Perception is reality... how digital retail environments influence brand perceptions through presence

Perception is Reality… How Digital Retail Environments Influence Brand Perceptions Through Presence

1. Introduction

"Everything you can imagine is real." - Pablo Picasso

Consumers are increasingly searching online before purchasing in-store (PwC Total Retail, 2017) and as a result, online retail initiatives have become increasingly multidimensional, with technology asserting itself as a point of differentiation (Grewal, Roggeveen, & Nordfält, 2017). Whereas videos used to be the normal medium of dynamic communication content, recent technological innovation has made virtual reality (VR) de rigueur. In particular, VR can help retailers create experiences with consumers, even with physical distance separating the two. In this research, we define 360-VR as an application that allows consumers to move forward and backward, as well as zoom in and click on hotpoints in a series of dynamic photographs. We compare 360-VR to two-dimensional media, based on the ability of the media to transport consumers. For example, consumers in New York can discover the tasting room, bar, and vineyards of the Chateau Montelena Winery in California via a 360-VR online insert. Car brands (e.g. Audi) also use 360-VR to help consumers visualize car designs and test drive cars from the comfort of their own homes. In fact, e-tailer eBay claims that as many as 63% of future car purchases will be made online and, particularly, that VR is a key success factor for the industry (eBay, 2017). In a similar fashion, in 2019, retailers planned to invest $1.56 billion in VR and augmented reality (Torchia & Shirer, 2018).

Still, little is known about how individuals respond to VR. For instance, do these 360-VR experiences help or penalize retailers? The answer may be more complicated than thought. While scholarly knowledge of VR conceptually addresses the topic (e.g. Cowan &

Ketron, 2019), it has yet to reveal how prior product knowledge and mode of information processing (e.g. efficacy of mental imagery) impacts consumer responses. It may be that retailers benefit from the use of VR (e.g. 360-degree experiences) in specific retail environments (e.g. in-store versus remote). Additionally, current research in VR focuses on visual sensory content. Yet, rapid developments in VR are improving the ability to deliver multisensory experiences, especially in relation to haptics (Wang et al., 2019). With this in mind, how does haptic-related content impact consumer information processing and brand evaluation?

In general, the literature implies that VR, compared to online or physical environments, augments product and brand attitudes (Daugherty, Li, & Biocca, 2008), heightens enjoyment (Nah, Eschenbrenner & DeWester, 2011), and leads to stronger behavioral intentions (Huang & Liao, 2015). Clearly, the benefits arise from the superior sensory experience (Poncin & Mimoun, 2014). When using 360-VR, consumers experience flow (Hoffman & Novak, 2009), which stems from immersion and presence. Immersion reflects the degree to which an individual is engrossed in the medium (Guttentag, 2010; Harrison, Haruvy, & Rustrom, 2011) and presence reflects how real the virtual environment feels, such that the consumer may forget their true physical location (Berg & Vance, 2016).

Parallel to presence in VR is mental imagery, curated from the consumer's imagination[1] (Cowan & Ketron, 2018). Prior research advises that mental imagery enables a more 'efficient' mode of processing than consideration (e.g. evaluating) modes (Ketron, Spears, & Dai, 2016). Mental imagery considers incoming stimuli and prior knowledge, and informs consumer responses to products (Spears & Yazdanparast, 2014). However, the influence of prior knowledge may be more important than mental imagery at different retailer touchpoints (e.g. in-store versus remote brand observation and purchasing decision-making).

[1] We use imagination to describe the process of crafting experiences in the mind's eye, while we use mental imagery to refer to the resulting images and narratives produced by the imagination.

For example, at the purchasing stage, consumers engage in more effortful, deliberate considerations, such that evaluation is more important than efficiency (Colicev, Malshe, Pauwels & O'Connor, 2018). This may be especially the case when considering imagination within the scope of consumer involvement (e.g. Spears, Ketron & Ngamsiriudom, 2016; Ketron et al., 2016). Indeed, at the purchasing stage, imagination may compete with elaborate processing. Given this possibility, it would be important to understand how to attenuate these effects. We propose that one mechanism retailers could use to counterbalance the effects of competing processing modes in 360-VR is cueing haptic stimuli. In particular, touch is associated with semantic processing (e.g. considering texture), and has a powerful influence on consumer behavior (Littel & Orth, 2013). Thus, haptic information could alter processing means in VR.

In light of the gaps in the literature, this research provides answers to the following questions: Where should retailers use 360-VR (in-store versus remote)? How does 360-VR motivate positive brand evaluations and purchase intentions? How does prior product knowledge influence the effect of 360-VR on the aforementioned consumer responses? Does mental imagery mediate these effects? When consumers have high product knowledge, can haptic information overcome lower responses from 360-VR (versus video)? The objectives of our study are, first, to investigate how 360-VR alters attitudes and intentions in and outside the physical retail location. Second, we aim to examine product knowledge as a moderator. Third, we evaluate touch as a boundary condition. Finally, we test mental imagery as a mediator. We conducted four experiments to meet the research objectives.

Our research provides three new perspectives to the retailing literature. First, we build upon prior research in 360-VR by demonstrating how and when these experiences affect consumer responses, and at which retailing contact point. Second, we advance literature on multisensory input (e.g. haptics and visual) within digital media to better understand the role

of each in contributing to information processing. The findings reveal that haptics can override visual input, even when consumers have high product knowledge. Third, the research enhances the literature on mental imagery in online retail environments, emphasizing the influence of product knowledge and sensory information in consumer responses. Finally, the research also identifies practical implications for retailers.

1. Literature Review

2.1 Experiencing Presence in 360-VR from Flow

Flow theory, commonly used to underpin VR research, suggests that individuals enter a cognitive state whereby they attend to information in the environment (Nakamura & Csikszentmihályi, 2001). As aforementioned, flow results from immersion and presence. Specifically, when consumers experience high immersion, their senses and thoughts are dominated by the virtual environment (Guttentag, 2010; Harrison et al., 2011), and they deem the real world unimportant (Biocca & Levy, 1995). Similarly, online environments elicit presence (Novak, Hoffman, & Yung, 2000), defined as the imagined experience of being in or interacting with an artificial setting as though it were real (Mollen & Wilson, 2010; Schlosser, 2003, 2006). In sum, immersion pertains to what degree the consumer thinks about the virtual (versus the real) world, while presence pertains to the extent the virtual context replaces reality. Importantly, cognitive effort is higher in more immersive environments (Spielmann & Mantonakis, 2018).

Shin (2019) suggests that processes whereby VR influences presence, flow, and consumer responses to a brand may be more complicated than previously assessed. Specifically, presence can be a double-edged sword. In general, presence contributes to an enhanced online experience (Novak et al., 2000). When visual media (e.g. photographs, videos) becomes virtual (e.g. 360-VR), information is treated in a more elaborate fashion,

which enhances perceptions about the online offer (Suh & Lee, 2005). As such, consumers experience greater presence from virtual media versus product packaging or videos. This occurs because consumers feel transported to the virtual environment where they interact; additionally, their experience is more vivid (Kim & Biocca, 1997). On the one hand, 360-VR can elicit higher levels of presence when it is more realistic (Lombard & Ditton, 1997; Steuer, 1992). On the other, high levels of presence through immersive features (e.g. interactivity within the environment, etc.) can also reduce the effectiveness of 360-VR in contributing to positive consumer evaluations (Bhatt, 2004; Cowan & Ketron, 2018).

In VR, tasks reflect real world decision-making, and are more effort-laden (Huang & Wan, 2019). For retailers and brands, this may mean that attempts to increase realism in VR may lead to a tipping point where presence and flow are interrupted (i.e., too demanding to continue to capture attention). For instance, while social interaction in VR increases loyalty and satisfaction, social interaction weakens the effect of immersion on consumer responses toward the brand (Hudson et al., 2019). Thus, VR experiences heighten the senses (Poncin & Mimoun, 2014) but can also lead to sensory overload (Cooper, Milella, Pinto, Cant, White & Meyer, 2018). We unpack the sensory aspects of 360-VR in the following section.

2.2 The Sensory Aspects of 360-VR

Sheridan (1992) identifies five variables that help induce presence: sensory information, control of sensors in the environment, ability to control the physical environment, task difficulty, and degree of automation. Generally, when consumers experience these five variables (e.g. when the media is more dynamic), their reactions are more positive than in static media environments (Klein, 2003). Specifically, 360-VR allows consumers to visualize, manipulate, and interact with complex data online (Aukstakalnis & Blatner, 1992), fostering the experience of being in a virtual retail environment (or remote

location) without being physically in it (Rheingold, 1993). In other words, 360-VR is a technological tool that allows users to perceive presence.

The feeling of presence also depends on the technology's level of vividness (as in the visual sense) and interactivity (as in manipulating the environment) (Klein, 2003). For print advertising or product packaging, visual cues lead to higher brand appeal (Krishna, 2012; Yoon & Park, 2012), and we posit the same to be true in 360-VR. Specifically, enhancing the visual senses through the creation of online retail environments such as 360-VR allows customers to immerse themselves more easily, leading to greater satisfaction and loyalty (Hudson et al., 2019), and to more favorable attitudes toward the retailer (Pizzi, Vannucci & Aiello, 2019). Furthermore, VR's effectiveness is attributed to the excitement and engagement consumers experience (Farah et al., 2019). Finally, research shows that 360-VR also provides interactivity via hand and finger movements, and product interactivity with 360-VR increases brand loyalty and spending (Kim, Wang & Malthouse, 2015).

Consequently, consumer interactions with the brand at various touchpoints can significantly impact their attitudes and purchases. Online settings offer off-site opportunities to communicate with consumers. Recent research suggests that best practices in VR actually occur in off-site channels. These work well for retailers because of the possibility to appeal to the early- and end-stages of consumer decision-making, where engagement is crucial (Farah et al., 2109). Both of these phases of consumer decision-making demand less effortful processing (Colicev et al., 2018). Given that mental imagery is an efficient means of processing information (Ketron et al., 2016), and the fact that 360-VR should evoke this style of processing (Cowan & Ketron, 2018), 360-VR should enhance consumer responses such as attitudes and purchases when used off-site (i.e. outside of the retail setting where the actual purchase is made). Thus, we posit that feelings of presence occurring in 360-VR cause consumers to engage in a more experiential purchase decision-making process (Schmitt,

1999), with the 360-VR environment offsetting the lack of physical contact (McKinney, 2004).

H1: High presence-inducing media (i.e. 360-VR) versus low presence-inducing media (i.e. video or product presentations) will result in more favorable a) brand evaluations and b) purchase intentions when the experiences are remote (e.g. online).

When making purchases, consumers are motivated to evaluate communication more deeply, which requires more cognitive effort, and engages the central route to persuasion (Petty & Cacioppo, 1986; Herr, Kardes, & Kim, 1991). The purchasing stage of consumption is aligned more closely with deep information processing and the evaluation of content for its actual merits (Colicev et al., 2018). Indeed, in-store communication is the most influential source of information for consumers when they are ready to make a purchasing decision (Baxendale et al., 2015). Together, this extant literature may explain the infrequent use of VR for the purchase phase (Farah et al., 2019). For example, consumers' presence in a retail environment influences their decision-making (Quidt, 2016). Yet, in VR, social interaction with others dampens the benefits of presence on brand responses (Hudson et al., 2019), suggesting that on-site distractions disrupt flow and, combined with the mental effort demanded in the purchasing phase, may detract from the VR experience. While 360-VR leads to flow states, the flow should trigger mental imagery (i.e. efficient processing) that may either conflict with the preferred style of effortful processing at the purchase stage or detract from the in-store shopping experience. Research confirms that shopping in VR (versus a physical store) demands more effortful processing (Huang & Wan, 2019). Thus, the same type of content created to connect consumers with the brand may not be best suited for in-store environments. In other words, when in the purchasing stage of consumption, consumers

may evaluate the brand less favorably when exposed to 360-VR (high presence) versus low presence media (i.e. video).

H2: High (versus low) presence-inducing media will result in less favorable a) brand evaluations and b) purchasing intentions when the experiences are on-site (e.g. retail store).

2.3 Product Knowledge Interacts with Presence in 360-VR

Prior research on the role of presence in VR provides conflicting accounts of the relationship between presence and consumer outcomes. For instance, Nah et al. (2011) show that while presence-inducing VR experiences can increase the desire to own a product, they also decrease consumer perceptions of brand value. Alternatively, Spielmann and Mantonakis (2018) show that positive brand attitudes result from presence. Interestingly, Orth et al. (2019) demonstrate that consumer processing style moderates the influence of virtual servicescape mystery and complexity on presence. Orth et al. (2019) were among the first to suggest that consumer characteristics can influence the VR experience. Similarly, Shin (2019) also furthers this line of inquiry by revealing that other consumer traits can trigger flow states, which in turn influence consumer responses. Together, this literature suggests that there is little consensus as to *how* presence in 360-VR influences brand evaluations: what is it about the media and consumer characteristics that explains brand evaluation? We suggest that product knowledge is one key, and unpack our reasoning below.

The flow experience in VR is constructed not only through the technology (e.g. VR versus video content), but also from the user's own traits and cognitions. Shin (2019) argues that when users are exposed to technological stimuli, they interpret and process the information cognitively based on their own experiences, traits, and contexts. For instance, those high in empathy experience flow, increasing their engagement with video. Shin (2019)

suggests that how users feel and interpret the technology (VR versus video) depends on their preferences and cognitive motivations for engagement. Given that flow is induced when the technological qualities of a medium are translated into the relevant cognitive qualities (Shin, 2019), it can be argued that product knowledge, a type of cognitive involvement, may influence information processing style and brand response. Specifically, consumers who have higher prior experience and knowledge about products may not enjoy VR in the same fashion (Mazursky & Vinitzky, 2005).

One potential explanation for this is the role of product knowledge in evoking different modes of information processing; product knowledge has an impact on how consumers evaluate product-related information (Celsi & Olson, 1988). In general, consumers with greater product familiarity and expertise usually elaborate more on the product and consider evaluations beyond what they know (e.g. Alba & Hutchinson, 1987). This usually takes the form of semantic processing, since those with higher (versus lower) knowledge have stronger (weaker) semantic maps (Gregan-Paxton & Roedder-John, 1997). As such, those with high product knowledge prefer processing information using semantic associations, such as expectations of a product category (Dimofte, 2010). It could be that consumers with high knowledge may report less favorable responses following 360-VR (versus video) exposure because their preferential mode of evaluation (i.e. semantic networks) competes with the processing mode cued by 360-VR (i.e. efficiency of mental imagery).

On the other hand, less knowledgeable consumers may benefit more from 360-VR. Given that novices do not have access to semantic associations of products (Roy & Cornwell, 2004), this style of processing should result in more effort when assessing categorical cues. Therefore, we propose product knowledge as a moderator between the presence induced from the media and consumer evaluations. We believe that when media elicits higher presence (e.g. 360-VR compared to video), it can diminish (improve) evaluations if consumers are (not)

highly knowledgeable. In sum, when presence is high, as in 360-VR retail environments, we predict that low levels of product category knowledge should have a more positive impact on brand evaluations. However, when consumers already have high product category knowledge, higher presence may reduce brand evaluations.

H3: High (versus low) presence-inducing media in online retail environments will positively impact a) brand evaluations and b) purchase intentions when product category knowledge is low (versus high).

2.4 Sensory Marketing Cues Online and Mental Imagery

Consumers engage their imagination when experiencing sensory marketing (Elder & Krishna, 2010) such that sensory cues help consumers imagine that they are interacting with the brand (Cian, Krishna & Elder, 2014). Prior research offers evidence that greater mental imagery increases attitudes and purchase intentions (Schlosser, 2003), even for consumers with a high need for touch who cannot physically touch the product (Spears & Yazdanparast, 2014). In a digital environment, mental imagery resulting from consumers' use of their imagination is even more important, as it is impossible to touch and see the product firsthand. In this case, mental imagery is defined as the mind's visions resulting from pre-existing information and new information in the sensory environment (Cowan & Dai, 2014). This definition implies that for consumers to develop mental imagery, they must experience sensory input. Importantly, mental imagery depends more on incoming information from the sensory environment than on knowledge (Hoch & Ha, 1986).

Consumer imagination does benefit from prior knowledge. Dimofte (2010) finds that individuals with low product category knowledge are more likely to engage in narrative (e.g. using their imaginations) processing, such as when advertisements instruct the user to imagine themselves in a Cadillac. This aligns with other research suggesting a match between efficient

processing and preferences in product novices (Beattie, 1983). In the awareness stage of consumption, those low in product knowledge naturally prefer less effortful processing of stimuli (Colicev et al., 2018), which parallels the efficiency of mental imagery (Ketron et al., 2016). When consumers have high product knowledge already, they rely more on semantic processing styles (Dimofte, 2010), and tend to prefer more product-specific information. Thus, the mental imagery mode of processing that 360-VR evokes represents a mismatch with these individuals' preferred processing style. In line with these arguments, Unnava, Agarwal, and Haugtvedt (1996) find that when mental imagery and perception compete for the same cognitive resources, the positive effects of mental imaging are thwarted. Thus, we propose that mental imagery will mediate the relationship of the media-induced presence to brand evaluations in light of consumer knowledge.

H4: Mental imagery mediates the interaction of product category knowledge and high versus low presence-inducing media on brand evaluations, leading to higher purchase intentions.

2.5 Haptic Cues in 360-VR Retail Experiences

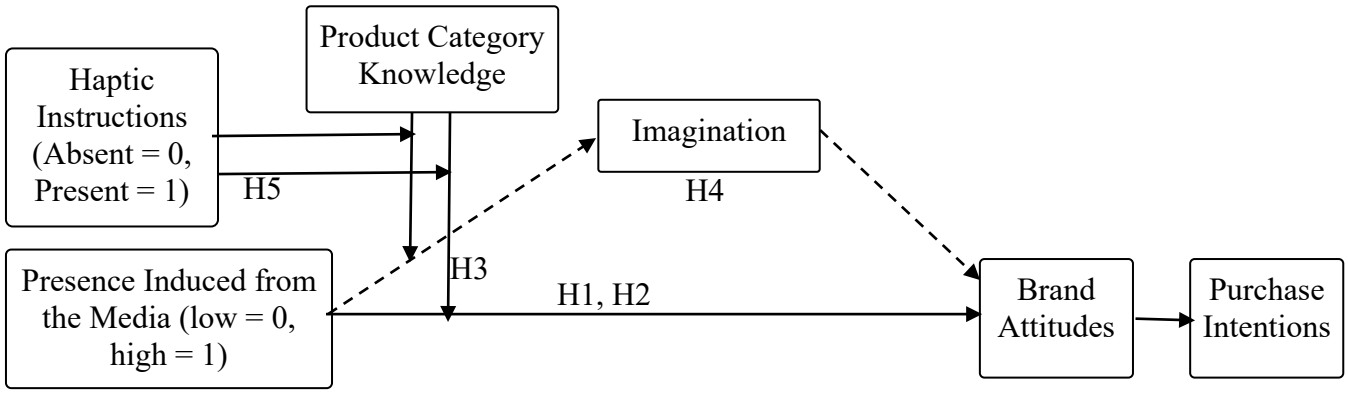
Haptic information (e.g. images of product texture, vivid descriptions of haptic information, etc.) plays a powerful role in influencing consumer evaluations. Research shows that haptic cues elicit favorable consumer evaluations (Krishna, Elder & Caldara, 2010), even with low product involvement (Peck & Johnson, 2011). Further, haptic cues enhance feelings of perceived ownership (Peck, Barger & Webb, 2013). In particular, haptic cues are signals to individuals about diagnostic or non-diagnostic aspects of an item's weight, texture, firmness, or temperature (Peck & Childers, 2003). However, touch requires greater physical proximity than other senses (Montagu & Matson, 1979) since it is harder to simulate or recreate without physical stimuli (Peck, 2010). There are ways to facilitate touch without physical proximity

even when people have a high need for touch (Jin, 2011). One way is via haptic imagery (e.g. describing an item's haptic properties), which focuses individuals' attention on touch features (Peck et al., 2013; Yazdanparast, Khajehzadeh & Keh, 2016) or vibrations (Hadi & Valenzuela, 2016).

Taken together, haptic and visual stimuli provide unique instances of multisensory stimuli. Haptic cues outperform visual stimuli in advertising (Cardamenis, 2016). In fact, haptic cues can overcome the absence of visual stimuli (Madzharov, Block, & Morrin, 2015; Yazdanparast et al., 2016). Consequently, we argue that haptic imagery can counterbalance the deficiencies of low mental imagery in 360-VR retail experiences. Haptic imagery can be chronically assessed from prior product knowledge (Peck & Childers, 2003). This parallels preferences for processing when consumers have high product knowledge. As consumers with high product category knowledge prefer semantic, not narrative, processing (Dimofte, 2010), cueing haptic imagery should engage semantic processing. Alternatively, without haptic imagery, we expect the same patterns to occur, as in hypotheses 3 and 4. Stated otherwise, when haptic imagery is present, there will not be a significant product category knowledge and 360-VR (versus video) interaction. However, when haptic imagery is absent, high (versus low) product knowledge should decrease brand evaluations when the media-induced presence is high (versus low). Figure 1 outlines our overall conceptual model.

H5: Haptic imagery (versus none) will serve as a boundary to the influence of product category knowledge and media-induced presence on a) brand evaluations and b) purchase intentions.

Figure 1. Hypothesized Relationships among Variables



2. Study 1: Virtual experience in Remote Location

The objective of Study 1 is to examine H1a and H1b and evaluate how off-site virtual retail experiences impact brand evaluations. The experiment was conducted as an intercept format with convenience samples. We achieved generalizability by sampling in two different cultures.

3.1 Sampling and Procedures

We devised a randomized between-subjects design varying one factor on two levels (presence: high versus low). Specifically, given that the Ruinart champagne cellar tour served as our online retail context, we selected two countries with varying access to the cellars (e.g. France with local access; Ireland with non-local access). Although no differences were expected between the two countries, country was included as a covariate in our analysis. A research assistant intercepted participants on the streets in Reims, France and Dublin, Ireland, respectively. Less than 10% of participants did not drink champagne, and less than 1% claimed to be champagne experts. The overall sample consisted of French (n = 72) and Irish (n = 56) consumers (55% women, 73% between 18 and 35).

Once respondents agreed to participate, they were shown and allowed to handle a bottle of Ruinart Blanc de Blanc champagne. Then they were then randomly assigned to a presence condition. As visual (e.g. photographs, videos) and virtual (e.g. 360-VR) media lead to different levels of presence (Suh & Lee, 2005), a 360-VR application should lead to high presence whereas the Ruinart bottle alone should elicit low presence.

In the high presence condition, in addition to viewing a bottle of champagne, respondents were presented with a Ruinart VR application and invited to spend as much time in the virtual tour as they wanted. The 360-VR application created by the Ruinart brand immerses the customer in the storage caves of the champagne brand, and the consumer can move the tablet up or down, as well as use their fingers to zoom in and out on features presented in the caves. Those in the low presence condition were invited to take as much time as desired to evaluate the Ruinart bottle. In other words, the bottle and packaging served as the only visual media from which to derive presence. Afterward, each participant completed a pen and paper version of the questionnaire, including attitudes toward the brand (Luna, Lerman & Peracchio, 2005; four bipolar items on a seven-point scale; $\alpha = .88$) and purchase intentions (Voss, Spangenberg & Grohmann, 2003; three bipolar items: unlikely/likely; improbable/probable; absolutely not/absolutely on a seven-point scale; $\alpha = .94$). Finally, respondents indicated their champagne consumption and demographics before being thanked and debriefed.

3.2 Analysis of Results and Discussion

A MANCOVA was run with the two conditions (0 – low presence: product only, 1 – high presence: 360-VR application) as the independent variable, country (0 – France, 1 – Ireland) as the covariate, and attitude toward the brand and purchase intentions as the dependent variables. Country was not a significant covariate ($p > .07$) for either dependent

variable. As expected, presence had a significant impact on each of the dependent variables: attitudes toward the brand ($M_{High\ presence}$= 6.30 versus $M_{Low\ presence}$ = 5.62, $F(1, 125) = 23.94$, $p = .001$; $\eta^2 = .16$) and purchase intentions ($M_{High\ presence}$= 5.82 versus $M_{Low\ presence}$ = 5.08, $F(1, 125) = 12.66$, $p = .001$; $\eta^2 = .09$). Specifically, the 360-VR media (versus the low presence media) led to more positive attitudes toward the brand and higher purchase intentions, supporting H1a and H1b.

The results suggest that 360-VR, a high presence-inducing media (versus product packaging details) enhances brand responses, which provides an alternative perspective with the research of Peck and Barger (2009) such that 360-VR led to greater responses than handling the product alone and deriving presence from packaging information. We estimate that this difference emerges due to presence. However, one could argue that the reason for these results is the technological experience rather than the presence. Moreover, these results are limited in that the positive effect from the VR-360 experience could have occurred due to more (versus less) information available between conditions. Though these results provide some interesting findings, teasing apart these potential influences is necessary to investigate how 360-VR contributes to brand responses in retail settings. The subsequent study is designed to address these limitations.

3. Study 2: 360-VR Field Study

The objectives of Study 2 are to examine how 360-VR presentations in a retail setting impact consumer responses. In this field study, across all conditions, participants were able to touch the product (in a glass or even the bottle). We devised three conditions: a low presence condition with just the product and its packaging (as per Study 1), a moderate presence condition with a video tour replicating the 360-VR content, and a high presence condition using a 360-VR application of the product.

4.1 Sampling and Procedures

In order to confirm that 360-VR induces more presence than a video, a pre-test was conducted on Mturk (n = 49; 52% female; M_{age} = 34, *SD* = 9.26). Participants were screened to ensure that they were 21 or older, and that they owned a device capable of downloading the application and watching videos. Then, they were randomly assigned to one of two conditions. The 360-VR condition used the same Ruinart champagne application as per Study 1, while those in the digital condition viewed an identical version of the virtual tour, but as a video available on YouTube. While similar, the virtual visit in the application allows users to navigate and control their experience, whereas the YouTube version encourages passivity (Lecointre, 2011).

We included a timer in the questionnaire to evaluate time spent in the media. Next, participants responded to seven items on a seven-point Likert-scale measuring felt presence (Spielmann & Mantonakis, 2018; α = .90). Finally, individuals provided their demographic information before being debriefed. Independent t-tests with presence induced from the media (0- video, 1- 360-VR) as the independent variable indicated that presence was significantly greater for the 360-VR (*M* = 4.94, *SD* = 1.27) than the video (*M* = 3.99, *SD* = 1.51; *t*(47) = -2.35, *p* < .03; Cohen's d = .68). Importantly, time spent in the media did not differ across the conditions (*t*(47) = .72, *p* = .47, Cohen's d = .21).

Based on the results of the pre-test, we devised a randomized between-subjects design varying one factor on three levels (presence: low, moderate, and high). In this field study, we worked with a wine store located in the city of Reims, France. The store is located in 16th century cellars and consists of 4300 square feet of underground selling space with a tasting bar in the middle; thus, it looks quite similar to the Ruinart caves presented in the pre-tested application and video. A bilingual research associate was posted at the bar over a 3-week

period and proposed a free tasting of Ruinart champagne to customers. The study was positioned to customers as a brand communication initiative, similar to a taste test in a grocery store. In the low presence condition, customers were allowed to handle the bottle of Ruinart; presence was derived from visual information only. For the moderate presence condition, individuals were asked to view the video of the Ruinart cellar tour on YouTube. In the high presence condition, customers were presented with the Ruinart VR application. In all cases, individuals were invited to spend as much time as they liked with their respective medium, and were then invited to a champagne tasting. Afterward, customers were asked to fill in a pen-and-paper questionnaire with their opinions about the brand. The questionnaire included the same measures of brand attitudes ($\alpha = .88$) and purchase intentions ($\alpha = .96$). As in Study 1, four consumers did not complete the attitude measure and six did not complete the purchase intentions measure. Customers also completed demographic information.

4.2 Analysis of Results and Discussion

A total of 160 customers participated in the study (58% men – three respondents did not provide their gender). More than 46% of respondents were between 30 and 59 years old. An ANOVA was run using the three conditions as the factor, and brand attitudes as the dependent variable. The effect was marginally significant ($F(1, 157) = 2.46$, $p = .088$, $\eta^2 = .03$). Planned comparisons using the LSD method showed that there was no significant difference between the low (n = 53; $M_{low\_p} = 5.27$, $SD = 1.52$) and moderate presence conditions (n = 53; $M_{mod\_p} = 5.38$, $SD = 1.11$, $p = .69$), and only a marginally significant difference between the low and high presence condition (n = 54; $M_{high\_p} = 4.80$, $SD = 1.64$, $p = .09$). Importantly, there was a significant difference between the moderate and high presence conditions ($p = .03$), suggesting that the video led to higher brand attitudes than the

application, supporting H2a. Running the same ANOVA with purchase intentions as the dependent variable was not significant ($p = .45$, $\eta^2 = .01$), failing to support H2b.

These findings answer a critical question for retailers. Specifically, the results from the in-store field study indicate that higher presence-inducing virtual media in stores can dampen consumer attitudes toward the brand, although purchase intentions are not affected. This parallels the findings of Farah et al. (2019), arguing that VR should not be made available at the purchase stage of consumer decision-making. While we did not explicitly test the underlying mechanism of presence because we pre-tested the presence-inducing qualities of the media, given the nature of a field experiment, we could speculate that in-store, greater interruptions threaten flow. As supported by Huang and Wan (2019), VR demands more mental resources toward a focal brand experience, which could compete with consumer motivations to expend more mental effort in store (i.e. purchase stage). This is supported by the fact that the 360-VR experience (high presence) was evaluated less favorably than both other conditions. We now turn to online presentations of 360-VR to identify the role of knowledge.

4. Study 3: Product Category Knowledge as a Moderator to 360-VR

Study 3 has several objectives. First, it aims to test H3a and H3b, specifically that online 360-VR results in positive (negative) consumer responses when consumers have low (high) product category knowledge. Second, this study considers mental imagery as a mediator of the aforementioned relationship (H4). Lastly, the study adds generalizability by obtaining a different sample on Mturk with U.S. participants.

5.1 Sampling and Procedures

We designed an online between-subjects experiment on Mturk with US respondents, with one manipulated condition (presence: low versus high) and one continuous moderating variable: product category knowledge. In this case, the study used the same Ruinart video and 360-VR content from Study 2 to induce low and high presence, respectively. The study recruited 228 participants (57% female, M_{age} = 37, SD = 10.3). An initial screening question asked respondents to indicate devices available to complete the survey (e.g. Smartphone, iPad, iPhone, etc.) and device features (e.g. sound, video, etc.). Only those who had an iPad or iPhone with sound and video capabilities qualified for the questionnaire (less than 1% disqualified). We then reminded the remaining respondents to turn up their iPad/iPhone volume. Next, participants were randomly assigned to one of the two media conditions. An attention check question, referring to both the video and application content, ensured that all participants completed the manipulation before moving on to the questionnaire.

Next, participants responded to the same variables as in Study 1: attitudes (α = .92) and purchase intentions (α = .96). Then, they answered two items on champagne (product category) knowledge (Mueller, Francis, & Lockshin, 2008; r = .78; p < .001). Next, 10 items measured mental imagery as the mediator, borrowed from the seven-point Likert-type mental imagery scale (Walters, Sparks, & Herrington, 2007; α = .87) with items "It was easy for me to imagine being at the Ruinart cave" and "Whilst reviewing the experience, many images came to mind." Afterward, participants indicated their degree of loyalty to another champagne brand (i.e. not Ruinart) on a 7-point scale (1 = not at all, 7 = very much) as a covariate. Next, to ensure that the results were not driven by differing media experiences, participants completed five items to provide an overall opinion of the experience using a 7-poing scale (dislike/like, offensive/tasteful, unfavorable/favorable, repulsive/appealing, disturbing/pleasing; α = .90). Finally, they completed manipulation checks and demographics.

5.2 Analysis of Results and Discussion

To ensure that the overall media experience was same, an independent sample t-test was employed, and, as expected, provided no evidence that the media evaluation differed across conditions (t = .31, p = .75, Cohen's d = .05). We ran PROCESS model 1 (Hayes, 2018) with presence as the factor (0 = video with low presence, 1 = 360-VR with high presence), mean-centered product category knowledge as the moderator, loyalty to champagne brands (p < .04) as a covariate, and brand attitudes as the dependent variable. The analysis revealed a significant interaction between presence and product category knowledge (b = -.17, t = -2.11, p = .03), with a main effect of product category knowledge (b = .08, t = 1.98, p < .05).

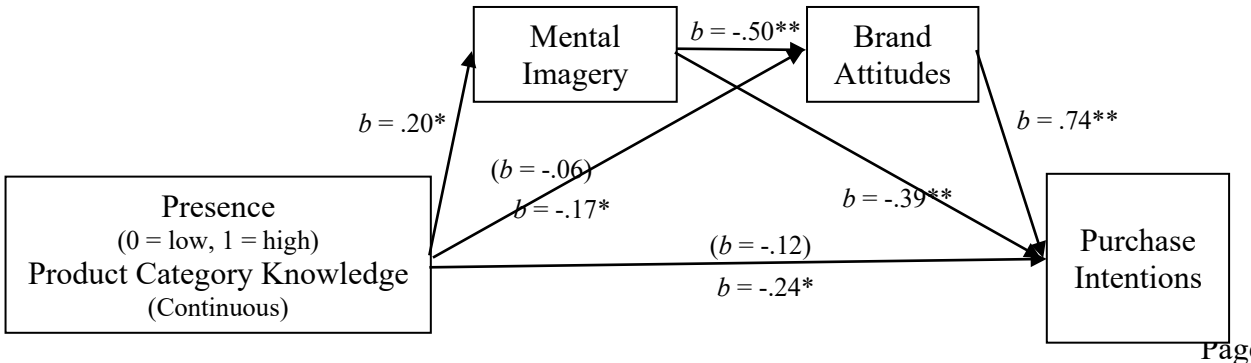
Since the moderator (e.g. product category knowledge) was continuous, we examined the turning points for where the effects of the independent variable (presence-inducing media) veer from non-significant to significant at p = .05. We employed the Johnson-Neyman technique (Bauer & Curran, 2005; Hayes, 2018; Hayes & Matthes, 2009). The Johnson-Neyman technique showed that product category knowledge (M = 3.69) at a value of 3.30 is the turning point for a significant media effect. While below 3.30, product category knowledge does not influence the relationship between the media and attitudes when knowledge is above the value of 3.30. 360-VR is associated with significantly lower attitudes than the video.

Next, we ran an identical PROCESS model 1 with purchase intentions as the dependent variable. A significant presence x product category knowledge interaction emerged (β = -.24, t = -2.54, p = .01), with a main effect of product category knowledge (β = .23, t = 4.85, p < .001). Again, we examined the turning points for where the effects of the independent variable (presence) veer to significant at p = .05. The Johnson-Neyman technique showed that product category knowledge at a value of 1.96 and 5.37 were the turning points

for significant presence effect. While equal to or below 1.96, high presence (360-VR) has a positive effect on purchase intentions. There was no significant moderation between product category knowledge above 1.96 and below 5.37. Again, product category knowledge at a value of 5.37 represented a turning point for significant presence and purchase intention effects. In particular, when knowledge is above the value of 5.37, high presence (360-VR) is associated with significantly lower purchase intentions than low presence (the video). In sum, H3b was fully supported, while H3a was partially supported. Specifically, product knowledge lowers attitudes for those high in product knowledge, but does not affect those low in product knowledge.

Using Hayes (2018) macro (PROCESS Model 85, 5,000 bootstraps, percentile CI), we tested our full conceptual model (presence x product category knowledge → mental imagery → brand attitudes → purchase intentions), where product category knowledge was the moderator. The results support serial mediation of mental imagery and brand attitudes in the relationship between presence, product category knowledge, and purchase intentions (indirect effect = -.08, 95% CI [-.15, -.01]). Moreover, the direct interaction effect of presence and product category knowledge on purchase intentions was not significant (b = -.12, t = -1.65, p = .10). The interaction between presence and product category knowledge on purchase intentions was entirely mediated by mental imagery and brand attitudes, respectively (Hayes, 2018), supporting H4 (see Figure 2 below).

Figure 2. Study 3 Results of Serial Mediation using PROCESS Model 85



*$p < .05$, **$p < .001$

This study builds upon the prior studies by providing greater insight into the role of high presence (i.e. 360-VR) versus low presence (i.e. video) inducing media on brand evaluations. Specifically, consumers with mid to high product category knowledge had poorer attitudes toward the brand and purchase intentions after viewing a 360-VR tour than a video. While those with low knowledge did not experience more favorable attitudes toward the brand following the 360-VR (versus video), their purchase intentions were enhanced. Thus, for low knowledge individuals, 360-VR leads to more changes in purchase intentions than attitudes, per se. Additionally, it appears that mental imagery, and thus brand attitudes, is diminished in the 360-VR when there is higher prior knowledge, which may represent a mismatch of the processing mode and processing preference (Dimofte, 2010; Spears & Yazdanparast, 2014). Overall, our findings suggest that 360-VR can be beneficial for consumers with low knowledge, though not for consumers with high knowledge. Still, much less is known about the role of sensory cues in 360-VR online retail environments, and whether haptics as a semantic cue can attenuate these negative effects. We explore this next.

5. Study 4: Haptic Imagery in 360-VR

The objectives of study 4 are three-fold. First, we aim to compare haptic and visual cues in online retail environments to evaluate hypotheses 5a and 5b; we expect haptic sensory information to serve as a boundary condition. Second, we aim to re-confirm the role of mental imagery (H4). Third, we aim to increase the generalizability of our previous findings by changing the online retail context. We use automobiles for Study 4. Many consumers conduct their car research (and even select a vehicle) online before making the purchase (Anderson, 2015), suggesting that online retail experiences may even be more important than real retail experiences (i.e. at dealerships), and provides an opportunity for creating meaningful

touchpoints at earlier phases in decision-making. While haptics in this case may not be diagnostic, the goal is to examine haptics as an affective stimulus, matching the processing style of those high in product category knowledge.

6.1 Sampling and Procedures

We devised an online between-subjects experiment on Mturk with U.S. respondents, with two manipulated variables and one measured variable. For the first manipulated variable, media-induced presence, individuals viewed one of two versions of the BMW website. The first website included a 360-VR simulation, thus capable of inducing higher levels of presence, in which users could zoom, change views, customize the car, and access features. The second website only showed video imagery of the vehicle and allowed users to scroll down the page providing information about, and images of, the car. We conducted a pre-test on Mturk (n = 54; 61% female; M_{age} = 33, SD = 8.15) to measure presence (α = .93) on these two websites, using the same procedures and measures as in the pre-test for Study 2. Independent sample t-tests indicated that presence was experienced to a greater extent on the 360-VR website (M = 4.30, SD = 1.37) than on the video website (M = 3.25, SD = 1.42; $t(52)$ = -2.71, $p < .01$, Cohen's d = .75). Thus, the manipulated media condition was deemed appropriate for the main study.

The second manipulated variable, haptic imagery, was varied through the website instructions. We randomly assigned the haptic imagery manipulation to half of the participants, where, following Peck et al. (2013), they reviewed the website whilst focusing on the texture of the inside and the outside of the car. The goal of the manipulation was to enhance perceptions of touch – though physical touch was absent, consistent with past research – given that haptic instructions can replicate outcomes of physical touch. Those without the haptic instructions were only instructed to review the content.

Participants viewed one of four conditions of the 2 (presence: low versus high) by 2 (haptic imagery instructions: present versus absent) between-subjects design. Participants then evaluated the car and responded to the following variables: product category knowledge (r = .74; $p < .001$), brand attitudes (α = .91), purchase intentions (α = .96), and mental imagery (α = .93). Afterward, respondents answered the same covariate question (concerning car brand loyalty) and the same control for attitudes toward the experience (α = .93). We then included a manipulation check for haptic imagery, which consisted of a three-item, seven-point Likert scale (α = .88) assessing the extent to which participants felt they had physically touched the car, borrowed from Peck et al. (2013). Finally, individuals provided demographics.

6.2 Analysis of Results and Discussion

A total of 185 participants participated in the survey (55% female, M_{age} = 38 *SD* = 12.7). To verify the haptic manipulation, an ANOVA was run with presence (0 = low presence, video, 1 = high presence, 360-VR) and haptic imagery (0 = absent, 1 = present) as the independent variables, and the touch manipulation check index as the dependent variable. There was only one main effect, whereby those who read haptic instructions felt they had touched the car more (M = 5.43, SD = 1.15) than those who did not (M = 4.76, SD = 1.45; $F(1, 184) = 11.56$; $p = .001$, $\eta^2 = .32$). Moreover, when conducting the same ANOVA with attitudes toward the experience as the dependent variable, there was no interaction ($p = .28$, η = .007), main effect of the touch instructions ($p = .95$, η < .001), or main effect from presence ($p = .31$, η = .006). Thus, the haptic imagery manipulation was deemed successful.

Using PROCESS Model 3 (Hayes 2018), presence (0 = low presence, 1 = high presence) served as the independent variable with mean-centered product category knowledge (continuous) as the first moderator, and haptic imagery instructions (0 = absent, 1 = present) as the second moderator; car brand loyalty was a covariate ($p < .01$), with attitudes as the

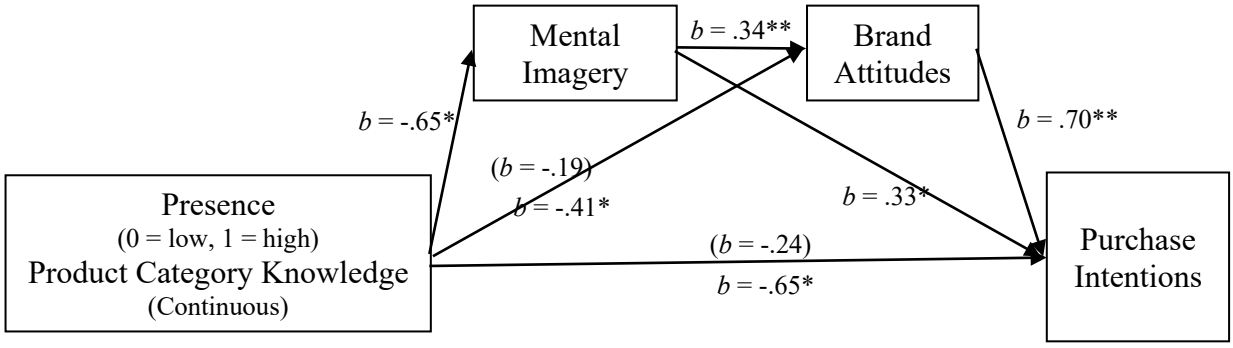
dependent variable (b= .44, t = 2.29, p < .01). Overall, this 3-way interaction supports the model in Figure 1. Moreover, there was a 2-way interaction of knowledge x presence (b = -.21, t = -2.65, p < .01), and a main effect of haptic instructions (b = .28, t = 1.95, p = .05) and knowledge (b = .08, t = 2.04, p = .04). To further explore the three-way interaction, we examined the conditional presence x product category knowledge interaction at values of absent and present haptic imagery. As expected, when haptic imagery was present, there was no interaction (b = .01, F = .01, p = .92), but the interaction was significant in the absence of haptic imagery (b = -.52, F = 12.77, p < .001). Since the first moderator (e.g. product category knowledge) was continuous, we examined the turning points for where the effects of the independent variable (presence) turn to significant at p = .05. The Johnson-Neyman technique revealed that product category knowledge (M = 5.56) at values of 3.00 and 6.07 are turning points for a significant presence effect. While at or below 3.00, product category knowledge increases the relationship between 360-VR (versus video) and attitudes, whereas knowledge at or above 6.07 indicates that 360-VR (versus video) is associated with significantly lower attitudes.

The same regression was run using PROCESS Model 3 (Hayes, 2018), but with purchase intentions as the dependent variable. A 3-way interaction emerged (b = 1.09, t = 2.97, p < .01), driven by main effects of product category knowledge (b = .50, t = 5.28, p < .001) and haptic imagery (b = .57, t = 2.32, p = .002). To further explore the three-way interaction, we examined the conditional presence x product category knowledge interaction at values of haptic imagery absent and present. As expected, the presence and product category knowledge did not interact when haptic imagery was present (b = .22, F = 1.04, p = .3), but did so significantly in the absence of haptic imagery (b = -.87, F = 8.45, p < .01). To further explore the three-way interaction, we examined the conditional presence x product category knowledge interaction at absent and present values of haptic imagery. Since the first

moderator was continuous, we examined the turning points for where the effects of the independent variable (presence) turns to significant at $p = .05$. The Johnson-Neyman technique showed that product category knowledge at a value of 3.63 and 6.07 were the turning points for significance. While equal to or below 3.63, 360-VR (versus video) increased purchase intentions. Again, product category knowledge at a value of 6.07 and above represented a turning point for significant media effect on purchase intentions. In particular, when knowledge is above 6.07, 360-VR (versus video) is associated with lower purchase intentions. Taken together, the analysis supports H5a and H5b.

Using Hayes (2018) macro (PROCESS Model 85, 5,000 bootstraps, percentile CI), we tested our full conceptual model (presence x product category knowledge → mental imagery → brand attitudes → purchase intentions), where product category knowledge was the moderator. Given the limitations of the PROCESS macro, we ran two models, one where cases were filtered to haptic instructions = 0, and a second where haptic instructions = 1. When haptic instructions were absent (= 0), the results supported serial mediation of mental imagery and brand attitudes on the relationship between presence, product category knowledge, and purchase intentions (indirect effect = -.15, 95% CI [-.29, -.05]). Moreover, the direct interaction effect of presence and product category knowledge on purchase intentions was not significant ($b = -.29$, $t = -1.24$, $p = .22$). The interaction between presence and product category knowledge on purchase intentions was entirely mediated by mental imagery and brand attitudes respectively (Hayes, 2018), supporting H4 (see Figure 3 below). When running the same analysis for present haptic instructions (= 1), the results did not support mediation (indirect effect = -.01, 95% CI [-.07, .03]).

Figure 3. Study 4 Results of Serial Mediation using PROCESS Model 85



*$p < .05$, **$p < .001$
Haptic Instructions = 0 (absent)

The results of Study 4 provide important insights. Specifically, touch appears to be a powerful boundary condition to the effect of product category knowledge in 360-VR online retail environments on consumer responses. 360-VR for a high knowledge consumer can dampen responses; it does not facilitate mental imagery (as in Study 2) because of a mismatch between enacted processing mode and preferred information processing style. We nonetheless demonstrate that haptic imagery can attenuate these effects. These results are generalizable to remote locations, as evidenced in Study 2.

6. General Discussion

Across four studies, this research demonstrates novel and relevant findings for retailers: positive brand evaluations and increased purchase intentions following a 360-VR online retail experience depend on individual product category knowledge, presence induced in the experience, and haptic input. We demonstrate that 360-VR increases brand evaluations and purchase intentions, however this effect is dependent on product category knowledge. Specifically, 360-VR (versus less presence-inducing media such as video content) results in attenuated (versus augmented) consumer responses when consumers have high (versus low) product category knowledge. This effect occurs because the processing style cued by 360-VR

results in presence. However, we also provide insight as to *where* 360-VR is most effective. In-store, consumers process information differently. The results demonstrate that 360-VR (versus less presence-inducing video content) dampens attitudes toward the brand, but has no effect on purchase intentions. We predicted that this would occur as a result of a mismatch between the cognitive effort required when engaging with 360-VR and that required when viewing, versus being, in a retail setting. Moreover, we predicted that mental imagery would be the underlying mechanism explaining this interaction. We also proposed that haptic cues would serve as a boundary condition to this interaction, enabling an instance of processing style match for those with high knowledge.

In sum, across two brand contexts and within three cultural contexts, our findings reveal that 360-VR retail environments are best used online versus in-store if retailers wish to positively influence brand responses (Studies 1 and 2). However, when consumers have high product category knowledge, online retail environments presented in 360-VR worsen brand attitudes and purchase intentions, because they compete with consumers' preferred semantic processing style and dampen mental imagery (Study 3). Study 4 replicates these findings, but further demonstrates that when haptic information is presented in 360-VR, these negative effects are attenuated. Therefore, 360-VR online retail environments can, when not taking into consideration the target market, be disadvantageous for brands. Yet, when segmenting consumers based on their product knowledge, and having high knowledge participants focus on haptic imagery, brand attitudes increase, as do purchase intentions.

This research makes three key scholarly contributions. First, it contributes to our understanding of technology in the retail space (Grewal et al., 2017) as it pertains to retail touchpoints. Recent research examines how virtual servicescapes can be modeled in order to maximize brand intentions (Orth et al., 2019) and we build upon this finding. Specifically, we outline *where* 360-VR should be used by retailers (online versus in-store). Other research also

examines how brand attitudes can be explained by presence-inducing media (Spielmann & Mantonakis, 2018); we build upon this research by demonstrating what might moderate and mediate the influence of 360-VR on brand evaluations and purchase intentions. In doing so, we provide clearer answers as to *for whom* and *when* 360-VR is efficient for retailers. By integrating product knowledge, mental cues, and haptics, we provide a more detailed roadmap of the theoretical underpinnings of 360-VR use for retailers. 360-VR may be most helpful online and beyond the retail space in affecting consumer attitudes and future purchase intentions. Yet, when consumers are in-store (e.g. Study 2), the results indicate that brand attitudes can suffer when presenting 360-VR experiences (versus video).

Second, the research advances knowledge on sensory marketing in digital settings, specifically. Contrary to past research, which focused on brands and retail environments (e.g. Yoon & Park, 2012), we show that visual (versus other) sensory inputs in online retail environments do not always have the most positive effect on brand evaluations. Rather, haptic cues have the greatest impact on consumer brand evaluations, even online. Still more research is needed to understand how haptic cues versus other sensory elements are most efficient in 360-VR. Nonetheless, this research bridges the gap between sensory marketing and technology for retailers. In particular, this research provides new perspectives for the literature on multisensory cues featuring haptic elements, a neglected area of sensory marketing. Rather than haptic and visual cues creating a cumulative experience, touch serves as a boundary condition online in 360-VR, overriding the effects of visual cues, and triggering a more meaningful experience.

Third, this research outlines the importance of mental imagery and product category knowledge in online retailing. Product category knowledge is often crucial for consumer purchases and facilitating mental imagery (e.g. Spears & Yazdanparast, 2013). Whereas past research indicates that mental imagery (imagining versus considering) is a more efficient

route to information processing (e.g. Ketron et al., 2016), we show that this is more nuanced than originally explained and, in fact, can decrease consumer attitudes and purchase intentions when the retailing context is presented in 360-VR. Indeed, 360-VR experiences may lead to mental imagery, but this type of information processing may not be preferred by all consumers. In fact, imaginative routes may be unpersuasive because of a mismatch in processing style cued by the media and existing consumer knowledge.

Finally, and along these lines, extant research has rarely investigated prior knowledge or mental imagery in VR. Typically, much research in VR supports knowledge, due to perceived presence, as an outcome of VR (e.g. Daugherty et al., 2008; Jayanthila & Rajendran, 2016). The little research incorporating prior knowledge as an antecedent shows that knowledge tends to predominate over product representations (Soderman, 2005). For instance, high and low levels of knowledge may decrease time spent in 360-VR retail environments, whereas knowledge does not influence time spent in online retail stores (Mazursky & Vinitzky, 2005). Given these findings, it would stand to reason that mental imagery may be an important element of visual sensory content in VR. We propose that this cognitive process can be disrupted via semantic cues. Our research, using 360-VR in online retail environments, provides initial evidence of this. We demonstrate that prior knowledge can have a positive or negative impact on consumer responses, depending on the level of presence induced by the experience.

8. Managerial Implications

The results suggest how retailers can optimize technology, especially when using online retail environments, as long as these are off-site. Specifically, 360-VR may help to communicate the brand story online, but the impact of this storytelling can be lost in store aisles due to cognitive competition. The results further suggest that 360-VR used online

(versus in-store) favors consumers with lower product knowledge. Since consumers with lower product knowledge typically shop in supermarkets or discount stores rather than at specialty boutiques (Cowan & Spielmann, 2017), there is opportunity to integrate personalized, digital experiences at each touchpoint for these types of retailers. Specifically, when retailers are highly specialized, they should use videos and pictures to avoid competition of their online media with existing consumer knowledge. However, when retailers are more generalized, with a less knowledgeable clientele, 360-VR online will be more effective.

Concurrently, we show that brands and retailers alike should use sensory factors to stimulate the imagination, especially by using 360-VR online retail environments for such consumers. Finally, 360-VR should integrate touch experiences, which are incredibly powerful and can be used universally. Importantly, if retailers sell specialty products or have highly knowledgeable consumers, and would prefer to use 360-VR, they should include haptic cues online, in addition to 360-VR, in order to encourage positive brand evaluations.

9. Limitations and Future Research

This series of experiments has its limitations. One of these is the sample populations. Although the studies attempt to generalize geographically, the samples represent only three countries. A second limitation concerns the sample in Study 2. Although this field study aimed to test hypothesis 2 using an in-store setting and provide greater ecological validity, it could suffer from self-selection bias. Likewise, the sampling frame in Study 3 requires individuals to own an Apple product because the app could only be downloaded onto iOS devices, which introduces sampling frame bias. In Studies 1 and 2, we hypothesize and find differences in consumer responses when 360-VR is remote versus on-site, yet we did not explicitly test the location as a moderator. We believe that this could be accomplished through

further research, including investigating when on-site 360-VR might be beneficial. Further, the haptic manipulation also provides a limitation. While haptics have an important role in digital strategy, as shown in Study 4, it is unclear how retailers should use such features. Many have been experimenting with ways to increase touch sensations. There are opportunities for future studies in this area. Given the knowledge gap concerning haptic cues, many opportunities exist to enhance theory and practice. Moreover, the types of products used could also change the importance of sensory input, such that touch may be less important for champagne than for cars. It would also have been optimal to test H1a, H1b, H2a, and H2b in a single study, using one brand that used 360-VR both online and in-store – however this is difficult, as most brands consider only one of those two options.

Although the goal of the research was to highlight the role of 360-VR online retail environments and sensory input, we do not compare these results across many different product categories. The results should therefore be extended to convenience and habitually purchased goods for which product knowledge is less important in the purchase decision. Further, our research is focused on 360-VR online retail environments. Given differences in VR applications, and their role in triggering presence and cognitive states, more research is needed to generalize to other types of VR. For example, future research should enlist head-mounted displays and virtual worlds to investigate sensory modalities across VR applications.

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