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**INFLUENCE OF EMBODIMENT AND CHALLENGES ON CONSUMERS'
BEHAVIORAL INTENTIONS DURING A VIRTUAL REALITY EXPERIENCE**

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INFLUENCE OF EMBODIMENT AND CHALLENGES ON CONSUMERS' BEHAVIORAL INTENTIONS DURING A VIRTUAL REALITY EXPERIENCE

Abstract:

The development of virtual reality (VR) applications provides users to physically interact in the virtual environment as in a real experience. This new experience offers for brands a new way to promote their offer to consumers, becoming the avatar and accomplish goals based on gamification mechanisms like video games. While actors from different professional fields are developing VR experiences (VRE), especially in the tourism industry, several works has focused on the role of VRE on enjoyment but not between the role played by gamification between the feeling of embodiment (resulting of the VRE sensorimotor interactions) and behavioral intentions. The research aims to measure the effects of the feeling of embodiment during a VR tourism experience on consumers' behavioral intentions and the role of the challenges level offered as moderator. Results of the experimental (n=200), where the user embodies a kayaker exploring Antarctica, confirm that the feeling of embodiment induces positive behavioral intentions towards the discovered tourist destination. More specifically, a greater intensity in the level of challenges offered to achieve the virtual experience moderates with greater intensity the relationship between feeling of embodiment and behavioral intentions. On a theoretical level, research enrich literature in marketing through the concept of embodiment, never used before. The study also makes recommendations to professionals and VR application developers on the positive effects of VRE directly related to the feeling of embodiment as well as the challenges offered. Finally, the study sets out certain limits to follow for further research in the field of marketing.

Keywords: « virtual reality »; « embodiment »; « gamification »; « challenges »; « behavioral intentions »; « experiential marketing »

INTRODUCTION

Thanks to VR, the consumer can discover the offer before buying it (Oh *et al.*, 2007), explaining its increasing use by professionals to promote their offer (Hashish, 2019), especially those of tourism (Guerra *et al.*, 2015) take advantage that today, 26 million consumers own a VR headset (Omdia, 2021) and that this figure will double by 2025 (*ibid.*). Given the tremendous growth of VR, we believe it is essential to understand the role of VR on consumer attitudes and behavior. Indeed, as consumer behavior evolves with technological innovations (Bargain and Camus, 2017), it is fundamental to "reconsider how to think and design experiences in virtual environments" (Gorisse, 2019, p.20) even though VR could, in the next few years, become accustomed in everyday uses (Alcañiz, 2019).

The emergence of immersive technologies (Milgram *et al.*, 1994) offers the opportunity to discover extraordinary and memorable experiences for consumers (Arnould and Price, 1993) in experiential marketing contexts (Flavián *et al.*, 2021). VR enhances interactivity with the offer, changing the modes of control as well as the engagement of the participant and his or her body (Flavián *et al.*, 2019).

VR is a computer-based, interactive and multi-sensory environment that operates in real time and involves living or bringing to life a story that is focused on inducing emotions and engaging multiple human senses, and it thus stimulates greater mental imagination (Henderson *et al.*, 2007; Barnes, 2011). The body does indeed take an important place when the participant performs VR activities (Fuchs, 2018).

The rise of VR provides ideal ground for brands to place their offers by proposing playful, original, and pleasant experiences in which the consumer embodies the main actor's role and can interact with their whole body in the metaverse (shared virtual space, immersive, accessible

in real time with sensorimotor interactions, in which it is possible to embody characters) (Roth *et al.*, 2020).

A significant amount of marketing research on VRE has recently emerged, particularly for tourism offerings (Hopf *et al.*, 2020; Pasanen *et al.*, 2019; Marasco *et al.*, 2018). These last ones show how important it is for destinations and brands to understand their customers to attract them and best promote their locations (Pesonen and Pasanen, 2017).

In VRE, embodied avatars beyond “on real-life experience [...] that often reached beyond real-life conditions” (Nagy and Koles, 2014, p. 1130). When the VRE occurs, individuals reflect their personality traits on the avatar (Belisle and Bodur, 2010) as if they were inhabiting him (Gee, 2008, p.258). What's more, with real sensorimotor interaction mechanisms (Galvan Debarba *et al.*, 2017). Although this established knowledge exists, there is a lack of empirical research considering the impact and cognitive effects of embodiment on sensorimotor interactions and their mechanisms, as well as their subsequent impacts on consumer behavior. Here we set out to determine the extent to which sensorimotor interactions can create a feeling of embodiment that then has positive effects on consumer's behavior after the VRE.

Furthermore, during VRE, these activities often incorporate gamification elements, such as challenges. Generally requiring the completion of a set of tasks, challenges are part of gamification mechanisms, aiming to create and stimulate iterative behavior on the part of the individual (Salen *et al.*, 2004). Challenges therefore have a central place in VRE. They underlie a psycho-motor (Barnes, 2011) and cognitive (Hamdi-Kidar and Maubisson, 2012) engagement of the participant. However, the influence of challenges on the VRE has been little studied in the marketing literature (Caroux, 2023; De Simone *et al.*, 2012).

To summarize, this research investigates the role of embodiment and level of challenge on tourist-consumer's behavior during a VRE.

Therefore, beyond the technical configuration proposed to live the VRE, we ask what influences do the sense of embodiment and the challenges during VRE have on the user's behavioral intentions towards the discovered destination and activity?

Theoretically, the aims of this research are to study for the first time these effects in VRE experiences and in marketing, in this instance the positive role played by embodiment and challenges offered on behavioral intentions with a VR application. The study makes also recommendations to professionals and VR application developers on the positive effects of VRE directly related to the feeling of embodiment as well as the challenges offered. Finally, the study sets out certain limits and avenues of research to follow for further research in the field of marketing.

LITERATURE REVIEW

Considered the most immersive digital technology (Fuchs, 2018), VR allows the user to feel as if they are becoming the protagonist of the virtual experience by interacting in real time (Harris *et al.*, 2001), which tends to foster a sense of truly embodying the avatar within the virtual environment (Roth and Latoschik, 2020; Spanlang *et al.*, 2014). In the literature, it is recognized that any effort to foster interaction with the offer and its environment is likely to improve the embodiment (Krishna, 2013; Elder et Krishna, 2012). While many studies have established that VRE have a positive influence on consumers' enjoyment and immersion as well as behavioral intentions (Marasco *et al.*, 2018; Pasanen *et al.*, 2019), very few have investigated their determinants, while the relationship with the embodied virtual character, in front of the player's surrogate mind and body (Gee, 2008) and in completing challenges (Hamdi-Kidar and Maubisson, 2012), is central.

The feeling of embodiment

To embody literally means ‘to enter into the flesh’. Embodiment is a concept currently mobilized in VR and user perception research (Roth *et al.*, 2020; Galvan Debarba *et al.*, 2017). According to Biocca (1997), the self in the VE is composed of the individual’s real (physical) body, their virtual body (visible or not in the experience), and their mental representation of the virtual body with their real body. Kilteni *et al.* (2012) assert that the user feels that they are in the virtual body when their motor properties are perceived as being identical to those of their real body. It is through this approach that we study the concept of embodiment, as the user in a VRE becomes an agent playing the lead role in the virtual persona’s ‘skin’. Embodiment corresponds to a fusion between the human and the virtual body, then forming the same entity (Tussyadiah *et al.*, 2017; Flavián *et al.*, 2020).

Agency and self-localization are the dimensions that compose the feeling of embodiment (Roth *et al.*, 2020). Agency corresponds to the coordination between the intention expected by the individual through their bodily actions and the effective responses that manifest in the VE. The more that movements performed in the real sphere correspond to those observed and reproduced in the virtual sphere, the greater the agency experienced by user (Caspar *et al.*, 2015). Ownership corresponds to the user attributing the virtual body to their own body and can even stretch as far as feeling real bodily sensations in response to what happens to the virtual body in the VE (Tsakiris, 2009). Ownership is like a mental transfer where the person becomes aware of the bodily reactions resulting from sensory stimulation.

With VR, users no longer just see the offering, "but interact with it and experience it" (*ibid.*, p. 1464). This "experience with products in the virtual world (without interacting with their physical counterparts) plays an increasingly important role" (Łysik and Łopaciński, 2019, p. 42). Interacting even virtually with the offer strengthens satisfaction with the experience and then leads to consumer commitment and purchase intention towards the offer (*ibid.*).

Compared to a website, VR allows interactions as they would be possible in a real environment (Luangrath *et al.*, 2021; Alcañiz *et al.*, 2019). Having interactive contacts with the offer becomes scripted in experiences involving the person physically. Indeed, it is no longer a matter of orienting or zooming using the keyboard and mouse, for example, but of using all or part of one's body and performing the same gestures in the same way as they would in a real environment (Kilteni *et al.*, 2012). This phenomenon thus corresponds to embodiment (*ibid.*; Flavián *et al.*, 2019). According to Tsakiris *et al.* (2006), haptic and ad hoc interactions in VR lead to the feeling of embodiment. Indeed, the "digital representation of the product's touch" (Luangrath *et al.* 2021, p. 5) can lead to perceiving the virtual experience as identical to the actual lived experience and consider the virtual body as one's own body (*ibid.*). To this end, the power of VR is superior to less immersive media (Łysik and Łopaciński, 2019). Elder and Krishna (2012) were the first in marketing to study the role that body involvement, and more specifically the embodiment of a virtual body, has on an individual's behavioral intentions following interaction with an offer. These authors have shown that embodiment experienced through motor stimulation leads to positive behavioral intentions of the user towards the offer (*ibid.*). Thus, we formulate the following hypothesis:

H₁: For a VRE, the embodiment felt has a positive effect on behavioral intentions.

More specifically: **For a VRE, the embodiment felt has a positive effect on the intentions to discover and visit the destination for real (H_{1a}) and to the intention to (re)do the sport activity for real (H_{1b}).**

The role of challenges

Gamification mechanisms (Harwood and Garry, 2015) "better engages end users" (Liu *et al.*, 2011, p. 1). We therefore assume that challenges, as an experiential condition, will influence the sense of embodiment through a mechanism of mental and physical transfer of goals from

the embodied avatar to one's own person (Gee, 2008) to complete these challenges and that the efforts undertaken to complete them (Hamdi-Kidar and Maubisson, 2012) will engage the skills of the individual (Gee, 2008; 1996). Several studies have shown that sensorimotor interactions positively impact feelings of embodiment (Roth *et al.*, 2020; Galvan Debarba *et al.*, 2017). The pseudo-natural interactions enabled with VR make it easier to accomplish challenges (Foloppe, 2017). Indeed, the techniques developed in VR to interact in virtual environments are often similar to those in real environments (Sternberger, 2006). This allows, on the one hand, to facilitate the understanding of interaction systems in the virtual environment, then transposed to the identical of the real space (Foloppe, 2017) and, on the other hand, to affect the perception of actually being the virtual character thanks to a natural behavior that does not require prior learning (Fuchs *et al.*, 2006). This feature improves the degree of perceived realism during sensorimotor interactions performed to carry out activities in the virtual environment (Foloppe, 2017). There is then an increased credibility on the mental illusion resulting from sensory realism (Kilteni *et al.*, 2012). Thus, it therefore reinforces the bodily properties of the virtual body with those of the real body (*ibid.*, Fuchs *et al.*, 2006). Furthermore, the motor interactions required to complete the challenges will enhance the sense of agentivity (Grodal, 2003) and possession (Klein and Borelle, 2019) and lead to the sense of embodiment (Harwood and Garry, 2015).

Moreover, when interactions with the offer engage the individual bodily, behavioral intentions are better (Krishna and Schwarz, 2014). The work of Lupinek *et al.* (2021) also concludes the positive influence of interaction on behavioral intentions during VR consumption experiences, highlighting in particular the role of the user's body involvement. That's why, we consider the level of challenges as a moderator between embodiment and consumer behavior.

Indeed, according to Salen and Zimmerman (2004), goal attainment is closely related to the appreciation of the quality of playability. The higher the participant's goal attainment, the

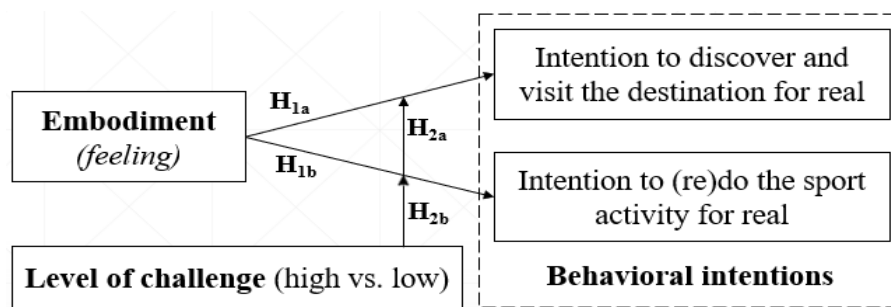
more engaged he or she will feel (Liu *et al.*, 2011) and, consequently, the more he or she will feel that the virtual environment and the real environment are merging (Gee, 2008). This leads us to formulate the following hypothesis:

H₂: A high (vs. low) level of challenge positively moderates the effect of embodiment on behavioral intentions.

More precisely: **A high (vs. low) level of challenge positively moderates the effect of embodiment on the intentions to discover and visit the destination for real (H_{2a}) and to the intention to (re)do the sport activity for real (H_{2b})**

The following figure presents the representation of the theoretical model.

Figure 1. Theoretical model of the proposed research.



METHODOLOGY

To answer the research question, we carried out an experiment with participants during a university event that took place in Angers in 2022. Two hundred participants characterized by a varied profile (individuals of different ages, socio-professional categories, lifestyles, etc. – which corresponds to the population targeted by our research) carried out the proposed VR experience. Participants were randomly assigned to one of our two experimental units (two levels of challenge: low vs. high) taking care that the two samples (low vs. high) are homogeneous in terms of gender, occupation, age and education. We have followed a

between-subjects approach. The resulting convenience sample (n=200 after data cleaning) was focused on individuals who were old enough to travel and to finance the offer with their own income in this case, a journey. We paid particular attention to obtain a normal distribution for each experimental cell. The following table describes the sample of respondents in detail.

Table 1. Sample description and subsamples comparison

	High-level	Low-level	Total	Chi ² (F)	ddl	p
	100	100	200			
Gender						
Female	57.0%	61,0%	59,0%	1.979 ^a	1	.159
Male	43.0%	39,0%	41.0%			
Occupation						
Employee	23.6%	11.5%	19.3%	5.753 ^a	7	.569
Blue-collar worker	7.3%	0.0%	4.6%			
Entrepreneur	1.8%	1.9%	1.8%			
Retired	1.8%	0.0%	1.2%			
Unemployed	1.8%	0.0%	0.3%			
Executive	18.2%	23.1%	21.3%			
Middle manager	23.6%	30.8%	19.2%			
Students	21.8%	32.7%	32.3%			
Age	37.0	32.1	34.5	(.117)	1	.050
Education						
High school diploma or less	34.5%	15.4%	28.7%	6.936 ^a	3	.733
Bachelor degree	34.5%	36.5%	36.9%			
Master degree	25.5%	28.8%	26.8%			
> Master degree	5.5%	19.2%	7.6%			

The experiment is produced by National Geographic and available on the Oculus Store¹. During this one, the participant is immersed for about ten minutes in a kayak ride to discover the virtualized Antarctic. Sensorimotor interactions allow exploration of the virtual environment. For the weak challenge, the user simply goes from point A to point B. The strong challenge requires following a specific path and take a picture of two animals.

Next, we performed a principal component analysis (PCA) and a confirmatory factor analysis (CFA) under IBM SPSS (v26) of the measurement instrument related to embodiment. We

¹ Official VR app store for Meta Quest head mounted devices owned by Meta (formerly Facebook).

selected the scale of Roth and Latoschik (2020). We selected the one of Bigné *et al.* (2001) to measure the intention to visit and discover the destination for real; and the one of Supphellen and Nysveen's (2001) to determine the intention to (re)do the sport activity for real.

The items of our scale (post-PCA) and the calculated indices of the CFA were controlled. The PCA allows us to rule on the representativeness of our construct according to the Kaiser, Meyer and Olkin test ($KMO > 0.6$; $p < 5\%$) (Kaiser and Rice, 1974) and the verification of convergent and discriminant validity (Fornell and Larcker, 1981), whose communality indices and mean variance explained (VME) are satisfactory ($\lambda > 0.5$ and $VME > 60\%$). The CFA shows the reliability of the measurement scale with respect to Cronbach's alpha ($\alpha > 0.7$) and Dillon-Goldstein's Rhô ($\rho > 0.7$) estimated in Xlstat (v2018) given our relatively moderate sample size (Jakobowicz, 2007). Refer to Table 2 for more details.

Table 2. The validation scale (SPSS, v26; Xlstat, v2018)

Measurement scale	λ	KMO	Sig.	α	ρ	AVE
Embodiment						
Emb1	,664	.829	.000	.855	.894	.699
Emb2	,671					
Emb3	,746					
Emb4	,721					
Emb5	,842					
Emb6	,811					
Emb7	,577					
Emb8	,660					

Legend: λ : Loadings; KMO: Kaiser-Meyer-Olkin Index; Sig.: Bartlett sphericity test significance; α : Cronbach's Alpha; ρ : Dillon-Goldstein's (DG's) rho; AVE: average variance extracted

RESULTS

The experiment (n=200) conducted with the Meta Quest 2 VR headset allows us to analyze these relationships using a partial least square's (PLS) approach. The PLS results show both that the feeling of embodiment positively influences behavioral intentions, and that the

presence of challenges positively moderates this same relationship. Therefore, hypotheses H₁ and H₂ are validated. Next tables (Tab. 3 and 4) describe the meanings of the regression analysis realized.

Direct effects with the partial least square (PLS) approach

First, we carried out a regression analysis according to structural equations model (SEM) methodology based on the PLS approach (Wold, 1985). The estimation component approach offered by PLS is particularly suitable for formative factors (Hair *et al.*, 2010). We highlight the relationship between embodiment and behavioral intentions the path coefficient (β) which measures the direction (positive or negative) and strength of the relationship of the independent variable on the dependent variable.

Table 3. PLS results (Xlstat, v2018)

Effects (Hypotheses)	R^2	β	SE	t	Pr > t	f^2	Result
Embodiment → Visit intention (H _{1a})	.039	.196	.07	2.82	.005(**)	.040	Supported
Embodiment → Do the activity (H _{1b})	.025	.158	.07	2.25	.026(*)	.026	Supported

Legend: R^2 : Pearson's correlation coefficient; β : regression coefficients (path coefficient); SE: standard error; t: Student test; Pr > |t|: significant at: *** $p < 0.001$; ** $p < 0.01$; and * $p < 0.05$

We observe that embodiment significantly ($p < .05$) and positively influence ($\beta > 0$) the intention to visit the destination (H_{1a}) and the intention to (re)do the sport activity for real (H_{1b}).

Impact of challenges as moderator variable

We realized a multigroup analysis (MGA) (Henseler *et al.*, 2009) to measure the effect of the qualitative moderating variable (challenges). MGA has the advantage of being simple and robust (Chin, 2003; Hair *et al.*, 2018) and giving more reliable results than other comparison

tests when the sample size is small (ibid.). The MGA is both simple and robust (ibid.) and is known to be more reliable than other tests when the sample size is relatively small (ibid.).

Table 4. Moderation effects results (Xlstat, v2018)

Body position effect on:	p-value	β high vs β low	\neq	Result
Embodiment & Intention to visit (H _{2a})	.043(*)	.253 vs .203	.050	Supported
Embodiment & Do the activity (H _{2b})	***	.229 vs .130	.099	Supported

*Legend: p-value significant at: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; β : regression coefficients (path coefficient)*

MGA show that challenge levels significantly ($p < .05$) modulates the relationship of embodiment with intention to visit the destination (H_{2a}) and intention to (re)do the sport activity for real (H_{2b}). The direction of effect ($\neq \beta$ high-level vs β low-level > 0) confirms that a higher level of challenge offers a greater effect on individual especially in the relationship between cognitive effects and resulting behavioral decisions.

CONCLUSION

As a reminder, the research question investigates the role that the sense of embodiment and the level of challenges have on the user's behavioral intentions towards the destination and the activity discovered following the virtual experience.

This research contributes to demonstrate for the first time in marketing the positive role played by embodiment on behavioral intentions with a VR application. This is a major theoretical contribution, as the latest generation of VR applications systematically include these mechanisms valued by consumers. This confirms the tendency for consumers to want to actively live their consumption experiences (Durand, 2018).

Moreover, Krishna and Schwarz (2014, p. 1) showed that sensory and motor stimulation of the body are like “a language” and are determinants in the “judgment and decision-making”

of consumers. Our study demonstrates that beyond sensory and motor stimulation, the feeling of embodiment (feeling like the virtual body was our body, feeling like we were controlling the movements of the virtual body, etc.) have a positive influence on behavioral intentions of consumers: intention to discover and visit the destination for real, and intention to (re)do the sport activity for real. The positive effects of the embodiment (in terms of feeling) on behavioral intentions confirm that VR enables a “try-before-you-buy” service (Tussyadiah *et al.*, 2018, p. 141) that engages the consumer in the offer (Huang *et al.*, 2016). It supports recent findings on the influence of technological embodiment on behavioral engagement (Flavián *et al.*, 2021) and of embodied cognition on purchasing behavior (Wen and Leung, 2021) but focusing, this time, on embodiment felt by individuals.

Additionally, our research shows that more engaging challenges in the experience lead to a higher sense of embodiment. This has not been the focus of previous research in marketing, where only a few studies have demonstrated the influence of challenges on consumer attitudes and behavior (e.g., Hamdi-Kidar and Maubisson, 2012). The same is true in computer sciences, where few works have studied the links between challenges and user engagement in an embodiment context (e.g., Gee, 2008). Our research shows that for a relatively high level of challenge (compared to a relatively simple level of challenge) the stronger the feeling of embodiment, the more favorable the intentions towards the proposed offer will be.

We can however note that the challenges and their levels are not easy to implement for professionals because they depend on many parameters, in particular individual parameters such as the skill level of the users. Completing a challenge induces a high level of pleasure and identification with the character but only if the difficulty is not too high given the user's skills (Hamdi-Kidar and Maubisson, 2012). Therefore, further research would be needed to determine, depending on the situation, the optimal level of challenge to reinforce behavioral intentions in the case of embodiment.

At the managerial level, the research provides insights into the experiential conditions, reinforcing consumer behavioral intentions during VRE. Thus, giving consumers the opportunity to interact with the offer during VRE by being in front of the actor is a source of positive and superior perception for the individual than a non-interactive media (Łysik and Łopaciński, 2019). We therefore advise VR professionals and managers operating or wishing to operate VR, with their customers, to integrate gamification mechanisms to enrich their virtual consumer experiences, leading to embodiment according to the storyliving principle (Durand, 2018). Indeed, it is important to give the sensation of physically experiencing the offer to consumers (Papagiannidis *et al.*, 2013) a true "try-before-you-buy" (Tussyadiah *et al.*, 2018, p. 141).

In view of the increasing evolution of the number of people owning VR headsets and the development of applications and marketplaces in the metaverse, it seems crucial to be able to guide managers to offer immersive and pleasurable experiences and to know the conditions to offer an optimal level of embodiment (Marasco *et al.*, 2018; Alcañiz *et al.*, 2019). Our study is a first step showing the importance for strategic issues of considering and evaluating the level of challenge in immersive virtual experiences. The following step could be to deepen the study of the influence of challenge levels according to the level of embodiment felt by the consumer, but also according to individual variables such as the consumer's skills and uses in terms of digital and virtual devices, or the psychological and mental state of the consumer at the time of the virtual reality experience.

Finally, our results relating to the role of action on embodiment would deserve further research, by integrating, for example, variables relating to sensory perception, proprioception or physiological sensations (Flavián *et al.*, 2021; Hopf *et al.*, 2020) induced by the virtual environment such as "cybersickness", like motion sickness (Sevinc and Berkman, 2020). This opens the way to new research perspectives mobilizing virtual reality experiences.

REFERENCES

- Alcañiz, M., Bigné, E., & Guixeres J. (2019). Virtual Reality in Marketing: A Framework, Review, and Research Agenda. *Frontiers in Psychology*, 10(1530), 1-15.
- Arnould, E.J., & Price, L.L. (1993). River Magic: Extraordinary Experience and the Extended Service Encounter. *Journal of Consumer Research*, 20(1), 24-45.
- Bargain, S., & Camus, S. (2017). L'expérience : une approche conceptuelle au service du tourisme. *Mondes du Tourisme*. Online.
- Barnes, S.J. (2011). Understanding use continuance in virtual worlds: empirical test of a research model. *Information & Management*, 48, 313-319.
- Belisle, J.F., & Bodur, H.O. (2010). Avatars as information: Perception of consumers based on their avatars in virtual worlds. *Psychology & Marketing*, 27, 741-765.
- Bigné, J.E., Sánchez, M.I., & Sánchez, J., (2001). Tourism image, evaluation variables and after purchase behaviour: Inter-relationship. *Tourism Management*, 22(6), 607-616.
- Biocca, F. (1997). The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, 3(2).
- Caroux, L. (2023). Presence in video games: A systematic review and meta-analysis of the effects of game design choices. *Applied Ergonomics*, 107(103936), 1-11.
- Caspar, E.A., Cleeremans, A., & Haggard, P. (2015). The relationship between human agency and embodiment. *Consciousness and Cognition*, 33, 226-236.
- Chin, W.W. (2003). A permutation procedure for multi-group comparison of PLS models. In Vilares, M., Tenenhaus, M., Coelho, P., Esposito Vinzi, V. and Morineau, A. (Eds). *PLS and Related Methods*, Decisia, Lisbon, 2003, 33-43.
- De Simone, J.J., Verbruggen, T., Kuo, L.H., & Mutlu, B. (2012). Is cheating a human function? The roles of presence, state hostility, and enjoyment in an unfair video game. *Comp. in Human Behavior*, 28(6), 2351-2358.
- Durand, S. (2018). *Le storytelling : le guide pratique pour raconter efficacement votre marque*. 2^{ème} édition, Dunod.
- Elder, R.S., & Krishna, A. (2012). The "visual depiction effect" in advertising: Facilitating embodied mental simulation through product orientation. *Journal of Consumer Research*, 38(6), 988-1003. <https://doi.org/10.1086/661531>
- Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2019). Integrating virtual reality devices into the body: effects of technological embodiment on customer engagement and behavioral intentions toward the destination, *Journal of Travel & Tourism Marketing*.
- Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2020). Impacts of technological embodiment through virtual reality on potential guests' emotions and engagement. *Journal of Hospitality Marketing & Management*, 30(3), 1-20.
- Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2021). The influence of scent on virtual reality experiences: The role of aroma-content congruence. *Journal of Business Research*, 123, 289-301.
- Foloppe, D. (2017). *Évaluation et entraînement des activités de la vie quotidienne dans la maladie d'Alzheimer : Intérêt de la réalité virtuelle*. Thèse de doctorat, LPPL, Université d'Angers.
- Fuchs, P. (2018). *Théorie de la réalité virtuelle*. Presses des Mines.
- Fuchs, P., et al. (2006). *Le Traité de la réalité virtuelle*. Presses des Mines, Paris.
- Galvan-Debarba, H., Bovet, S., Salomon, R., Blanke, O., Herbelin, B., & Boulic, R. (2017). Characterizing first and third person viewpoints and their alternation for embodied interaction in VR. *PLoS ONE*, 12(12), 1-19.
- Gee, J.P. (2008). Video Games and Embodiment. *Games and Culture*. 3(3-4), 253-263.

- Gorisse, G. (2019). *Impact du point de vue et de la fidélité des avatars sur les sentiments de présence et d'incarnation en environnement virtuel immersif*. Thèse de doctorat. ENSAM.
- Grodal, T. (2003). *Stories for Eye, Ear, and Muscles: Video Games, Media, and Embodied Experiences*. In Wolf, M.J.P., and Perron, B. (eds.). *The Video Game Theory Reader*. Routledge, New York, 129-155.
- Guerra, J.P., Pinto, M.M., & Beato, C. (2015). Virtual reality-shows a new vision for tourism and heritage. *European Scientific Journal*, 11(9), 49-54.
- Hair, J.F., Black, W., Babin, B., & Anderson, R. (2010). *Multivariate data analysis, 7th ed.* Pearson Prentice Hall, Upper Saddle River, New Jersey.
- Hair, J.F., Sarstedt, M., Ringle, C.M., & Gudergan, S.P. (2018). *Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Thousand Oaks, CA: Sage.
- Hamdi-Kidar, L., & Maubisson, L. (2012). Les chemins d'accès à l'expérience de flow : le cas des jeux vidéo. *Management & Avenir*, 58(8), 120-143.
- Harris, K., Harris, R., & Baron, S. (2001). Customer participation in retail service: Lessons from Brecht. *International Journal of Retail and Distribution Management*, 29(8), 359-369.
- Harwood, T., & Garry, T. (2015). An Investigation into Gamification as a Customer Engagement Experience Environment. *Journal of Services Marketing*, 29, 533-546.
- Hashish, Y. (2019). *Les effets de l'expérience de téléprésence sur internet sur les émotions, les attitudes et les intentions comportementales des touristes : le cas du tourisme domestique en Égypte*. Thèse de doctorat. MRM, Université de Montpellier.
- Henderson, A., Korner-Bitensky, N., & Levin, M. (2007). Virtual reality in stroke rehabilitation: a systematic review of its effectiveness for upper limb motor recovery. *Top Stroke Rehabil.*, 14, 52-61.
- Henseler, J., Ringle, C.M., & Sinkovics, R.R. (2009). The Use of Partial Least Squares Path Modeling. *Advances in International Marketing*, 20, 277-320.
- Hopf, J., Scholl, M., Neuhofer, B., & Egger, R. (2020). Exploring the impact of multisensory VR on travel recommendation: A presence perspective. In J. Neidhardt, & W. Worndl (Eds.), *Information and communication technologies in tourism 2020* (169-180). Cham, Springer.
- Huang, Y.C., Backman, S.J., Backman K.F., & Chang, L.L. (2016). Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research*, Vol. 18, Issue 2, p.116-128.
- Kilteni, K., Groten, R., & Slater, M. (2012). The sense of embodiment in virtual reality. *Presence : Teleoperators and Virtual Environments*, 21(4), 373-387.
- Klein, N., & Borelle, C. (2019). Réalité virtuelle et santé mentale: La fin d'un art de faire ?. *Revue d'anthropologie des connaissances*, 13(2), 613-639.
- Krishna, A. (2013) *Customer Sense. How the 5 Senses Influence Buying Behavior*. Palgrave MacMillan, New York.
- Krishna, A., & Schwarz, N. (2014). Sensory marketing, embodiment, and grounded cognition: A review and introduction. *Journal of Consumer Psychology*. 24(2), 159-168.
- Liu, Y., Alexandrova, T., & Nakajima, T. (2011). Gamifying intelligent environments. *International ACM workshop on Ubiquitous meta user interfaces, Ubi-MUI '11*, Scottsdale, Arizona, USA.
- Luangrath, A.W., Peck, J., Hedgcock, W., & Xu, Y. (2022). Observing Product Touch: The Vicarious Haptic Effect in Digital Marketing and Virtual Reality. *Journal of Marketing Research*, 59(2), 306-326.
- Lupinek, J.M., Jinhee, Y., Ohu, E.A., & Bownlee E. (2021). Congruity of Virtual Reality In-Game Advertising. *Frontiers in Sports and Active Living*, Vol.3.
- Łysik, L., & Łopaciński, K. (2019). Use of virtual reality in digital marketing communication. *Informatyka Ekonomiczna - Business Informatics*, 4(54), 29-45.

- Marasco, A., Buonincontri, P., van Niekerk, M., Orlowski, M., & Okumus, F. (2018). Exploring the role of next-generation virtual technologies in destination marketing, *Journal of Destination Marketing & Management*, 9, p. 138-148.
- Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE Transactions on Information and Systems*, 77(12), 1321-1329.
- Nagy, P., & Koles, B. (2014). "My Avatar and Her Beloved Possession": Characteristics of Attachment to Virtual Objects. *Psychology & Marketing*, 31, 1122-1135.
- Oh, H., Fiore, A.M., & Jeoung, M. (2007). Measuring Experience Economy Concepts: Tourism Applications. *Journal of Travel Research*, 46(2), 119-132.
- Omdia (2021). *Omdia research reveals 12.5m consumer VR headsets sold in 2021 with content spend exceeding \$2bn*. 9 December 2021. From: [omnia.tech.informa.com](https://www.omnia.tech/informa.com)
- Papagiannidis, S., Pantano, E., See-To, E., & Bourlakis, M. (2013). Modelling the determinants of a simulated experience in a virtual retail store and users' product purchasing intentions. *Journal of Marketing Management*, 29(13-14), 11462-1492.
- Pasanen, K., Pesonen, J., Murphy, J., Heinonen, J., & Mikkonen, J. (2019). Comparing Tablet and Virtual Reality Glasses for Watching Nature Tourism Videos. *In Information and Communication Technologies in Tourism*, 120-131.
- Pesonen, J., & Pasanen, K. (2017). A Closer Look at Tourist Information Search Behaviour When Travelling Abroad: What Is the Role of Online Marketing in Choice of Destination?. In: Schegg, R., Stangl, B. (eds) *Information and Communication Technologies in Tourism 2017*, Cham, Springer.
- Roth, D., & Latoschik, M.E. (2020). Construction of the Virtual Embodiment Questionnaire (VEQ). *IEEE Transactions on Visualization and Computer Graphics*, 26(12), 3546-3556.
- Salen, K., & Zimmerman, E. (2004). *Rules of Play: Game Design Fundamentals*. The MIT Press, Cambridge MA.
- Sevinc, V. & Berkman, M.I. (2020) Psychometric evaluation of Simulator Sickness Questionnaire and its variants as a measure of cybersickness in consumer virtual environments. *Applied ergonomics*, 82(102958).
- Spanlang, B., Normand, J.M., Borland, D., Kiltner, K., Giannopoulos, E., Pomés, A., González-Franco, M., Perez-Marcos, D., Arroyo-Palacios, J., Muncunill, X.N., et al. (2014). How to build an embodiment lab: Achieving body representation illusions in virtual reality. *Front. Robot. AI*, 1.
- Sternberger, M.L. (2006). *Interaction en réalité virtuelle*. Université Louis Pasteur, Strasbourg 1, France.
- Supphellen, M., & Nysveen, H. (2001). Drivers of intention to revisit the websites of well-known companies. *International Journal of Market Research*, Vol. 43, Issue 3, p. 341-352.
- Tsakiris, M. (2009). My body in the brain: A neurocognitive model of body ownership. *Neuropsychologia*, 48(3), 703-12.
- Tussyadiah, I.P., Jung, T., & tom Dieck, M.C. (2017). Embodiment of wearable augmented reality technology in tourism experiences. *Journal of Travel Research*, 57(4), 1-37.
- Tussyadiah, I.P., Wang, D., Jung, T., & tom Dieck, M.C. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, 66, 140-154.
- Wen, H., & Leung, X.Y. (2021). Virtual wine tours and wine tasting: The influence of offline and online embodiment integration on wine purchase decisions. *Tourism Management*, 83, 1-12.
- Wold, H.O.A. (1985). Partial Least Squares. In: S. Kotz & N.L. Johnson (Eds.). *Encyclopedia of statistical sciences*, 6, 581-591. New York: Wiley.