more satisfying user experience as it brings a higher level of visual comfort. Additionally, it has been argued that darker visuals can lead consumers to make more shopping choices with hedonic values rather than utilitarian values by increasing their feeling of anonymity (Huang, Dong, & Labroo, 2018; Ayshford, 2018). Yet, to our knowledge, no studies have investigated in depth the relationship between the use of lightning of a screen device and the related WTP in an online shopping experience. In this research, we will examine this subject on the prediction that the darker light of a screen will positively contribute to the customer's experience and subsequent purchase behavior, namely WTP.

Another dominantly studied sense in the consumer behavior field is the audition. The sense of audition has become a common factor to consider in the construction and design of the retail environment to facilitate consumer emotions and purchase behaviors (Michel, Baumann, & Gayer, 2017). Therefore, placing auditory cues in a retail context is increasingly used by marketers to enhance consumers' positive emotions, as it helps create a pleasant or exciting atmosphere (Hultén, 2015). Moreover, in addition to having heuristic characteristics, auditory cues can also potentially influence the complex decision-making process of consumers, such that they are willing to pay more (Hwang, Oh, & Scheinbaum, 2020). For example, one study from Sunaga (2018) investigated the impact of music frequency on WTP. The study finds that playing background music at a low frequency can increase consumers' WTP for luxury brands. Another study from Carvalho et al. (2015) also reveals that introducing contextual music can increase an individual's WTP significantly by creating subjective values of a tasting experience.

Additionally, volume, or the intensity of the music, is one dimension of the audition that has been commonly studied by marketers and researchers. Evidence suggests that the music volume in retail stores positively affects customer satisfaction with the shopping experience (Cachero-Martínez & Vázquez-Casielles, 2017) and purchase behaviors (Andersson, Kristensson, Wästlund, & Gustafsson, 2012). In addition, Sullivan (2002) found that low-volume music can make consumers stay at the venue longer. However, the current body of literature lacks the understanding of how volume affects shoppers' WTP in an online retail environment. Therefore, this research will contribute to academic research on volume by investigating its connection to WTP.

2.2.3. Multisensensory investigation of audiovisual cues on WTP

Regarding the interaction effect between auditory and visual cues on consumers' purchase behavior, previous studies have shown some positive outcomes. For instance, one recent study from Wang and Spence (2015) investigated how both auditory (e.g., music) and visual (e.g., lighting) attributes influence people's ratings on the liking and fruitiness of a range of vodkas. Their findings show a strong positive relationship between the congruent sensory conditions (e.g., raspberry vodka in red lighting and sweet music) and the liking ratings of the product. Also, Yoganathan et al. (2019) also found that placing both ethically congruent visual and auditory cues can increase consumers' WTP for ethical products.

Existing shreds of evidence also posit that the learned associations between certain auditory and visual cues can spur audiovisual integration (Chen & Spence, 2010; Fiebelkorn, Foxe, & Molholm, 2010). Yet, those studies are limited to the scale of food industries, beverage services, and packaging (Naspetti, Alberti, Mozzon, Zingaretti, & Zanoli, 2019). In a digital retailing landscape, to our knowledge, no prior studies have investigated the relationship between the effects of the audiovisual cue integration and consumers' WTP. Additionally, some studies have argued that, in certain contexts, sensory overload may occur (Doucé & Adams, 2020; Velasco & Spence, 2019). For instance, compared to two congruent sensory cues, adding one more congruent sensory stimulus might result in customers' dissatisfaction pf the shopping experience (Homburg, Imschloss, & Kühnl, 2012). This outcome is usually associated with the level of stimulation (Spence et al., 2014; Homburg et al., 2012). That is to say, the impact of a pair of high arousal music and high arousal light on WTP can be weaker than that of the low arousal congruent pair due to overstimulation (Doucé et al., 2020).

Hence, it is of great interest to further investigate whether adding more sensory cues (i.e., audiovisual cues) as compared to the unimodal (i.e., auditory or visual cue) can lead to an accumulative positive impact on WTP, and how much the accumulative effects are comparable to those of the unisensory cues. Based on the foregoing discussion, we assume that increasing the number of sensory cues with congruence can enhance the shopping experience, which results in a higher WTP. Namely, we assume that an individual's WTP will be higher when experiencing audiovisual stimuli than auditory or visual stimuli alone. We also expect the highest WTP when the visual and auditory cues are congruent.

2.3. Customer control: Should marketers let customers take control over their multisensory experience?

The extant literature commonly heightens the importance and superiority of customer centricity as a substantial and necessary drive for any company's success (Palmatier & Sridar, 2017; Shah, Rust, Parasuraman, Staelin, & Day, 2006). Customer centricity is a process of dual value creation (Hemel & Rademakers, 2016). It aligns the business's strategy and offerings from the perspective of the customers, in order to leverage in return a sustainable and differentiated competitive advantage (Fader, 2020; Shah et al., 2006). Customer-centric firms yield higher performance as they account for the crucial aspect of customer heterogeneity (Palmatier & Crecelius, 2019). Indeed, substantial variations in the customers' preferences, needs, and desires inevitably differentiate them in their subsequent consumption behaviors (Palmatier & Sridar, 2017). However, as each customer is fundamentally singular, optimally matching their needs and expectations to the right product or service presents a significant challenge for companies (Shah et al., 2006). To adroitly approach the multiplicity of needs and preferences, marketers can leverage the principles of co-creation and customization.

Customization can be defined as the extent to which the customer participates in the process of creating, designing, or choosing a product or service that can satisfy their consumption habits and preferences (Teng, 2010). Customization is valuable for marketers due to its positive impact on the customers' WTP (Fink & Geldman, 2017; Merle, Chandon, & Roux 2008) and WTP a premium (Lei, Wang, Peng, & Guo, 2020). Furthermore, customization can satisfy the customers' need for innovativeness and expression of one's identity (Tian, Bearden, & Hunter, 2001), as they become co-creators of the production process, thereby enhancing their shopping experience (Stevens, Esmark, Noble & Lee, 2017). Indeed, a further examination of the literature has revealed the fundamental role of the customers as main actors and creators in the value-generating process of their experience (Lemon & Verhoef, 2016; Chandler & Lusch, 2015). Additionally, scholars believe that the consumers' involvement in the co-production of the service experience can increase their perceived control (Bendapudi & Leone, 2003). Hence, some researchers formulated that higher levels of customization can yield greater customer control (Stevens et al., 2017; Ding & Keh, 2016).

Recently, the control factor has raised interest and notably in the emerging trend of customer empowerment defined as “the process by which consumers are given control of variables that are conventionally pre-determined by marketers” (Joosten, Bloemer, & Hillebrand, 2016, p.219; see also Cova & Place, 2006). In this way, co-production is used as a form of customer empowerment (Bacile, Ye, & Swilley, 2014). Indeed, the literature suggests that customers enjoy increased control over the service experience (Cheung & To, 2011; Bendapudi & Leone, 2003) and benefit from the consumption exchange when feeling empowered (Wathieu et al., 2002). This feeling of empowerment perceived by customers often derives from the sense of ownership and responsibility of having control over their actions in their environments, which ultimately leads to higher WTP (Sarstedt & Neubert, 2017; Norton et al., 2012). Therefore, in the light of the literature, we expect that customers who have attributed some level of control through a customization opportunity will most likely be more willing to pay for the service experience.

Heretofore, studies about customization have mainly focused on fulfilling customers’ expectations and needs by modifying the attributes of the products or services. However, it has been argued that value is not only found in the possession of a product, but also in the physical and mental usage of the experiences associated with it (Grönroos & Ravald, 2011). Therefore, it is of interest to explore within a co-created design applied to the shopping experience holistically. For this purpose, marketers can leverage both the multisensory and customization tool in the value creation process with the customer. Indeed, while multisensory experience can enhance consumers’ shopping experience, the feeling of empowerment can facilitate the value-generating process. Online retailers have been testing different multisensory technologies to allow consumers to customize their shopping experiences (Petit et al., 2019), with an emphasis on creating emotional and behavioral connections by stimulating customers’ senses (Shabgou & Daryani, 2014; Keller, 2013).

Indeed, the development of digital multisensory experiences constitutes a new path for marketers, as consumers are increasingly experiencing the world through virtual interfaces (Petit, Cheok, Spence, Velasco, & Karunanayaka, 2015). Hence, it is of interest to explore the digital sensory blueprints that best optimize purchase behaviors (i.e., WTP) and the scope of the customers’ involvement in the process.

To the best of our knowledge, if the current body of research has revealed the benefits of embedding sensory inputs in the consumers' online activities (Eklund & Helmefalk, 2018; Hwang et al., 2020; Ho, Jones, King, Murray, & Spence, 2013), no research has yet empirically explored the concept of control over unisensory or multisensory cues on digital shopping experiences and their effects on WTP.
As a result of our investigation of the current body of multisensory and customer co-creation literature discussed above, we created the following hypotheses:

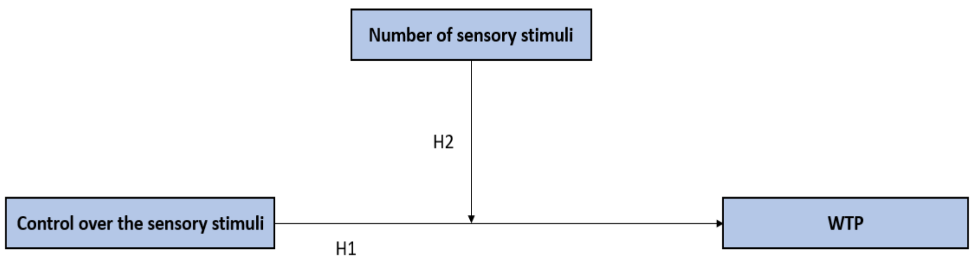
***H_1**: Allowing customers to control sensory stimuli leads to a higher WTP than in a non-control setting for an online shopping experience.*

***H_2**: The exposure to audiovisual stimuli leads to a higher WTP than the exposure to auditory and visual stimuli alone for an online shopping experience.*

In the end, the conceptual model has been generated (Figure 1). This model depicts the relationships that we are expecting to be observed among the independent variables (*control over the sensory stimuli* and *number of sensory stimuli*) and the dependent variable (*WTP*) during the experiment. Hereby, the *number of sensory stimuli* indicates the relative comparison between the multisensory stimuli (audiovisual stimuli) vs. unisensory (visual stimuli or auditory stimuli).

Figure 1

Conceptual Framework



To avoid the word redundancy, we denote the visual, auditory, and audiovisual stimuli respectively as V, A, and AV stimuli. Also, we refer the variable of the *number of the sensory stimuli* as *sensory stimuli* in the following sessions, indicating the relative comparison between the multisensory stimuli (AV stimuli) vs. unisensory stimuli (V or A stimuli). Likewise, the variable *control over the sensory stimuli* will be referred to as *sensory control*.

3. METHODS

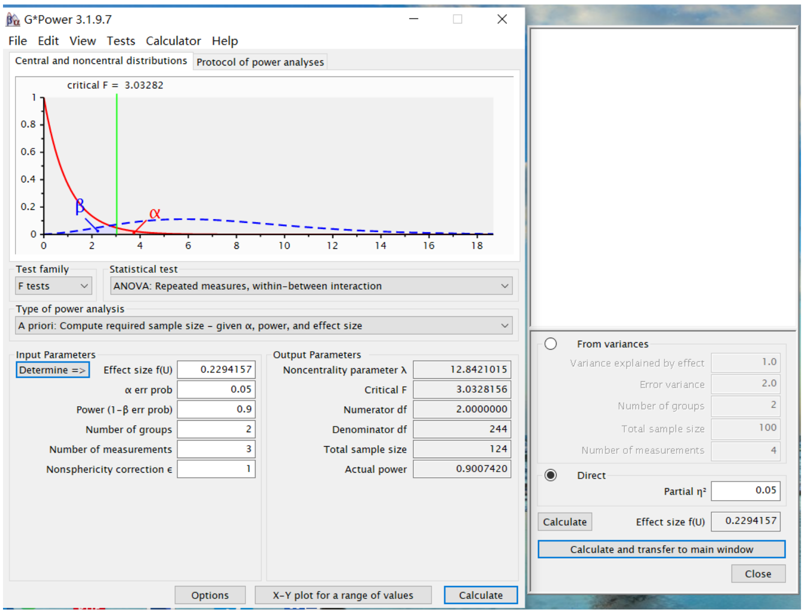
3.1. Participants

The experiment was conducted online with a random sample of 128 participants, recruited through online media platforms. Participants' age was limited to a minimum of 18 to 75 years old. As the experiment involved the imaginary purchase of a luxury product, we ensured that the participants earned a real stream of income in order to relate to the shopping scenario. In addition, in order to exclude the influence of cross-country differences in luxury consumption behavior (Siahtiri & Lea, 2019; Yang, Ma, Arnold, & Nuttavuthisit, 2018), we exclusively recruited participants in Norway (i.e., Norwegian citizens and Norway residents).

The minimum sample size for this experiment was determined through the use of the statistical software G*Power (Faul et al., 2007). To avoid Type I and Type II errors, we set .90 as our power value (Heinrich-Heine-Universität Düsseldorf, 2017), a partial Eta square set to .05 (Cohen 1998), and confidence interval of 95% with a p-value α = .05. The results of the analysis (see Figure 2) indicated a recommended sample size of 124 participants, a statistical requirement we met with the collection of 128 effective responses.

Figure 2

*G*Power Analysis Display*



3.2. Apparatus and materials

Regarding the sensory variables, the study focused on the relative comparison of three sensory conditions (i.e., A vs. V, A vs. AV, and V vs. AV). For this purpose, a total of 6 videos were created, imitating a virtual shopping experience from the customer's perspective. The videos were created using the video-editing software Final Cut Pro through which we adjusted the lightning levels (i.e., bright vs. dark) of the mobile screen display and incorporated the sound levels (i.e., low vs. high) of the brand's music.

As baselines, we set a no-music condition for the auditory cue and a brightness level of 700 nits for the visual cue. Any condition contrasting the baselines was recognized as the experimental stimulus (i.e., light > 700 nits, light < 700 nits, and music). Thus, we elaborated a two-level choice for each stimulus on the basis of one of their dimensions, namely the brightness level for the visual cue and the volume level for the auditory cue (see Table 1).

Table 1

Stimuli Level Design

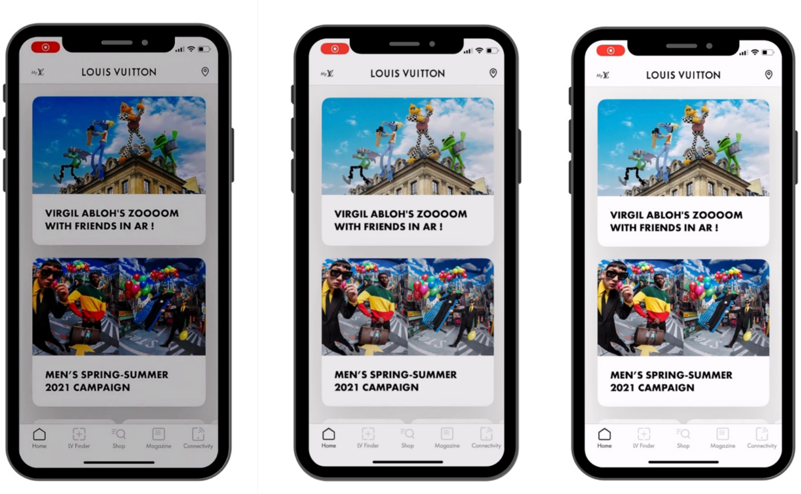
Stimulus	Level	Value	Baseline
V	Bright illumination	800.00 nits	700.00 nits
	Dark illumination	285.00 nits	
A	High volume	63.50 dB	0.00 dB
	Low volume	49.50 dB	

In regard to the A stimuli, we selected a non-lyrical instrumental symphony, as such type of music is commonly used in luxury stores (Zeng & Wang, 2016). The lack of objective guidelines for the sound level led us to restrict the volume's interval based on health institutions' recommendations (CDC, 2019). To ensure the safety of our participants while maintaining a realistic experiment design, we established the thresholds of *low volume* being at a whisper level and *high volume* at a conversation level. The sound levels were measured through the sound level app NIOSH SLM (Crossley, Biggs, Brown, & Singh, 2021; Murphy & King, 2016), before being edited into the videos on Final Cut Pro.

For the brightness level, the contrast level was manipulated using the Color Inspector tool on Final Cut Pro. With no pre-existing scientific guidance on the brightness scale to use for such an experiment, we adjusted it to an extent where significant visual contrast was observed as seen in Figure 3. The brightness levels were then recorded using a luminance meter.

Figure 3

Brightness Levels of the Visual Stimuli



Note. The brightness levels presented are 285 nits, 700 nits, and 800 nits (from left to right).

3.3. Design and procedure

3.3.1. Experimental procedure

We conducted an experiment following a 2 (sensory control: sensory control vs. no sensory control) x 3 (sensory stimuli: A stimuli vs. V stimuli vs. AV stimuli) mixed factorial design. The first factor followed a between-participants design, while the second factor followed a within-participants design. Indeed, we found that while the between-subject design prevents carryover learning effects and reduces the duration of the experiment, the within-subject design provides control over the differences in the individuals' evaluation behavior (Charness, Gneezy, & Khun, 2012; Oberfeld, Hecht, Allendorf, & Wickelmaier, 2009).

To test the sensory conditions under this experimental design, we created a series of videos imitating a virtual shopping experience from the customer's perspective. The videos take the participants on a shopping journey through their mobile phones, starting from the opening of the brand's app up to the selection of a product to purchase. Our goal was to create a realistic shopping experience in order to increase the likelihood of collecting insights into real consumer behavior, as well as to enhance the reliability of our research (Morales, Amir, & Lee, 2017). Furthermore, while each video formally represented one sensory condition, they all displayed the shopping scenario with an equal time length of 42 seconds, in order to preserve the internal validity of the experiment (Edmonds & Kennedy, 2016).

Thereafter, we inserted them into an online survey we elaborated on Qualtrics where we additionally randomized them in order to prevent any order effect bias (Thau, Mikkelsen, Hjortskov, & Pedersen, 2021). The survey was then randomly assigned to two groups of participants of equal sizes. One group, the *sensory control group*, was attributed control over the levels of the three different sensory stimuli conditions they were exposed to in the virtual shopping experience. The second group, the *no sensory control group*, had no sensory control and rather was exposed to three pre-selected sensory stimuli conditions in the same virtual shopping experience.

As shown in Table 2, each group would experience three repeated measures of sensory stimulation, with the purpose that each participant would be formally exposed to the A, V, and AV conditions.

Table 2

Experimental Conditions of the Study

Condition	Group	Auditory and visual settings	
1a	No sensory control	Music	Baseline light
2a	No sensory control	No music	Darker light
3a	No sensory control	Music	Darker light
1b	Sensory control	Choice: low & high-volume music	Baseline light
2b	Sensory control	No music	Choice: darker & brighter light
3b	Sensory control	Choice: low & high-volume music	Choice: darker & brighter light

Finally, all participants were asked a series of 9 questions assessing their profile, shopping evaluation, and purchase behavior, with the inclusion of an attention-check question to prevent data quality issues (Abbey & Meloy, 2017). Each question was constructed around the legal and ethical guidelines of the Norwegian Centre for Research Data, in order to protect the personal data of the participants and ensure the GDPR compliance of our research.

3.3.2. Survey design

The Qualtrics survey was presented in English to ensure its accessibility to both the internationals and Norwegian participants residing in Norway. It was elaborated on 3 main sections (see Appendix A). The first section consisted of questions gathering demographic information (i.e., gender, age, income, and education level). At the beginning of the second section, participants were asked to listen to an audio record consisting of a series of 3 digits. They had to transcribe them to ensure that their sound system was on and in good condition for the rest of the experiment.

Thereafter, participants entered the second section containing the pre-recorded videos representing the sensorial conditions studied (i.e., A stimuli vs. V stimuli vs. AV stimuli). They were instructed to imagine engaging in a virtual shopping experience through an app on their mobile phone. While the *no sensory control group* was immediately directed to watch pre-selected videos, the *sensory control group* was first presented with illustrations of the videos they would be exposed to in the experiment. It provided them with guidance on the sensory conditions options they could interact with (i.e., dark vs light screen; high vs. low volume; light screen vs. high or low volume; dark screen vs. high or low volume). All participants were then asked to watch the entire 3 video clips presented and to fill in their WTP for the given product after experiencing each sensory condition.

The third section of the survey consisted of several questions in the form of open questions, single choice questions, and 7-point Likert scale questions, which are known as a common method to measure behavior and opinions (Sekaran & Bougie, 2016). Among these questions, we inserted an additional attention check question to identify the participants who arbitrarily selected the answers. Also, in order to ensure that the virtual shopping was experienced through the participants' mobile phones and eliminate the confounding effect of distinct on-screen layouts, we asked the respondents to report the devices on which they completed the survey (i.e., mobile phones, digital tablets, and computers). Lastly, we asked participants their thoughts on the experiment to exclude bias results and collect qualitative comments and insights.

3.3.3. Study variables

In this study, we intended to test whether the number of sensory stimuli and control over these sensory stimuli would positively influence the WTP among the study participants. Hence, we set our dependent variable as *WTP*. The *sensory stimuli* and *sensory control* constituted our independent variables (see Table 3).

Table 3

Summary of Studied Variables

Variables	Type	Measurement
WTP	Dependent variable	Scale
Sensory control	Independent variable	Nominal
Sensory stimuli	Independent variable	Category
Gender	Control variable	Nominal
Age	Control variable	Scale
Education level	Control variable	Ordinary
Income level	Control variable	Ordinary
Desire to control the brightness	Control variable	Interval
Desire to control the volume	Control variable	Interval
Brand familiarity	Control variable	Interval
Purchase frequency of luxury products	Control variable	Scale
Annual luxury spending	Control variable	Scale
Realistic level of shopping experience	Control variable	Interval

In relation to the control variables, a *realistic level of shopping experience* variable, was created to ensure the participants adhered to a sufficient degree of realism under this experiment. Moreover, the demographic characteristics of the participants were gathered under *gender*, *age*, and *education level* variables. In addition, as the purchase of luxury goods shows to be influenced by the *income level* of an individual (Aliyev & Wagner, 2018; Yang et al., 2018), we integrated this variable into the control variables. Based on the statistic shown in SSB (2020) regarding the Norwegian salary levels, we re-coded the *income level* variable on three levels as low-income level (36,250 NOK or less), medium-income level (26,251 to 54,570 NOK), and high-income level (54,571 NOK or more).

Moreover, we investigated the concept of brand familiarity as another control variable regulating the participants' product knowledge, perceived risks, and purchase intentions (Neponucemo, Laroche, & Richard, 2014; Park & Stoel, 2005). As the luxury brand chosen is a well-known brand, we considered the confounding effect of brand familiarity on the WTP. Brand familiarity was then categorized under 3 brand control variables, namely *brand familiarity*, *purchase frequency of luxury products*, and *annual luxury spending*. In this way, we aimed to ensure that participants' WTP was limited to their interactions with the sensory cues rather than influenced by their attachment to the brand and propensity to buy its products.

Lastly, some researchers have highlighted how complex, conditional, and contextual the notions of desire, opportunity, and capacity of control are. Joosten, Bloemer & Hillebrand (2016) have argued in their study that "more control is not always better: it is better when it is desired, but worse when it is not desired" (p.233). In this way, in order to assess the participants' degree in the desire of having control, we included the *desire to control the brightness* and *desire to control the volume* as our last control variables.

4. RESULTS

We have obtained a total of 221 responses, meaning that participants have completed the survey. To prepare the data, we excluded 93 data entries based on several criteria. First, the data that did not pass the attention check was rejected. Participants were asked to select "somewhat agree", therefore any other responses revealed an inattentive participant and constituted an invalid data point. Secondly, the data with the value of 0 NOK as WTP was removed as it indicated that the participant did not want to purchase the given product at all. Thirdly, as the experiment recreated a virtual shopping experience specifically on a mobile app, we excluded the data of participants who reported taking the survey on any other electronic device than their mobile phone. Lastly, we excluded the data with an unreasonable timespan of survey completion. To avoid discarding cases arbitrarily, we conducted an exploratory data analysis with stem-and-leaf plots for timespan data. This analysis displayed the data distribution and showed potential outliers

(NCSS, n.d.). Unusual values that did not follow the time pattern of the whole data set were thereafter removed (see Appendix B1).

A two-way 2 (sensory control: give sensory control vs. no sensory control) x 3 (sensory stimuli: A stimuli vs. V stimuli vs. AV stimuli) mixed design ANOVA was conducted, with *sensory control* and *sensory stimuli* as repeated measures and *WTP* as a dependent variable. For significant interaction effect, the simple main effects were interpreted separately for between and within subject variables. For this purpose, a general linear model (GLM) was used to generate multivariate analysis to measure simple main effects for the between-subjects variable. Moreover, a repeated-measures one-way ANOVA was computed to generate simple main effects for the within-subjects variable. Whenever sphericity was violated, Greenhouse-Geisser corrected values were presented. A Mann-Whitney U test and a Spearman rank-order correlation were run separately for each of the control variables. Thereafter, significant variables were added as covariates to re-run the two-way ANOVA.

4.1. Descriptive statistics

After the data preparation, the final sample consisted of a total of 128 participants (66 males and 62 females), aged between 20 to 67 years old (M = 30.52, SD = 9.14), as seen in Appendix B2. Among those participants, 56.3% of them had a low-level income, 25% had a medium-level income, while 9.2% had a high-income level (with 9.4% who selected "prefer not to say"). In addition, 71.9% of the participants stated purchasing luxury products on average at least once a year (purchase frequency of luxury products, M = 3.03, SD = 5.45), and the annual average spending on luxury goods ranged from 500 NOK to 125,000 NOK (M = 5460.83, SD = 13430.11).

Moreover, we computed descriptive statistics to see differences in the demographic characteristics between the *sensory control group* and the *no sensory control group*. We also used the frequency function in SPSS to compute the valid percentage of the variables of *income level* and *education level* to see their distributions in each group. Regarding the *education level*, there were 1 participant in the *no sensory control group* and 2 participants in the *sensory control group* who selected "prefer to not say". Similarly, there were 5 participants in the *no sensory control group* and 7 participants in the *sensory control group* who selected "prefer not to say" in terms of *income level*.

As Table 4 and Table 5 indicate, participants in the *no sensory control group* had on average a relatively higher brand familiarity of the given product, higher desire to control two sensory stimuli (i.e., brightness & volume), higher frequency of purchasing luxury products, and much higher annual spending on luxury products. Additionally, 57.1% of the participants had a high income in the *no sensory control group*, compared to only 14% in the *sensory control group*. Also, the *education level* distribution in the two groups was somewhat similar, except for 3.1% of the participants who reported having a Ph.D. degree in the *sensory control group,* while none of them possessed such a degree in the *no sensory control group*.

Table 4

Descriptive Statistics

Variables	Sensory control Mean	Non-sensory control Mean
Brand familiarity	5.56	**5.98**
Desire to control the brightness	4.66	**4.69**
Desire to control the volume	5.34	**5.45**
Purchase frequency of luxury products	2.91	**3.16**
Realistic level of shopping experience	5.54	5.42
Annual luxury spending	4150.32	**6750.86**
Age	28.80	**32.23**
Gender*	0.61	0.42

Note. The value of the *no sensory control group* that is larger than the *sensory control group* is marked in bold. Gender* is coded using a nominal scale, where male = 0, female = 1, as no participant selected the option of binary/third gender.

Table 5

Frequency Exploration

Variable	Level	Sensory control Valid Percent	Non-sensory control Valid Percent
	Low	50.88	72.88
Income*	Medium	35.09	20.34
	High	14.04	6.78

Education**	Elementary School	0.00	0.00
	Middle School	3.13	1.59
	High School	4.69	**7.94**
	Bachelor	60.94	57.14
	Master	28.13	**33.33**
	PhD	3.13	1.59

Note. The value of the *no sensory control group* that is larger than the *sensory control group* is marked in bold.

Income* (individual income per month) is coded using an ordinal scale, where 36,250 NOK or less = 1 (low), 36,251 to 54,570 NOK = 2 (medium), and 54,571 NOK or more = 3 (high).

Education** is coded using an ordinal scale, where elementary school degree = 1, middle school degree = 2, high school degree = 3, bachelor's degree = 4, master's degree = 5, and PhD degree = 6.

4.2. Main effects and interaction effects

The result indicated that the assumption of sphericity had been violated (χ^2 (2) = 18.84, $p < .05$), see Appendix B3. Therefore, the value for the main effect of *sensory stimuli*, as well as its interaction effect with *sensory control*, needs to be corrected for violations of sphericity. In this case, we used Greenhouse-Heisser corrected values instead. As Table 6 shows, the main effect of the *sensory stimuli* is not significant on *WTP*, for the sensory manipulation of the V stimuli, A stimuli, and AV stimuli. In addition, there was no significant main effect of *sensory control* on *WTP*. In contrast, a significant interaction effect was found between the *sensory stimuli* and *sensory control* (Table 6).

Table 6

Interaction and Main Effects in Experiment

Variables	F-value (2,252)	p-value	Partial eta squared
Sensory control	.08	.78	< .01
Sensory stimuli	.09	.89	< .01
Interaction	**5.30**	**.01**	**.04**

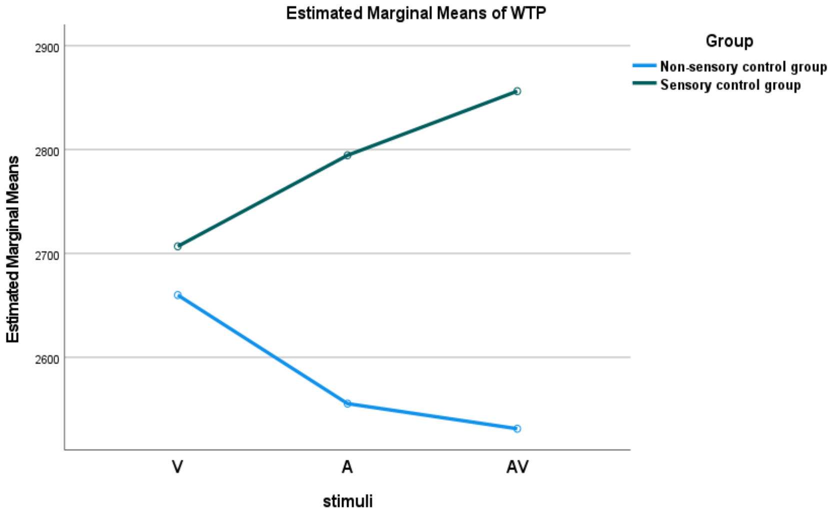
Note. Significant values are highlighted in bold.

Those statistics indicate that there was no significant difference in the WTP among the three different sensory manipulations, neither for the *sensory control group* nor for the *no sensory control group*. In this case, our H_1 and H_2 were rejected.

Yet, we observed that the *sensory stimuli* variable had a different effect on *WTP* for the participants between the *sensory control* and *no sensory control group*. Notably, *Figure 4* shows that the participants from the *sensory control group* had a higher WTP than the *no sensory control group* in general.

Figure 4

Interaction Effect of Sensory Control and Sensory Stimuli on WTP



Additionally, the performance of *sensory stimuli* yielded a different pattern (see Table 7). In the *sensory control group*, the WTP of AV stimuli was the largest, and that of AV stimuli was at the medium level, while that of V stimuli was the smallest. On the contrary, in the *no sensory control group*, the WTP of V stimuli stayed at the highest value, that of A stimuli maintained at the medium level, while that of AV stimuli was the smallest.

Table 7

Marginal Means from Interaction Effects

	V_A = sensory stimuli			
V_B = sensory control	V stimuli	A stimuli	AV stimuli	Marginal means
Sensory control	2706.88	2794.53	2856.25	M_B = 2785.89
No sensory control	2659.97	2555.47	2531.30	M_B = 2582.25
Marginal means	M_A = 2683.43	M_A = 2675.00	M_A = 2693.78	M_T = 2684.07

4.3. Simple main effects of sensory stimuli

Since there was a significant statistical evidence showing that there is a strong interaction effect between the *sensory control* variable and the *sensory stimuli* variable, we ran a one-way repeated measures ANOVA to generate simple main effects for the within-subjective variable at each sensory control level. Significant simple main effects were analyzed through pairwise comparisons and were Bonferroni-corrected (see Table 8 & 9).

Table 8

Simple Main Effects for Sensory Control

Group	F-value (1,126)	p-value	Partial eta squared
No sensory control	1.79	.18	.03
Sensory control	**4.62**	**.02**	**.07**

Note. Significant values are highlighted in bold.

The results showed that for the *no sensory control group*, there was no significant difference in the WTP among the three sensory stimuli conditions. As for the *sensory control group*, it showed strong significance for the difference between the WTP from V stimuli and AV stimuli, while the difference between the other two pairs was not significant (Table 8 & 9). It appeared that participants with sensory control over the AV stimuli tend to have a higher WTP than those with sensory control over the A stimuli (Table 9).

Table 9

Pairwise Comparisons

Group	Sensory stimuli		Mean difference	Std. Error	p-value
No sensory control	V	A	104.50	73.71	.48
		AV	128.67	85.37	.41
	A	V	-104.50	73.71	.48
		AV	24.17	54.04	1.00
	AV	A	-128.67	85.37	.41
		V	-24.17	54.04	1.00
Sensory control	**V**	A	-87.66	57.26	.392
		AV	**-149.38**	**46.31**	**< .01**

A	V	87.66	57.26	.392
	AV	-61.72	43.61	.49
AV	**V**	**149.38**	**46.31**	**< .01**
	A	61.72	43.61	.47

Note. Significant values are highlighted in bold.

4.4. Simple main effects of the sensory control variable

To test the simple effects of the *sensory control* variable on each sensory stimulus condition, we ran the multivariate analysis with the least significant difference test (LSD) to compare the difference. The results shown in Table 10 indicate that there was a statistically significant difference in WTP between the *sensory control group* and the *no sensory control group* under the AV stimuli condition. However, it also showed that when participants experienced a V and AV stimulation, the difference between these two groups was not significant (Table 10).

Table 10

Simple Main Effect for Sensory Stimuli

Sensory stimuli	F-value (1,126)	p-value	Partial Eta Squared
V	.09	.76	< .01
A	2.69	.11	.02
AV	**4.63**	**.04**	**.04**

Note. Significant values are highlighted in bold.

4.5. Control variables

A Mann-Whitney U test was run separately for each of the 10 control variables (i.e., *age*, *gender*, *income level*, *education level*, *brand familiarity*, *luxury purchase frequency*, *annual luxury spending*, *desire to control the brightness*, *desire to control the volume*, *realistic level of the virtual shopping experience*) to see if they were significantly different between the *sensory control group* and *no sensory control group*. The result indicated that *age*, *gender*, and *income level* were significantly different between these two groups (see Appendix B4).

To further analyze their effects, these control variables were added into a two-way ANOVA as covariates. The results indicated that there was no significant interaction effect between these three control variables and the *sensory stimuli* variable. Additionally, results showed that they did not have any significant influence on the interaction effect between the *sensory control* and sensory stimuli variables (F(2,222) = 3.37, p = .04, $\eta_p{}^2$=.03), see Appendix B6.

We also conducted a Spearman rank-order correlation to assess the relationship between each control variable and the WTP under the three sensory stimuli conditions, for the two sensory control levels separately. The results revealed that there was a strong positive correlation between the *age* and the WTP of participants under both the A stimuli (R_S(62) = .26, p = .04) and AV stimuli (R_S(62) = .32, p = .01, $\eta_p{}^2$) in the *no sensory control group* (see Appendix B5). This result indicates that in the *no sensory control group*, the older the participants were, the higher their WTP was under the A and AV stimuli. Also, in the *sensory control group*, there was a significant and negative correlation between the *education level* and WTP of participants under the V stimuli (R_S(62) = .26, p = .04), meaning that the higher the education level the participants were, the lower their WTP was under the V stimuli. Other control variables did not show any statistical significance regarding their correlation to each sensory stimulus.

Therefore, we re-ran the two-way ANOVA by including the *education level* as a covariate in addition to three other control variables (i.e., *age*, *gender*, and *income level*). The results indicated that adding these control variables as covariates did not influence the significant interaction effect between the *sensory control* and *sensory stimuli* variables (F(2,222) = 3.21, p < .05, $\eta_p{}^2$= .03), see Appendix B7.

5. DISCUSSION

Our research had a dual purpose. First, it aimed at comparing the effects of providing a multisensory vs. unisensory stimulation in the online shopping experience. We assumed that the synergic effect of the auditory and visual sensory cues was higher in driving consumers' WTP than the effect of these cues experienced individually. Secondly, it aimed at showing the implications of providing customer control over the given sensory stimuli during their online multisensory shopping experience. We assumed that the effect of having control over the auditory and visual sensory cues was superior in driving WTP than having no control over them in an online context. Hence, we conducted an online survey mimicking the shopping experience of a luxury product. Thereafter, we analyzed the sensory and control variables in relation to the participants' WTP.

Surprisingly, we did not find evidence supporting the effect of multisensory cues drives a higher WTP as compared to that of unisensory cues. Hence, H_1 was rejected. In investigating the outcomes of our study, we found potential explanations justifying these contesting results. First and foremost, we argue that the virtual environment is subject to peripheral factors influencing the empirical evaluation of the multimodal sensory condition on purchase behavior (Peytchev & Hill, 2010). Indeed, although online atmospheric cues show to positively affect shoppers' behavior (Eroglu, Machleit, & Davis, 2003), the immediate environment of the online buyers may influence their shopping experience in the virtual world (Sautter, Hyman, Lukosius, 2004). If the participants were in a stimuli-active environment at the time of the experiment, they could have been exposed to additional atmospheric cues. This situation could result in excessive sensory stimulation and impaired perception of the single senses, and ultimately affect the outcomes in WTP and sensory evaluation.

Furthermore, the maturation of the virtual world turned critical and active thinking into the resources steering the purchase decision-making of the online buyers (Hwang et al., 2020). In addition, research shows that some consumers favor utilitarian value in their online shopping (Overby & Lee, 2008). In this case, the sensory stimulation could be assessed by the cognitive information it provides about an item rather than by the experiential arousal it procures (Velasco et al., 2013; Macpherson, 2010). While utilitarian value might not be the main factor driving a buyer's willingness to purchase a product, it could alleviate the effects of hedonic and sensorial attributes in the context of online luxury consumption. In this way, in the process of purchasing a Louis Vuitton perfume, adding more senses (i.e., the pairing of audiovisual stimuli) is not valuable for the participants' product evaluation and intention-to-buy, and therefore, no significant differences in WTP among three sensory manipulation conditions were found.

Additionally, the utility of a product can be negative despite the positive attitude a multisensory experience can evoke, especially for luxury buyers who hold a greater perceived risk while purchasing luxury goods online (Park, Lenon, & Stoel, 2005). Moreover, in the experiment, the type of product and the inability of the participants to interact with it might have influenced their perceptions of the sensory experience. Indeed, Jain (2021) reported that deprivation of haptic interactions discourages consumers to purchase luxury goods online, often linked to a higher WTP (Bushong, King, Camerer, & Angel, 2010). Likewise, the product being a perfume could have directly influenced the WTP of the participants, as one of them anecdotally mentioned that his low WTP correlated to his inability to sense it, rather than the sensorial architecture of the simulations. Had the product been different and not involving the intrinsic yet not experienceable sense of smell in a digital context, perhaps then would the results be different. This situation however highlighted the current state of sensory marketing is quite dependent on the development of the sensory-enabling technologies (Petit et al., 2018) and further need for congruency between senses and product characteristics.

Another core aspect of our study relates to the sensory control. We did not find evidence supporting that allowing customers to control their sensory stimuli encounters lead to higher WTP. Hence, H_2 was rejected. Although perceived control contributes to enhancing the experience and customer satisfaction (Van Dolen et al., 2007), the customization of the interface might not be enough in reducing the risk and uncertainty associated with the online purchase. The level of the customized control in this study could be another reason for such a result. One study by Liang and Liu (2019) shows that extending the choice selections of the interface, such as color, can increase consumers' acceptance of the digital shopping experience. They also illustrated the importance of the value co-creation process with the consumers, that retailers should improve their app interface constantly to attract and retain consumers. Therefore, since we only set two levels (high volume vs. low volume; brighter light vs. darker light) with relative contrast to generate sensory stimulation, the options provided, as well as the choice variety might not be desirable enough for consumers to feel satisfied (Kuo & Cranage, 2012).

Finally, an interesting finding occurred when we studied the interaction effect between the sensory stimuli and sensory control variables. The result indicates that when participants have control, the number and nature of the senses impact significantly the WTP of participants. Specifically, we found that while the A stimuli was not statistically impactful, the opposite was true for the V stimuli and the AV stimuli. Additionally, the WTP was higher when the participants had control over AV stimuli than the V stimuli only. From this observation, we can infer two main assumptions.

First, V cues are dominant in the e-retail environment and contribute to the pleasure and immersion in the online experience (Rose, Clark, Samouel, & Hair, 2012). As customers can control and tailor dynamically the visual features of the mobile interface to their preferences, the effects of this sense could therefore increase. It is noteworthy to mention that the participants favored a bright-intensity screen, as only a few participants opted for the darker brightness level. This information implies that the brighter setting was more aesthetically pleasing, or that the contrast elaborated was not optimal or adequate to the situation (i.e., as brightness is usually regulated through the customer's device, marketers usually focus on influencing other visual dimensions such as quality or color).

Secondly, the control of the audiovisual inputs in an interplay could positively complexify the sensorial experience of the participants. Indeed, as the cognitive and hedonic needs are increasingly fulfilled, the generated enjoyment and satisfaction of the online shopping experience lessen the perceived risks of the buyers (Ha & Lennon, 2011; Forsythe, Liu, Shannon & Gardner, 2006) and improve their WTP. In this way, by involving the customer as the main actor in his purchase of luxury goods, luxury e-commerce marketers have the possibility to enhance customer engagement (Leckie, Nyadzayo, & Johnson, 2016), and to facilitate better purchase decision-makings, specifically when the customer is attributed control over the AV stimuli.

6. MANAGERIAL IMPLICATIONS

This research has implications for marketers interested in improving the purchase behaviors of their customers through the means of a co-created online sensorial experience.

Our findings suggest that when participants have control over the sensory cues, their WTP was higher under the AV stimuli condition than under the V stimuli condition. Therefore, we recommend marketers to adapt the online servicescape encounter by engaging their customers to control certain aspects of their e-sensory shopping experience. For brands interested in developing their co-creation value through their mobile app touchpoint, we propose to prioritize giving customers control over the visual and audiovisual cues of their app display. Specifically, the platform should be presented in its conventional design with a complementary button giving access to the brand's experiential world. In their "*My immersive capsule*" space where the sensorial experience occurs, customers would have the choice between manipulating visual cues (i.e., brightness feature) or audiovisual cues (i.e., brightness and sound feature) at either a high or low-intensity level. At any moment, the customer should be able to change the customization of the app's visual and sound display, as well as disengage in the sensorial design while remaining on the platform. In this way, customers can be autonomous in serving their needs of experiential value according to their dynamic preferences.

Furthermore, within the scope of our research, we restricted the control of the multisensory environment to two stimuli (i.e., visual and auditory), presented under one of their dimensions (i.e., screen brightness and music volume) at two contrasting levels (i.e., bright and dark, high and low). Perhaps, marketers could expand the control and choice variety by integrating other audiovisual dimensions. For instance, they could provide control over a greater range of music genres or add depth to the visual interface by the complementary use of 3D and AR views, which might result in enhancing the customers' experiential journey (Liang & Liu, 2019). However, we do not advise marketers to overcharge their multisensory design but rather to pilot, test, and iterate diverse sensory control strategies. From their learnings, they can derive a congruent multisensory control design suited to the involvement level and sensory preferences of their customers.

Lastly, our findings show that a co-created sensory experience through a mobile device can positively drive customers' spending decisions. However, with the customer journey becoming increasingly complex and nonlinear (Grewal & Roggeveen, 2020), we believe through digital means like mobile apps, companies can engage with consumers through different touch points in the customer journey. This helps enhance the experiential values during the customer experience. For instance, luxury fashion brand Chanel has an app exclusively for hedonic purposes (e.g., watching fashion show videos, reading fashion news, and event notification) with no possibility of purchase (Vogue Business, 2021), Burberry is using its customers' mobile device as a means to purchase products virtually while at an experiential event with AR interactions to strengthen immersiveness (Burberry, 2021). In this way, we suggest marketers explore at which stage on the consumer journey they should leverage their branded app and grant sensory control, in order to keep seamless sensory experience across channels and ensure positive purchase behaviors.

7. LIMITATIONS AND FURTHER RESEARCH

The first limitation involves the sensory stimuli level selection. Lacking theoretical guidance on the selection regarding the brightness (brighter light vs. darker light vs. baseline) and volume (high volume vs. low volume vs. no music), our criteria is merely based on “being able to see the relative contrast”. Consequently, the extent to which our findings can be generalized to a wide range of brightness & volume settings needs to be established.

The results from our experiment showed that the participants experiencing the virtual shopping condition with the AV stimuli have a higher WTP compared to those under the condition with V stimuli alone. However, as noted throughout, introducing more sensory stimuli or stronger sensory stimulation does not necessarily always lead to a stronger influence on the shopping behavior as one may be in danger of creating sensory overload (Spence, et al., 2014; Richard & Chebat, 2016). The study in this paper only compared the effect of the two sensory cues with the single sensory cue, and the customization of the sensory control limits at giving merely two options of each sensory cue level. Hence, further research is needed to explore choice variety as a moderator for the effect of the sensory control on WTP: whether giving customers more options can lead to a more desirable shopping experience, and therefore enhancing the influence of sensory control on higher?

Yet, due to the individual difference in multisensory perception, it is also suggested that the level of sensory stimulation should be adapted to the “sensotype” of the individual (Petit et al.,2019). For instance, one may be more desirable in online shopping with a rich sensory-stimulated environment while the other may feel sensory overload with the same level of stimulation. Moreover, as aforementioned, consumers’ risk perception (i.e., the related when doing online shopping, such as private information disclosure) of an online shopping experience can lead to negative purchase behavior (Li et al., 2020; Wu, & Gaytán, 2013). Therefore, it might be interesting for future research to explore how to categorize the individual differences to create a personalized shopping experience that is the most economical and desirable for the brands, as personalization can be very expensive.

Additionally, previous studies demonstrated that the effect of the sensory cues tends to be stronger in certain product categories that are essentially more experiential (Spence, et al., 2014). It would be therefore also interesting to replicate our study in the future by adding the product category as a moderator to evaluate how different types of the products can result in various outcomes of the purchase behavior, for instance, categorized by the product characteristics (i.e. hedonic product vs. utilitarian product) (Wakefield, Robin, & Whitten, 2006), or by the experiential value perspective of products (i.e. extrinsic-active value vs. extrinsic-reactive value vs. intrinsic-active value vs. intrinsic-reactive value products) (Dacko, 2017).

The second limitation connects to the number of the senses studied. Since customers are perceiving the environment by using all senses collectively (Chen & Spence, 2017), further research might extend the sensory cues to more than the brightness (visual) and volume (auditory) and explore the sensory integration mechanism in the interaction among more than two sensory cues. The atmospheric factors such as product display in the app with the visual and auditory cue could also provide a deeper insight into how consumers evaluate the shopping environment holistically (Spence, et al., 2014).

The third limitation attaches to the manipulation of the brightness. The study contributes by finding significant evidence that participants empowered with sensory control tend to be willing to pay more when experiencing AV stimuli than V stimuli. However, the perceived display brightness is rather subjective as it differs following the surrounding luminance (Zhou et al., 2020; Lim, Li, & Tu, 2019). It was found by Lim et al. (2019) that the peripheral vision luminance has an inverse impact on the perceived display brightness, meaning that the display brightness is perceived to be lower when the level of surrounding brightness is higher. Since we conducted our experiment by an online survey, it was rather difficult to control the surrounding environment of the participants. In this case, the perceived visual stimulation by the same level of the display brightness varies in our study.

It could be therefore of interest to conduct the study to explore the joint effect between the surrounding luminance and display brightness on consumers' WTP and figure the optimal combinations. As nowadays there is an increasing tendency that many consumers look for information through the smartphone instead of interacting with the retail salesperson (Harris Interactive, 2013; Shankar, Inman, Mantrala, Kelly, & Rizley, 2011), this can contribute to the brands that want to start or expand their businesses in the omnichannel environment and embed the technology to the offline stores to create a seamless customer experience. For instance, providing a device in-store to assist customers in product selection, which enables the tailoring of a message (Shankar et al., 2011).

What is noteworthy is that several participants left the notes with their overall feelings of the virtual shopping experience in addition to their answers for the purpose of the study. Some of them showed their liking to the video with the background (i.e., feeling more enjoyable and pleasant compared to no music condition) though they give the same WTP as the other two manipulation conditions. Therefore, though we did not find significant main effects of both sensory stimuli and sensory control variables in WTP, it is still worthwhile exploring the internal mechanism between these two variables with other factors than behavioral response, such as psychological feelings and emotional experience (Dong & Liu, 2017).

8. CONCLUSION

The effect of the single cue on consumers' purchase behavior has been extensively studied. Yet, the current literature lacks an in-depth understanding of the effects and mechanisms behind the multisensory cues in interplay. Meanwhile, the field of customer co-creation has been increasingly attracting marketers' attention due to the hedonic benefits created during the co-production process. Therefore, this study aims to answer the research questions of whether increasing the number of sensory cues and giving consumers control over sensory cues can lead to a higher WTP in an online context. To answer these questions, this study conducted a 2x3 factorial design experiment to test our hypotheses.

Findings highlight the importance of placing the visual cue (i.e., brightness) when giving the participants sensory control. The study demonstrates that when giving participants sensory control over the audiovisual stimuli (i.e., brightness and volume interplay), participants presented a higher WTP compared to the visual stimuli (i.e., brightness) alone. To our knowledge, this study is one of the first to explore the effect of the interplay between sensory control and multisensory cues on consumers' purchase behavior. Our study contributes to initiating a step toward the integration of the customer co-creation and multisensory marketing fields. We encourage future studies to expand the understanding of multisensory integration (i.e., interaction mechanism for more than two sensory cues) and the optimal level of the sensory control on consumers' purchase behavior.

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APPENDIX A

Appendix A1. Introduction of the survey

HANDELSHØYSKOLEN

Welcome to our study!

In this study, led by Jingjing Feng and Cindy Kong, second-year master students at BI Norwegian Business School, we are interested in understanding how people evaluate their willingness to pay to luxury products through the phone app under certain conditions. This study is designed for our master thesis paper. If you decide to take part, we will play different videos that mimic the online shopping experience and ask you to respond to a few questions about them. The procedure will take approximately 10 minutes.

In order to participate in the study, you need to be able to play audio clearly from your device. There are no right or wrong responses, please respond according to what feels right to you. We hope you enjoy it. Your participation is very important to us.

***Since this study is designed for studying about people's shopping behavior through a phone app, to ensure the validity of the experiment, we strongly recommend you to fill in this survey through your mobile phone.**

If you have any questions about the research study, please contact the MSc.students responsible for this reserach, Ms.Jingjing Feng (jingjing.feng@student.bi.no) or Ms.Cindy Kong (cindy.kong@student.bi.no).

→

STATEMENT OF CONSENT

1. I have read and understand the information about this experiment and understand its general purpose.

2. I understand that I can withdraw from the questionnaire at ant time, for any reason, and without penalty, and that doing so will destroy my data. (NB - Please be aware that data colleted is anonymous - if you change your mind after completing the experiment, we will be unable to trace your specific data to remove it).

3. I understand how to raise a concern or make a complaint (detailed above).

4. I understand that my responses are anonymous.

5. I agree to take part in this online experiment.

Do you agree to take part?

- Yes, I agree to take apart
- No, I disagree to take apart

→

Appendix A2. Demographic questions of the survey

Question 1. How old are you as per taking this survey? Please type your age in the box below. *whole numbers only

→

Question 2. Please specify your gender.

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

→

Question 3. Please indicate your monthly income <u>before tax</u> as per taking this survey.

- ○ 0 - 36,250 NOK
- ○ 36,251 - 54,570 NOK
- ○ 54,571 NOK or more
- ○ Prefer not to say

→

Question 4. What is the highest level of education you have completed as per taking this survey?

- ○ Elementary School
- ○ Middle School
- ○ High School
- ○ Bachelor
- ○ Masters
- ○ PhD
- ○ Prefer not to say

→

Appendix A3. Virtual mobile app shopping manipulation of the survey

Appendix A3.1. Introduction & audio test

The Virtual App Shopping Experience

Now, imagine that you would like to buy a bottle of perfume from Louis Vuitton through their brand app. You will be expected to watch 3 videos in total, under different conditions in the following pages. These videos are designed to mime the shopping experience through the phone app mentioned above. Please carefully watch the video while imaging that you are the one who is doing the online shopping.

After each video, you will be asked to type your willingness to pay for the perfume shown in the given video.

→

Audio Test

Before start watching the video, we need to make sure that you have the sound on and the audio system in your device works. Please play the audio clip below and type the number that you hear in this clip.

***If you cannot hear anything from this clip, please check your audio system and adjust it til it works.**

→

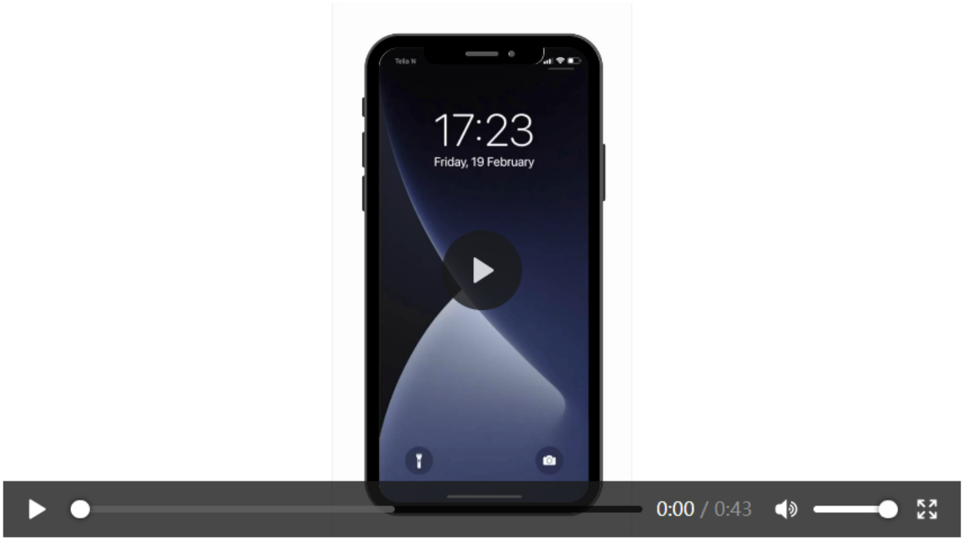
Appendix A3.2. Sensory manipulation for non-control group

Appendix A3.2.1. Auditory manipulation for non-control group

Please imagine that you are shopping through the Louis Vuitton app in your phone and you would like to purchase the bottle of perfume shown in the video. Please also note that you are not allowed to adjust the volume of the background music when shopping.

Please play the video when you feel you are ready for virtual shopping.

*** To optimize the watching experience, please adjust your phone volume to the maximum level before you start the shopping experience. You may also have to select the full-screen mode before you start watching.**



How much are you willing to pay for the product presented in the video? Please specify your answer in the table below.
***whole numbers only (in NOK).**

NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

→

Appendix A3.2.2. Visual manipulation

Imagine that you are shopping through the Louis Vuitton app in your phone and you would like to purchase the bottle of perfume shown in the video.

Please play the video when you feel ready for your virtual shopping.

*** To optimize the watching experience, you may also have to select the full-screen mode before you start watching.**

→

How much are you willing to pay for the product presented in the video? Please specify your answer in the table below.
***whole numbers only (in NOK).**

NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

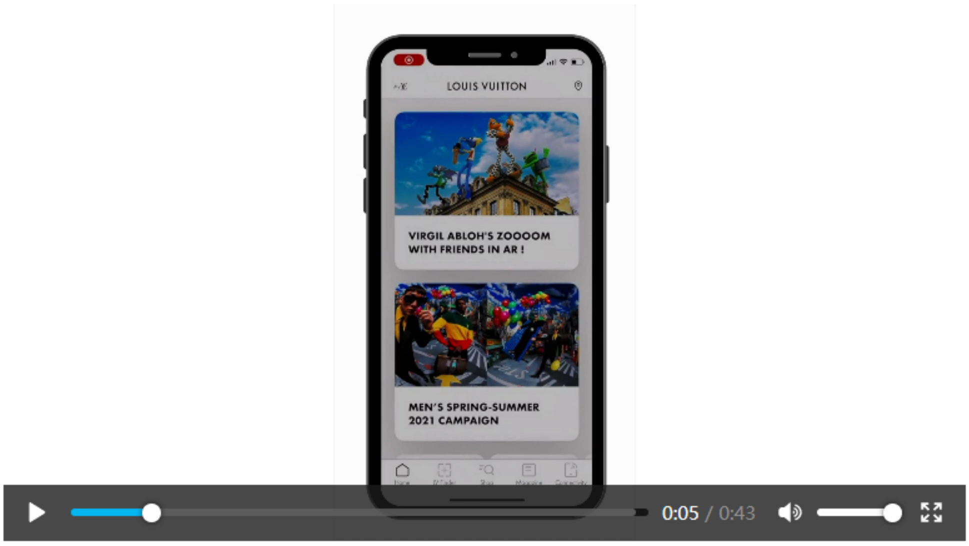
→

Appendix A3.2.3. Audiovisual manipulation

Please imagine that you are shopping through the Louis Vuitton app in your phone and you would like to purchase the bottle of perfume shown in the video. Please also note that you are not allowed to adjust the volume of the background music when shopping.

Please play the video when you feel you are ready for virtual shopping.

*** To optimize the watching experience, please adjust your phone volume to the maximum level before you start the shopping experience. You may also have to select the full-screen mode before you start watching.**



→

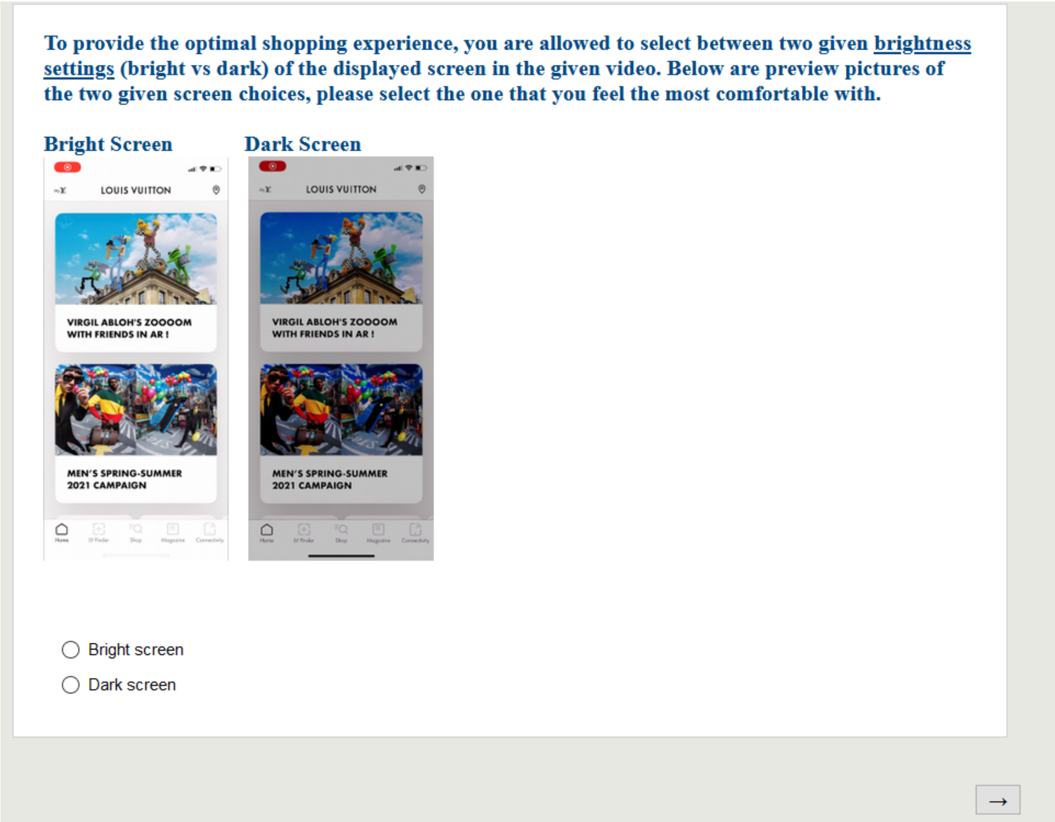
How much are you willing to pay for the product presented in the video? Please specify your answer in the table below.
***whole numbers only (in NOK).**

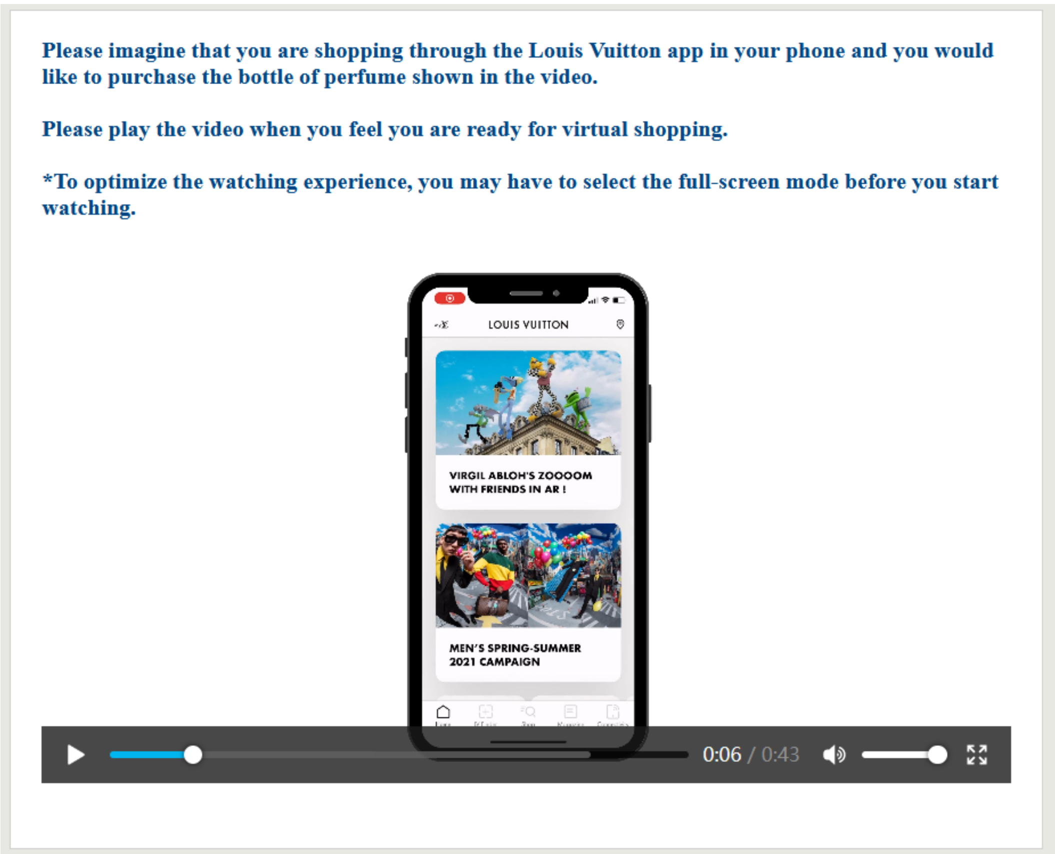
NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

→

Appendix A3.3. Sensory manipulation for the control group

Appendix A3.3.1. Visual manipulation- bright screen selected





How much are you willing to pay for the product presented in the video? Please specify your answer in the below table.
***whole numbers only (in NOK).**

NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

→

Appendix A3.3.2. Auditory manipulation

To provide the optimal shopping experience, you are allowed to selected the <u>volume level</u> (high-volume vs low-volume) between two given settings in the given video. Please select the one that you feel the most comfortable with.

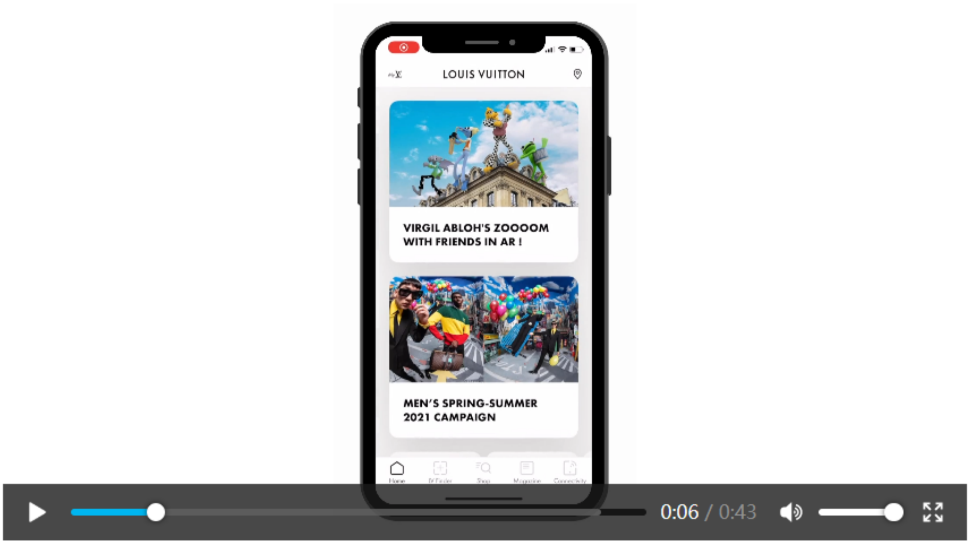
- ◯ High-volume
- ◯ Low-volume

→

Please imagine that you are shopping through the Louis Vuitton app in your phone, and you would like to purchase a bottle of perfume shown in the video.

Please play the video when you feel you are ready for virtual shopping.

*** To optimize the watching experience, please adjust your phone volume to the <u>maximum level</u> before you start the shopping experience. You may also have to select the full-screen mode before you start watching.**



How much are you willing to pay for the product presented in the video? Please specify your answer in the table below.
***whole numbers only (in NOK).**

NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

→

Appendix A3.3.3. Audiovisual manipulation - bright screen & high volume selected

To provide the optimal shopping experience, you are allowed to select <u>both</u> between two given <u>brightness settings</u> (bright vs dark) of the displayed screen and between two given <u>volume level</u> (high-volume vs low-volume) in the given video.

Below are preview pictures of the two given screen choices, please select the one brightness setting and one volume level each that you feel the most comfortable with.

NB - you MUST choose one brightness setting AND on one volume level each in the given choices, otherwise you will not be able to go to the right page.

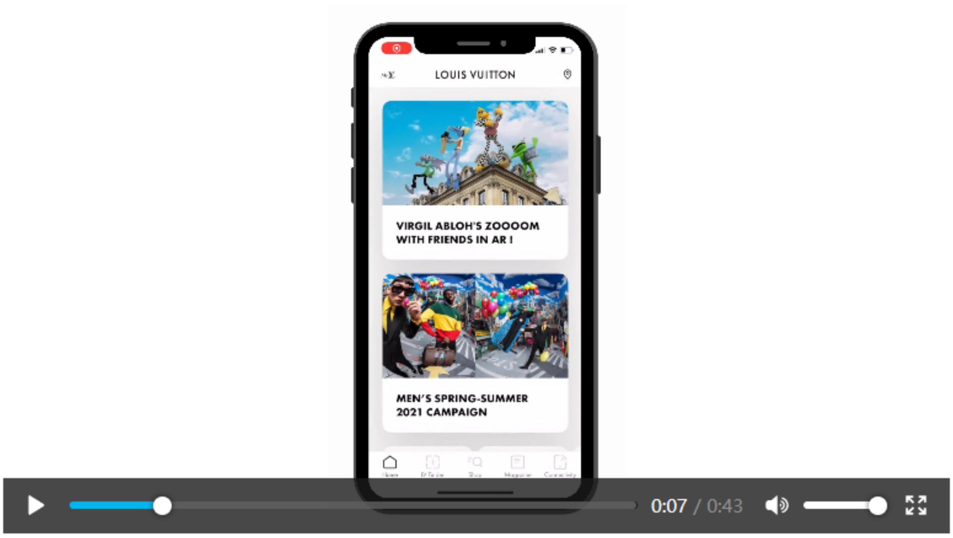
Bright Screen **Dark Screen**

- [ ] Bright screen
- [ ] Dark screen
- [ ] High volume
- [ ] Low volume

Please imagine that you are shopping through the Louis Vuitton app in your phone, and you would like to purchase a bottle of perfume shown in the video.

Please play the video when you feel you are ready for virtual shopping.

*** To optimize the watching experience, please adjust your phone volume to the <u>maximum level</u> before you start the shopping experience. You may also have to select the full-screen mode before you start watching.**



→

How much are you willing to pay for the product presented in the video? Please specify your answer in the table below.
***whole numbers only (in NOK).**

NB - the range of the market price for a bottle of perfume (100ml) from Louis Vuitton is 2500 - 5500 NOK.

→

Appendix A3.4. Questions for control variables

Please indicate the extent to which you agree with the following statements related to the shopping experience you just had. Please select the box and use the scale given below that goes from Strongly Disagree to Strongly Agree.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think the shopping experience in the video is realistic	○	○	○	○	○	○	○
I am familar with the brand of louis Vuitton	○	○	○	○	○	○	○
I desire to control the screen brightness in the given video	○	○	○	○	○	○	○
I desire to control the volume of the music in the given video	○	○	○	○	○	○	○

On average, how many times do you purchase fashion-related luxury items per year?

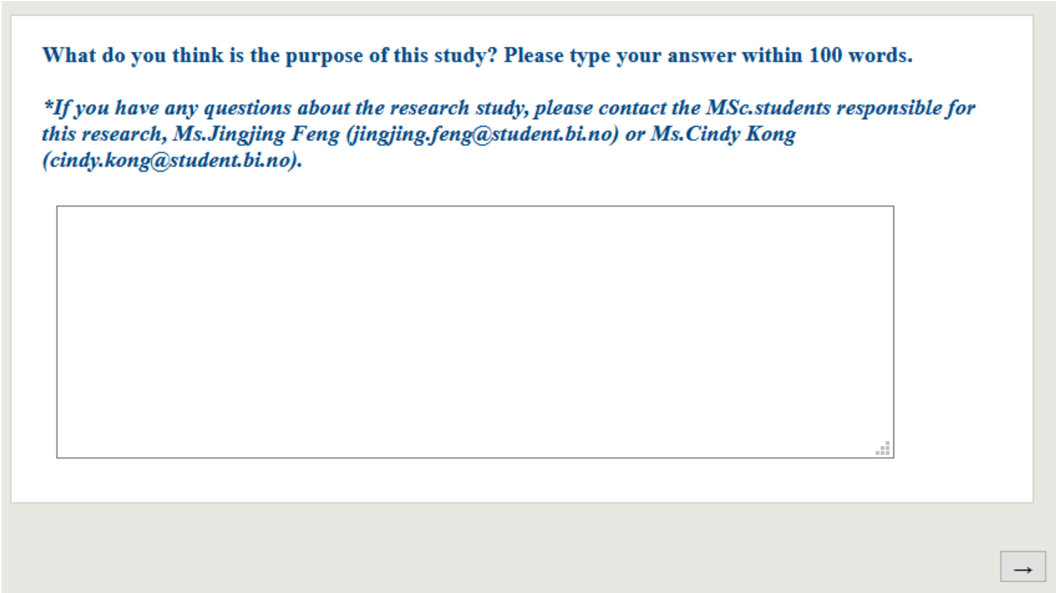
***whole umbers only.**

On average, how much money do you spend on fashion-related luxury items per year?

***whole numbers only (in NOK).**

Please indicate which type of devices that you use when completing this survey.

- ○ Mobile phone
- ○ Laptop
- ○ Ipad
- ○ Others, please specify in the below box



What do you think is the purpose of this study? Please type your answer within 100 words.

***If you have any questions about the research study, please contact the MSc.students responsible for this research, Ms.Jingjing Feng (jingjing.feng@student.bi.no) or Ms.Cindy Kong (cindy.kong@student.bi.no).**

→

APPENDIX B

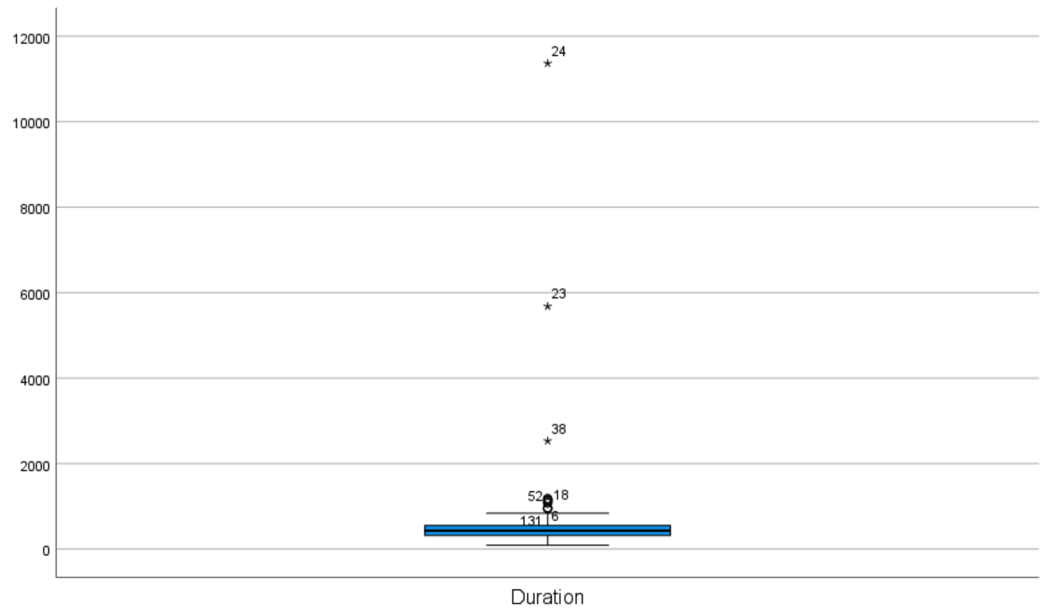
Appendix B1. Stem-and-Lead Ploy

```
Duration Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

     2.00        0 .  99
     1.00        1 .  0
    12.00        1 .  666677777789
    10.00        2 .  0000111223
    10.00        2 .  5555668889
    12.00        3 .  000011112344
    25.00        3 .  5556666666777777888888999
    21.00        4 .  001112222222333333444
    20.00        4 .  55555555566678888899
    12.00        5 .  000122223344
    13.00        5 .  5555566889999
     8.00        6 .  00111112
     4.00        6 .  5699
     4.00        7 .  2234
     3.00        7 .  789
     1.00        8 .  3
    12.00 Extremes    (>=948)

 Stem width:     100
 Each leaf:        1 case(s)
```



Appendix B2. Descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Realistic_level	127	1	7	5.48	1.326
Brand_familarity	128	2	7	5.77	1.335
Desire_control_brightness	128	1	7	4.67	1.632
Desire_control_volume	128	1	7	5.40	1.365
Frequency_luxury_purchase	128	0	50	3.03	5.499
Annual_spending	127	0	125000	5460.83	13430.105
Age	128	20	67	30.52	9.143
Gender	128	0	1	.52	.502
Income	116	1	3	1.48	.679
Education	127	2	6	4.23	.692
Valid N (listwise)	114				

Appendix B3. Two-way mixed ANOVA

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Epsilon[b] Huynh-Feldt	Epsilon[b] Lower-bound
stimuli	.860	18.843	2	<.001	.877	.896	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Group
Within Subjects Design: stimuli

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Appendix B4. Mann-Whitney U test

Test Statistics[a]

	Desire_control_brightness	Realistic_level	Brand_familarity	Desire_control_volume	Frequency_luxury_purchase	Annual_spending	Age	Gender	Income	Education
Mann-Whitney U	2020.500	1974.500	1728.500	1874.000	2046.000	1760.500	1391.000	1664.000	1303.500	2013.500
Wilcoxon W	4100.500	4054.500	3808.500	3954.000	4126.000	3776.500	3471.000	3744.000	3073.500	4029.500
Z	-.134	-.210	-1.593	-.856	-.010	-1.248	-3.139	-2.114	-2.429	-.014
Asymp. Sig. (2-tailed)	.894	.834	.111	.392	.992	.212	.002	.035	.015	.989

a. Grouping Variable: Group

Appendix B5. Correlation coefficient

Correlations

Group			V_stimuli	A_stimuli	AV_stimuli	Realistic_level	Brand_familarity	Desire_control_brightness	Desire_control_volume	Frequency_luxury_purchase	Annual_spending	Age	Gender	Income	Education
0	V_stimuli	Pearson Correlation	1	.791**	.724**	.046	-.075	.146	.049	.237	.028	.191	.002	-.040	-.136
		Sig. (2-tailed)		<.001	<.001	.720	.556	.249	.699	.059	.825	.131	.985	.765	.288
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	A_stimuli	Pearson Correlation	.791**	1	.888**	-.022	.042	.066	.043	.255*	.083	.285*	-.095	.013	-.114
		Sig. (2-tailed)	<.001		<.001	.865	.741	.606	.734	.042	.519	.022	.456	.922	.376
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	AV_stimuli	Pearson Correlation	.724**	.888**	1	-.083	.143	-.026	-.013	.203	.043	.340**	-.174	.096	-.181
		Sig. (2-tailed)	<.001	<.001		.518	.260	.837	.921	.107	.739	.006	.169	.472	.157
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Realistic_level	Pearson Correlation	.046	-.022	-.083	1	-.030	.099	.091	.041	.082	.025	-.065	-.126	-.067
		Sig. (2-tailed)	.720	.865	.518		.817	.442	.476	.751	.525	.843	.614	.345	.606
		N	63	63	63	63	63	63	63	63	62	63	63	58	62
	Brand_familarity	Pearson Correlation	-.075	.042	.143	-.030	1	.080	.048	.223	.081	-.084	.289*	-.219	.037
		Sig. (2-tailed)	.556	.741	.260	.817		.529	.709	.077	.526	.511	.020	.096	.773
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Desire_control_brightness	Pearson Correlation	.146	.066	-.026	.099	.080	1	.151	.118	-.056	-.307*	.161	-.066	.372**
		Sig. (2-tailed)	.249	.606	.837	.442	.529		.235	.355	.662	.014	.203	.620	.003
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Desire_control_volume	Pearson Correlation	.049	.043	-.013	.091	.048	.151	1	.076	.055	-.029	.015	.019	.078
		Sig. (2-tailed)	.699	.734	.921	.476	.709	.235		.553	.670	.818	.907	.884	.545
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Frequency_luxury_purchase	Pearson Correlation	.237	.255*	.203	.041	.223	.118	.076	1	.439**	.060	-.011	-.109	.154
		Sig. (2-tailed)	.059	.042	.107	.751	.077	.355	.553		<.001	.640	.931	.413	.229
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Annual_spending	Pearson Correlation	.028	.083	.043	.082	.081	-.056	.055	.439**	1	-.010	.156	-.108	-.053
		Sig. (2-tailed)	.825	.519	.739	.525	.526	.662	.670	<.001		.940	.223	.419	.680
		N	63	63	63	62	63	63	63	63	63	63	63	58	62
	Age	Pearson Correlation	.191	.285*	.340**	.025	-.084	-.307*	-.029	.060	-.010	1	-.434**	.423**	-.243
		Sig. (2-tailed)	.131	.022	.006	.843	.511	.014	.818	.640	.940		<.001	<.001	.055
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Gender	Pearson Correlation	.002	-.095	-.174	-.065	.289*	.161	.015	-.011	.156	-.434**	1	-.280*	.067
		Sig. (2-tailed)	.985	.456	.169	.614	.020	.203	.907	.931	.223	<.001		.032	.603
		N	64	64	64	63	64	64	64	64	63	64	64	59	63
	Income	Pearson Correlation	-.040	.013	.096	-.126	-.219	-.066	.019	-.109	-.108	.423**	-.280*	1	.099
		Sig. (2-tailed)	.765	.922	.472	.345	.096	.620	.884	.413	.419	<.001	.032		.458
		N	59	59	59	58	59	59	59	59	58	59	59	59	59
	Education	Pearson Correlation	-.136	-.114	-.181	-.067	.037	.372**	.078	.154	-.053	-.243	.067	.099	1
		Sig. (2-tailed)	.288	.376	.157	.606	.773	.003	.545	.229	.680	.055	.603	.458	
		N	63	63	63	62	63	63	63	63	62	63	63	59	63
1	V_stimuli	Pearson Correlation	1	.825**	.891**	.074	-.168	.043	-.175	-.076	.283*	.102	.197	-.116	-.306*
		Sig. (2-tailed)		<.001	<.001	.563	.185	.733	.167	.549	.024	.423	.118	.391	.014
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	A_stimuli	Pearson Correlation	.825**	1	.896**	.227	-.049	.193	.018	.039	.280*	-.077	.191	-.137	-.262*
		Sig. (2-tailed)	<.001		<.001	.072	.702	.127	.888	.761	.025	.547	.131	.310	.036
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	AV_stimuli	Pearson Correlation	.891**	.896**	1	.076	-.094	.187	-.012	-.076	.260*	.057	.158	-.137	-.306*
		Sig. (2-tailed)	<.001	<.001		.549	.460	.139	.927	.552	.038	.654	.212	.309	.014
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Realistic_level	Pearson Correlation	.074	.227	.076	1	.121	.003	.132	.100	.074	-.043	.221	-.175	.120
		Sig. (2-tailed)	.563	.072	.549		.342	.980	.297	.434	.560	.739	.080	.192	.344
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Brand_familarity	Pearson Correlation	-.168	-.049	-.094	.121	1	.040	.060	-.034	.131	-.048	-.016	-.077	.004
		Sig. (2-tailed)	.185	.702	.460	.342		.755	.636	.791	.302	.707	.902	.568	.973
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Desire_control_brightness	Pearson Correlation	.043	.193	.187	.003	.040	1	.683**	.081	.028	.056	-.051	-.048	-.155
		Sig. (2-tailed)	.733	.127	.139	.980	.755		<.001	.522	.829	.658	.687	.723	.222
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Desire_control_volume	Pearson Correlation	-.175	.018	-.012	.132	.060	.683**	1	-.134	-.117	-.125	-.005	.095	-.102
		Sig. (2-tailed)	.167	.888	.927	.297	.636	<.001		.290	.358	.326	.968	.484	.421
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Frequency_luxury_purchase	Pearson Correlation	-.076	.039	-.076	.100	-.034	.081	-.134	1	.143	.181	-.067	.099	.112
		Sig. (2-tailed)	.549	.761	.552	.434	.791	.522	.290		.259	.152	.598	.466	.379
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Annual_spending	Pearson Correlation	.283*	.280*	.260*	.074	.131	.028	-.117	.143	1	.149	-.074	-.120	.072
		Sig. (2-tailed)	.024	.025	.038	.560	.302	.829	.358	.259		.239	.561	.375	.574
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Age	Pearson Correlation	.102	-.077	.057	-.043	-.048	.056	-.125	.181	.149	1	-.083	.302*	.239
		Sig. (2-tailed)	.423	.547	.654	.739	.707	.658	.326	.152	.239		.514	.023	.057
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Gender	Pearson Correlation	.197	.191	.158	.221	-.016	-.051	-.005	-.067	-.074	-.083	1	-.157	-.146
		Sig. (2-tailed)	.118	.131	.212	.080	.902	.687	.968	.598	.561	.514		.245	.251
		N	64	64	64	64	64	64	64	64	64	64	64	57	64
	Income	Pearson Correlation	-.116	-.137	-.137	-.175	-.077	-.048	.095	.099	-.120	.302*	-.157	1	.248
		Sig. (2-tailed)	.391	.310	.309	.192	.568	.723	.484	.466	.375	.023	.245		.063
		N	57	57	57	57	57	57	57	57	57	57	57	57	57
	Education	Pearson Correlation	-.306*	-.262*	-.306*	.120	.004	-.155	-.102	.112	.072	.239	-.146	.248	1
		Sig. (2-tailed)	.014	.036	.014	.344	.973	.222	.421	.379	.574	.057	.251	.063	
		N	64	64	64	64	64	64	64	64	64	64	64	57	64

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix B6. Two-way ANOVA with covariate added (*age*, *income*, and *gender*)

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
stimuli	Sphericity Assumed	167161.514	2	83580.757	.698	.499	.006
	Greenhouse-Geisser	167161.514	1.766	94629.365	.698	.482	.006
	Huynh-Feldt	167161.514	1.858	89987.770	.698	.489	.006
	Lower-bound	167161.514	1.000	167161.514	.698	.405	.006
stimuli * Age	Sphericity Assumed	308518.137	2	154259.068	1.287	.278	.011
	Greenhouse-Geisser	308518.137	1.766	174650.700	1.287	.276	.011
	Huynh-Feldt	308518.137	1.858	166084.038	1.287	.277	.011
	Lower-bound	308518.137	1.000	308518.137	1.287	.259	.011
stimuli * Income	Sphericity Assumed	42575.821	2	21287.911	.178	.837	.002
	Greenhouse-Geisser	42575.821	1.766	24101.977	.178	.811	.002
	Huynh-Feldt	42575.821	1.858	22919.769	.178	.822	.002
	Lower-bound	42575.821	1.000	42575.821	.178	.674	.002
stimuli * Gender	Sphericity Assumed	444486.930	2	222243.465	1.855	.159	.016
	Greenhouse-Geisser	444486.930	1.766	251622.010	1.855	.164	.016
	Huynh-Feldt	444486.930	1.858	239279.885	1.855	.162	.016
	Lower-bound	444486.930	1.000	444486.930	1.855	.176	.016
stimuli * Group	Sphericity Assumed	808343.359	2	404171.680	3.373	.036	.029
	Greenhouse-Geisser	808343.359	1.766	457599.464	3.373	.042	.029
	Huynh-Feldt	808343.359	1.858	435154.091	3.373	.040	.029
	Lower-bound	808343.359	1.000	808343.359	3.373	.069	.029
Error(stimuli)	Sphericity Assumed	26600525.25	222	119822.186			
	Greenhouse-Geisser	26600525.25	196.080	135661.578			
	Huynh-Feldt	26600525.25	206.194	129007.343			
	Lower-bound	26600525.25	111.000	239644.372			

Appendix B7. Two-way ANOVA with covariate added (*age*, *income*, *gender*, and *education*).

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
stimuli	Sphericity Assumed	53270.518	2	26635.259	.222	.801	.002
	Greenhouse-Geisser	53270.518	1.755	30362.042	.222	.772	.002
	Huynh-Feldt	53270.518	1.862	28613.545	.222	.785	.002
	Lower-bound	53270.518	1.000	53270.518	.222	.638	.002
stimuli * Age	Sphericity Assumed	269171.393	2	134585.697	1.122	.327	.010
	Greenhouse-Geisser	269171.393	1.755	153416.812	1.122	.322	.010
	Huynh-Feldt	269171.393	1.862	144581.806	1.122	.325	.010
	Lower-bound	269171.393	1.000	269171.393	1.122	.292	.010
stimuli * Income	Sphericity Assumed	52705.016	2	26352.508	.220	.803	.002
	Greenhouse-Geisser	52705.016	1.755	30039.728	.220	.774	.002
	Huynh-Feldt	52705.016	1.862	28309.793	.220	.787	.002
	Lower-bound	52705.016	1.000	52705.016	.220	.640	.002
stimuli * Gender	Sphericity Assumed	458671.327	2	229335.664	1.912	.150	.017
	Greenhouse-Geisser	458671.327	1.755	261424.114	1.912	.156	.017
	Huynh-Feldt	458671.327	1.862	246369.156	1.912	.153	.017
	Lower-bound	458671.327	1.000	458671.327	1.912	.170	.017
stimuli * Education	Sphericity Assumed	216948.817	2	108474.408	.905	.406	.008
	Greenhouse-Geisser	216948.817	1.755	123652.055	.905	.395	.008
	Huynh-Feldt	216948.817	1.862	116531.149	.905	.400	.008
	Lower-bound	216948.817	1.000	216948.817	.905	.344	.008
stimuli * Group	Sphericity Assumed	769947.175	2	384973.587	3.210	.042	.028
	Greenhouse-Geisser	769947.175	1.755	438838.763	3.210	.049	.028
	Huynh-Feldt	769947.175	1.862	413566.806	3.210	.046	.028
	Lower-bound	769947.175	1.000	769947.175	3.210	.076	.028
Error(stimuli)	Sphericity Assumed	26383576.43	220	119925.347			
	Greenhouse-Geisser	26383576.43	192.996	136705.200			
	Huynh-Feldt	26383576.43	204.790	128832.586			
	Lower-bound	26383576.43	110.000	239850.695			