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When virtual others are with me: exploring the influence of social presence in virtual reality wine tourism experiences

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Abstract

Purpose – The purpose of this study is to examine the role of social presence in enhancing positive behaviors in the virtual reality (VR)-based wine tourism context through an innovative approach.

Design/methodology/approach – Two sequential experimental studies were conducted to test proposed hypotheses using Web and head-mounted display (HMD) VR formats. Specifically, Study 1 probed the influence of social presence on mental imagery, which subsequently impacted destination visit intention, drinking intent and memorable experience. Study 2 used a field experiment to explore the boundary effects of environmental cues (nature versus social) on social presence and a series of behavioral intentions using an HMD format.

Findings – The findings represent one of the first efforts to unravel the influence of social presence on positive behaviors through mental imagery and the moderating role of environmental cues.

Research limitations/implications – This research enhances the understanding of wine tourism, drawing upon social presence theory and stimulus-organism-response framework.

Practical implications – The outcomes provide valuable insights for wine tourism marketers in developing innovative marketing strategies by addressing the usage of social presence and environmental cues in a VR setting.

Originality/value – To the best of the authors' knowledge, this study is the first to enrich the existing knowledge of wine tourism by exploring the role of social presence and environmental cues in both Web and HMD VR formats.

Keywords Social presence, Mental imagery, Virtual reality, Drinking intent, Marketing

Paper type Research paper

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1. Introduction

Best practices for promoting wine tourism have been recently called into question due to the dynamic changes in winery visitors' demand for wine experience, particularly after the

pandemic (Amaral *et al.*, 2024; Gastaldello *et al.*, 2023; Kotur, 2023). Rising awareness of health concerns has decreased consumer demand across all wine categories significantly (Silicon Valley Bank Wine Division, 2024). Gen Z and Millennials, representing future purchasing power, have shown a notable decline in interest in wine products and culture – nearly a 30% drop in market share – in favor of other beverages like hard seltzers, low alcoholic beverages and even non-alcoholic products over wines (Silicon Valley Bank Wine Division, 2024; Wine Enthusiast, 2024). Consequently, traditional wine tourism experiences driven by a passion for wine are facing titanic challenges due to these shifts in preferences. Instead, Gen Z and Millennials are looking for wine tourism experiences that align with their lifestyles rather than focusing solely on wine-related events (Deng *et al.*, 2022; Rachão *et al.*, 2023). Additionally, prior literature is well-documented that not all winery tourists are wine lovers (Harsányi and Hlédik, 2022). To put it differently, conventional wine tourism marketing strategies may not be as effective as they once were. However, the entire wine tourism industry continues to feel limited in developing new forms of wine tourism experience to address the evolving demand (Tafel and Szolnoki, 2021).

In recent decades, virtual reality (VR) technology has been widely used in the tourism industry as a powerful marketing tool for marketing, driving positive consequences such as visit intention and memorable experience (Leung *et al.*, 2022). VR technology can provide realistic previews of actual destinations while reducing the potential risks and uncertainties associated with traveling to a new location (Gursoy *et al.*, 2023). Though a rising number of prior studies (e.g. Wen and Leung, 2021) attenuated on the merits of using VR in wine tourism over other traditional wine tourism marketing tactics such as short videos or still ads, there are additional opportunities to develop marketing strategies beyond the traditional wine-centric approaches (e.g. winscape)(Bonn *et al.*, 2018; Kotur, 2023), particularly to attract tech-savvy potential visitors who may not be primarily interested in the wine itself.

Social presence has recently been highlighted as an effective marketing strategy during the decision-making process because it enhances enjoyment, trust, sociability, usefulness and entertainment and fosters a sense of "being there" and "being engaged" with virtual others (Ogonowski *et al.*, 2014; Srivastava and Chandra, 2018; Ye *et al.*, 2020). To the best of our knowledge, no existing literature has investigated the potential role of social presence in a VR format within the wine tourism context, let alone from both Web-VR (Lv *et al.*, 2011) and head-mounted display (HMD) VR formats. The potential effectiveness of integrating virtual reality (VR) technology, particularly focusing on social presence, may help to craft innovative marketing strategies tailored to more customers, especially more Gen Z and millennials and stimulate more positive consequences. To close the gap, this study is to examine the role of social presence, mainly exploring its impact on some positive behaviors and understanding its underlying mechanism in a VR context, from both Web-VR and HMD VR formats. Additionally, the boundary effects of environmental cues (nature versus social) are also designed to offer additional contextual information, given their significant roles in wine marketing and in the VR world (Hannum *et al.*, 2019; Zarantonello and Schmitt, 2023).

Explicitly, two sequential studies are designed in this research. Drawing from social presence theory (Short *et al.*, 1976) and the stimulus-organism-response (SOR) framework, Study 1 will use an online survey to understand the influence of social presence as marketing stimuli on prospective travelers' memorable experiences, drinking intent and destination visit intentions through mental imagery in a Web-VR context. Study 2 will adopt a field study to extend the findings of Study 1 to probe the boundary effect of environmental cues in a head-mounted display (HMD) context. This study contributes to the wine tourism and VR literature by being one of the first efforts to shed light on the impact and underlying mechanisms of social presence in holistic VR settings (both Web and HMD VR formats) while

also providing contextual influence of environmental cues in moderating the influence of social presence on the proposed outcomes. The findings will shed light on the prominence of social presence and help the wine tourism industry develop new and effective wine tourism marketing strategies to target additional segments of consumers seeking wine tourism experiences that go beyond the wine-centric methods.

2. Literature review and hypotheses development

2.1 Social presence theory

Social presence theory was penned by Short *et al.* (1976) to highlight the social elements in a medium. This theory outlines how individuals use differential levels of social cues (e.g. face-to-face versus texts) in media to produce different levels of personal feedback that develop social acceptance (Tu, 2000). The feeling of involvement, intimacy and immediacy are categorized as the key components representing social presence (Rice, 1993; Short *et al.*, 1976). To operationalize social presence in a more rigorous manner, Biocca *et al.* (2003) define social presence using three dimensions: the feeling of being accessible to another person, being in the same space and environment and being close to the other person. Given the digital nature of a VR environment, a presentation style involving social presence within a digital marketing environment contributes to better cognition processing and sense-making (Van Kerrebroeck *et al.*, 2021). Prior literature (e.g. Bulu, 2012; Srivastava and Chandra, 2018) found that increases in social presence also enlarged the users' feeling of intimacy and psychological closeness with others in a virtual world. Other studies (e.g. Ogonowski *et al.*, 2014) have found that social presence helps to create a more salient virtual environment, increasing the initial trust toward a brand new product. Besides, the sense of social presence is found to result in desired outcomes such as purchase intention (Oh *et al.*, 2023) in the retailing context and visit intention (Ying *et al.*, 2022) in the tourism context. Therefore, social presence is suggested as an innovative way to promote wine tourism in a VR context beyond the traditional marketing content.

2.2 Hypotheses development of Study 1

Social presence has drawn much attention in recent years due to its essential role in promoting effective social engagement and mitigating the feeling of isolation in a virtual world (Oh *et al.*, 2023; Sterna and Zibrek, 2021). Ogonowski *et al.* (2014) indicate that perceived social presence will produce a higher level of initial trust, thereby boosting positive consequences. Prior literature has shown that highly vivid and interactive stimuli in a mediated environment will produce affirmative attitudes and behaviors (Coyle and Thorson, 2001). Park *et al.* (2021) stressed that social-oriented attributes would exemplify social presence and generate positive behaviors (e.g. booking intention) in a hotel setting. A positive relationship between social presence and behavior intention is also found in digital marketing contexts (Johnson and Hong, 2023). Socialization was found to facilitate drinking behaviors (Previte *et al.*, 2015). Following this logic, we infer that social presence may also facilitate other desirable behaviors such as destination visit intention and drinking intent within a wine tourism setting:

H1. Social presence is positively related to destination visit intention.

H2. Social presence is positively related to drinking intent.

Memorable experience refers to the lasting positive impression triggered by a tourism event, and perceived values, such as price, health and emotional values from the customers' perspective, are found to shape individuals' experiences and influence the creation of

memorable experiences (Cheung *et al.*, 2021). Yung *et al.* (2022) suggested that social presence conveys social value and plays a key role in creating memorable experiences in the human-computer interaction environment in the tourism and hospitality industry. Xu *et al.* (2021) suggest that a heightened sense of social presence may be achieved through a strong feeling of social connections and human touch, even in various virtual scenarios where physical human contact is missing, as the feeling of social presence resonates with affirmative emotional value. Thus, we posit a positive relationship between social presence and memorable experiences in a VR world:

H3. Social presence is positively related to memorable experience.

Prior literature discovered that social presence, to some degree, echoes the quality of the medium itself from social and personal elements (Bulu, 2012; Oh *et al.*, 2018). A high level of social presence will create a sociable, warm and intimate atmosphere (Bulu, 2012), potentially creating a more reliable and accurate simulation of a real-world experience (valence) in a vivid and interactive manner (Sterna and Zibrek, 2021) from a visual perspective, responding to the features of vividness, valence and modality underneath mental imagery. Thus, we inferred that this correlation between social presence and mental imagery also existed in a wine tourism setting. Therefore, we propose the following:

H4. Social presence is positively related to mental imagery.

Mental imagery depicts a cognitive process in which perceptual information is represented in memory (Miller *et al.*, 2000). The mental imagery process, extended from the dual coding theory, has heavily hinted at the benefit of virtual reality and augmented reality technology in enhancing the customers' comprehension of the product or services from the quality and elaboration perspective (Bogicevic *et al.*, 2019; Tussyadiah *et al.*, 2018). Tangible sensory experience (e.g. haptic cues and visual appeal) stems from the VR experience and is an important component of triggering imagination (Huang, 2006). Following the stimulus-organism-response(SOR) framework, the manifestation of mental imagery is mainly associated with the vividness, quantity, valence and sensational modality of stimuli (Cowan and Ketron, 2019; Miller *et al.*, 2000) and will result in positive consequences. Figure 1 will present a holistic picture of the proposed hypotheses in Study 1:

H5–H7. Mental imagery is positively related to destination visit intention (*H5*), drinking intent(*H6*) and memorable experience (*H7*).

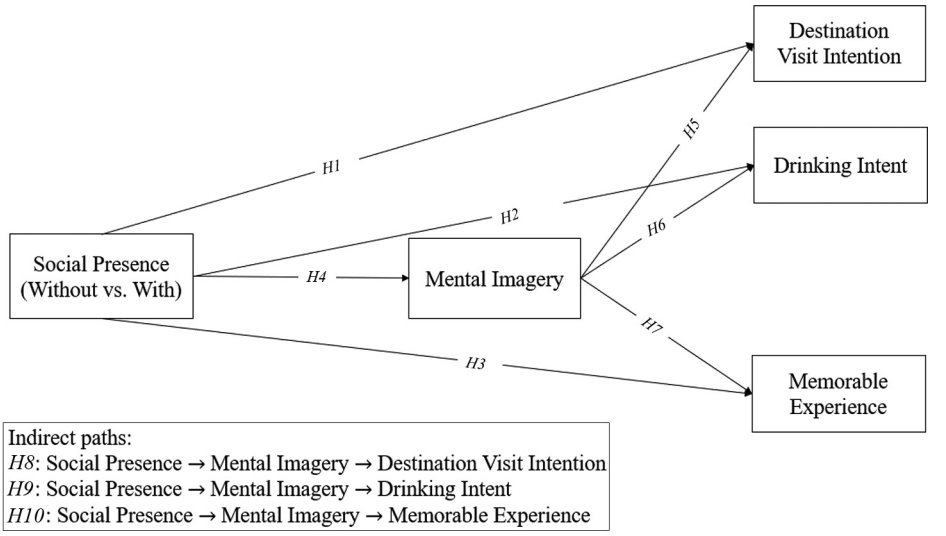
H8. Social presence is positively related to destination visit intention via the mediating role of mental imagery.

H9. Social presence is positively related to drinking intent via the mediating role of mental imagery.

H10. Social presence is positively related to memorable experience via the mediating role of mental imagery.

2.3 Hypotheses development of Study 2

Hannum *et al.* (2019) substantiated that different environments (i.e. traditional sensory booth in the lab, immersive virtual wine tasting room and actual wine bar) influence the customers' perceptions, such as the hedonic rating of wine products and calls for further investigation with the environment context as the research foci due to inconsistent social



Source: Authors' own work

Figure 1. Proposed research model of Study 1

elements in their research. When including social presence in this research, an environmental cue that aligns with the core quality of social presence (i.e. a sense of connection with others by Biocca *et al.*, 2003) or not within the realm of wine tourism may embody different levels of involvement endorsed by the VR technology. Situational involvements are found to be highly associated with self-relevance, enjoyment and interest (Huang, 2006). Thus, the levels of situational environments that are reflected by the environment (social or natural) in the virtual world will be associated with social presence in different manners, thereby influencing the original relationship between social presence and destination visit intention.

Specifically, a social-focused environment in the wine tourism context, such as a tasting room, cellar door or winery restaurant that embraces the essences of social engagement and interaction (e.g. interactivity and intimacy) (Bruwer *et al.*, 2018) in wine tourism may echo a high level of involvement (Frost *et al.*, 2020) and interplay with social presence to trigger a stronger desire of visiting that winery or wine region. On the other hand, a natural environment in the wine tourism context, like a serene vineyard or a scenic landscape in wine tourism is considered a peaceful place for mindfulness or seeking rejuvenation from the crowds (Gaetjens *et al.*, 2023), evoking a sensation of tranquility and a heightened recognition of the natural beauty. Such an ambience might not align with the fundamental concept of social presence and thus mirror a low-level involvement situation where dramatic cognitive information is required to trigger the product persuasion (Cowan and Ketron, 2019). Therefore, adding a natural environment to a social presence-dominant virtual experience will create a sense of discord and act as a noisy disruptor, buffering the initial positive relationship between social presence and behavioral outcomes. Thus, we propose the following hypotheses and Figure 2 with the proposed model in Study 2:

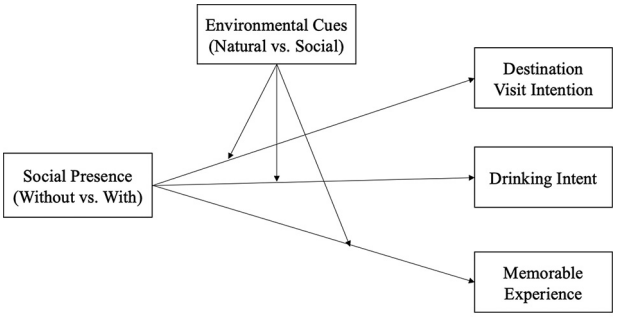


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Figure 2. Proposed model of Study 2

H11. Environmental cues (nature versus social) moderate the relationship between social presence and destination visit intention, i.e. when exposed to a social (vs natural) environmental cue, the positive relationship between social presence and destination visit intention is stronger.

H12. Environmental cues (nature versus social) moderate the relationship between social presence and drinking intent, i.e. when exposed to a social (vs natural) environmental cue, the positive relationship between social presence and drinking intent is stronger.

H13. Environmental cues (nature versus social) moderate the relationship between social presence and memorable experience, i.e. when exposed to a social (vs natural) environmental cue, the positive relationship between social presence and memorable experience is stronger.

3. Research studies of Study 1 and Study 2

The proposed hypotheses are examined through two experimental studies. Study 1 examines the effect of social presence on positive behavioral outcomes through an online experiment test. To present the stimuli of Study 1 in an immersive environment, we mimicked the key functions of the Web-based VR (Lv *et al.*, 2011). Expanding on the results of Study 1, Study 2 is built upon a field experiment to investigate the interactive role of environment cues (nature vs social) on the relationship between social presence and behavioral outcome(s). The stimuli of Study 2 were presented through head-amounted VR gear.

3.1 Study 1

3.1.1 Stimuli design. To execute Study 1, the VR stimuli were carefully selected and proposed following two phases. First, we relied upon YouTube to source an extensive collection of high-resolution 360-degree VR-compatible videos in the wine tourism context. Following the three main qualities of social presence (i.e. a feeling of being accessible to another person, a feeling of being in the same virtual environment and a feeling of being close to the other person) proposed by Biocca *et al.* (2003), a panel of experts in wine and VR research reviewed all the 360-degree VR-compatible videos in random order and provided some feedback regarding their perceptions regarding VR video quality consistency, the level of VR experience immersion, notions of social presence and consistency of the wine tourism

scenario. Based on their feedback, the research team selected eight VR videos, consisting of four videos featuring social presence and four videos without social presence, for a preliminary test to finalize the stimuli.

Second, a preliminary online study was conducted through Amazon Mturk by recruiting participants who have had VR experience in the past six months. The research team designed an online experimental test via the Qualtrics platform. The selected eight 360-degree VR videos were embedded in the Qualtrics survey web page to mimic the Web-VR experience (Lv *et al.*, 2011). All the invited participants (n = 160) were required to provide some feedback after reviewing one of the randomly assigned VR videos. Eventually, two 360-degree VR videos (one without social presence and the other with social presence) were selected based on the scores of realism, video quality and level of the application of Web-VR experience (see Figure 3). The navigation icon display in the top-left corner demonstrates the VR functionality of 360-degree immersion and can be played in the Web context.

3.1.2 Research procedure and measurement items. To scrutinize the hypotheses proposed in Study 1, we designed an online experimental test via the Qualtrics platform. The confirmed stimuli were successfully integrated into the Qualtrics-based survey, allowing participants to easily interact with the 360-degree feature while viewing the VR video. The video was accompanied by a series of questions tied to the manipulation check questions and measured items. Participants were randomly assigned to watch one of two VR videos and report their perceptions regarding the manipulation check questions (e.g. level of social presence, perceived video quality) and measured constructs. Given the benefits of Mturk in accessing a large pool of research participants with diverse backgrounds, as well as its ability to provide reliable data for experimental research (Lu *et al.*, 2022), we recruited a specific group of panels with prior VR experience via Mturk. To guarantee the data quality, we followed the suggestions of Lu *et al.* (2022), including selecting participants with a 95% or greater approval rate, using screening questions, incorporating attention checks and providing open-ended questions for feedback.

All the measurement items were borrowed from well-established studies. Precisely, perceived social presence was manipulated by asking the extent to which the participants felt connected with others and surrounded by other people in the virtual environment using a bipolar scale (0 = No, 1 = Yes). Mental imagery was measured with four items using a seven-point Likert scale from Bogicevic *et al.* (2019). The scale of memorable experience was adapted from Kim and Chen (2019) and Leung *et al.* (2022) using a seven-point Likert scale

Condition 1 – Without Social Presence

Condition 2 – With Social Presence

Source: YouTube

Figure 3. Two conditions of Study 1 stimuli

(1 = strongly disagree, 7 = strongly agree). Drink intent was modified based on wine purchase intent from Wen and Leung (2021) and Deng *et al.* (2022). Destination visit intention was measured via a three-item seven-point Likert scale (1: very unlikely – 7: very likely) following Tussyadiah *et al.* (2018). We also included a few controlling variables. VR comfort was measured by asking the extent of comfort using VR technology through a seven-point rating scale (1 = definitely not comfortable, 7 = definitely very comfortable). Wine knowledge was measured through a three-item using a seven-point Likert scale following Dodd *et al.* (2005). The level of video-centric quality (i.e. graphical quality, audio quality, content quality and overall quality) was measured using a seven-point scale (1: very poor; 7 = very good) following Chi *et al.* (2022) (see Appendix 2 Table A1). Demographic questions were asked at the end.

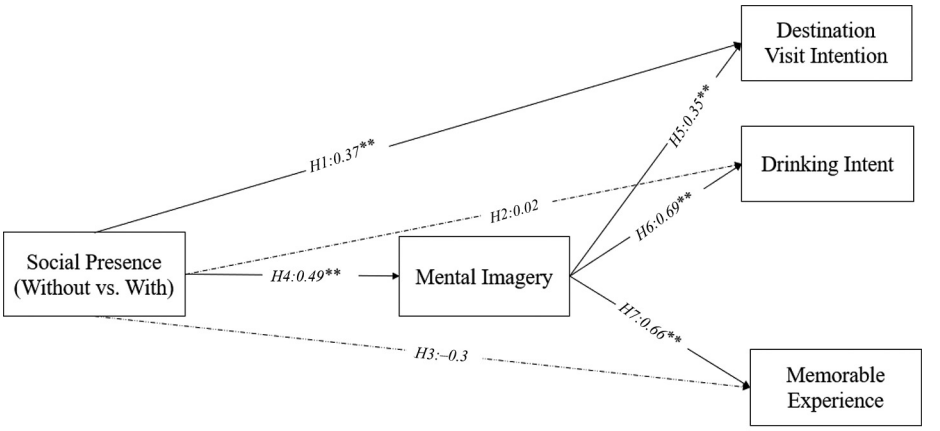
3.1.3 Manipulation check. A sample of 80 responses was collected initially through Mturk for a manipulation check. A simple *t*-test was plotted, and the result revealed a significant difference between the two conditions, $t(79) = 10.15$, $p < 0.001$, implying the effectiveness of the manipulation. Next, an independent *t*-test was conducted to examine the influence of VR video quality on graphical quality, audio quality, content quality and overall quality dimensions. None of the outputs indicated a significant difference between the two conditions since the *p*-values range from 0.10 to 0.81, thus excluding the potential confounding effect caused by the quality of video on decision-making.

3.1.4 Formal data collection, analysis and result of Study 1. After the manipulation check, the sample for Study 1 was collected via Mturk and 177 out of 246 responses were held for analysis ($n_{without\ people} = 85$, $n_{with\ people} = 92$) after ruling out the responses that failed two attention checks. Sixty-three percent of participants are male, reported as Millennials or Gen Zers and gained bachelor's degrees. The detailed social-demographic profile is demonstrated in Appendix 3 Table A2.

Before testing the hypotheses, we checked the validity of the data set and measurement scale. The result revealed no missing data, and all items were normally distributed. In addition, the screening test results showed no significant differences across the two groups who were exposed to different VR videos in terms of graphical, audio, content and overall quality and no significant differences across the two groups with different wine knowledge. Mplus was used to decode the data and test the proposed path.

Confirmatory factor analysis was conducted to test the proposed measurement model via Mplus following Wang and Wang (2019). The output revealed a decent model fit: $\chi^2/df = 2.18$, $p < 0.01$, CFI = 0.97, TLI = 0.96, RMSEA = 0.06 and SRMR = 0.03. The loadings for all the items were significant ($p < 0.01$). Further, no localized ill fit was detected since none of the residual correlations between indicators were beyond the threshold of 0.10 (Wang and Wang, 2019). Cronbach's α of all constructs ranged from 0.87 to 0.94, suggesting sound internal consistency. All constructs' average variance extracted (AVE) demonstrated good convergent validity by exceeding the criterion value of 0.50 (Fornell and Larcker, 1981). The AVE values of latent constructs are larger than their squared correlations with other study constructs; this result demonstrated the discriminant validity of all constructs (Fornell and Larcker, 1981).

The structural model was operated and demonstrated a good model fit with the data: $\chi^2/df = 2.15$, $p < 0.01$, CFI = 0.97, TLI = 0.96, RMSEA = 0.06 and SRMR = 0.03. Figure 4 provides a full picture of the path analysis. As predicted, social presence was positively related to destination visit intention, $\beta = 0.38$, $p < 0.001$, leading to full support for *H1.H2* and *H3* were not supported due to insignificant linkages between social presence and drinking intent and memorable experience, respectively. As for *H4*, the proposed hypothesis between social presence and mental imagery was confirmed since $\beta = 0.49$, $p < 0.001$. As



Indirect paths:
H8: Social Presence → Mental Imagery → Destination Visit Intention: $b = 0.17$, 95% *CI* [0.08, 0.26]
H9: Social Presence → Mental Imagery → Drinking Intent: $b = 0.34$, 95% *CI* [0.26, 0.42]
H10: Social Presence → Mental Imagery → Memorable Experience: $b = 0.33$, 95% *CI* [0.23, 0.41]

Source: Authors' own work

Figure 4. Result of Study 1

expected, the proposed hypothesis (*H5*) between the positive link between mental imagery and destination visit intention was supported, $\beta = 0.36$, $p < 0.001$. Likewise, the positive relationships between mental imagery and drinking intent ($\beta = 0.69$, $p < 0.001$) (*H6*) and mental imagery and memorable experience ($\beta = 0.67$, $p < 0.001$) (*H7*) are all confirmed.

Then, we tested the mediated effect of mental imagery using 50,000 bootstrap analyses. Mental Imagery was found to partially mediate the positive relationship between social presence and destination visit intention, $b = 0.17$, 95% *CI* [0.08, 0.26], fully mediate the relationship between social presence and drinking intent, $b = 0.34$, 95% *CI* [0.26, 0.42], fully mediate the relationship between social presence and memorable experience, $b = 0.33$, 95% *CI* [0.23, 0.41], respectively, confirming *H8*, *H9* and *H10*.

3.2 Study 2

While Study 1 found that social presence plays a role in influencing behavioral outcomes, it remains unclear if this effect would persist with the introduction of moderating variables. In virtual reality (VR), environment-related variables are well-documented as moderators that influence the relationship between VR-endorsed stimuli (e.g. technology types and features) and behavioral outcomes at various stages (i.e. pre-purchase, purchase and post-purchase) (Zarantonello and Schmitt, 2023). Similarly, in the context of wine tourism, environments serve as important cues and provide different values (e.g. social value) (Gao *et al.*, 2024). For example, social environments like tasting rooms may offer educational or social value, while natural environments such as vineyards or rural settings may provide aesthetic value (Haller *et al.*, 2021). Therefore, we designed Study 2 to extend Study 1, aiming to examine the potential moderating role of environmental cues (natural versus social) on the relationship between social presence and behaviors (i.e. destination visit intention, drinking intent and

memorable experience). This aims to enhance our understanding of how different stimuli associated with social presence work in the VR format.

3.2.1 Stimuli design. To locate the most suitable stimuli, our research team carefully selected four new VR-accessible short videos (2: social presence: with vs without x 2: environmental cue: nature vs social) by replicating the procedure from Study 1 through Mturk ($n = 80$). All selected VR videos, which are the stimuli for Study 2, are in high resolution (2160 × 2160 pixels per eye or higher) and include quality video and audio, with each video lasting around three minutes. These videos present a panoramic effect that fully immerses participants in a 360-degree visual experience in wine tourism. Figure 5 illustrates the four conditions in a still version, given the limitations of the presentation format.

3.2.2 Research procedure and measurement items. After approval of the Institutional Review Board (IRB), a series of offline and online recruitment efforts were carried out with the assistance of the university's marketing and communication team. Participants were asked to sign up for one of the various lab sessions within a two-week data collection period based on their availability. On the day of the lab experiment, participants were greeted and briefed on the research objectives. Each participant was then guided to our VR lab and equipped with VR gear. After answering a few questions to ensure their comfort level with wearing the Oculus 2, one of the four prepared 360-degree VR videos was randomly selected and played to ensure a fully immersive experience. Upon completing the VR session, participants were directed to scan a QR code to access a questionnaire, where they responded to a battery of questions and reported their perceptions regarding the proposed constructs in this research. After completing the questionnaire, participants received a small cash stipend of three dollars as a token of appreciation. The entire process took about half an hour per participant. Appendix 1 Figure A1 provides an overview of the lab-based experiment flow, along with an example. The participants were primarily Gen Z and Millennials. The constructs were measured using the same procedure and measurement items as in Study 1 (see Appendix 2 Table A1).

3.2.3 Manipulation check. Prior to the formal lab experiment, a sample of 100 responses was collected via Mturk in Study 2 to inspect the efficacy of manipulation. A series of

Source: YouTube

Figure 5. Four conditions of Study 2 stimuli

ANOVAs, in addition to post-hoc LSD tests, were conducted to test the four conditions. Manipulation is passed since $F(3, 96) = 402.09$, $p < 0.001$. Once again, an ANOVA was conducted to examine the influence of VR video quality on graphical quality, audio quality, content quality and overall quality dimensions across four conditions. None of the outputs indicated a significant difference between the four conditions since the *p*-values range from 0.08 to 0.88, eliminating the potential confounding effect.

3.2.4 Formal data collection, analysis and result of Study 2. To conduct the field experiment study, we collected 85 usable responses as the minimum sample required is 82 (effect size $d = 0.35$, α err prob of 0.05, a power of 0.8) using G*power analysis (Faul *et al.*, 2007). The sample consisted of 38 males and 46 females (see Appendix 4 Table A3). To test the proposed moderating effect of environmental cues (*H11–H13*), we ran a MANCOVA to test the main effect of social presence, virtual environment cue and their interaction controlling wine knowledge and VR comfort. *H11* is confirmed since the moderating role of the virtual environment cues buffering the relationship between social presence and destination visit intention (see Table 1), while *H12* and *H13* are rejected due to insignificant interaction ($p > 0.05$).

Figure 6 presents a visualized interaction plot. Specifically, when exposed to a social environment (i.e. tasting room), a higher social presence ($M = 5.52$, SD = 0.33) generated significantly higher visit intention compared to the presence of a lower social presence ($M = 4.22$, SD = 0.30), $F = 8.58$, $p < 0.01$. However, when exposed to a natural environment (i.e. vineyard), there is no significant difference regarding destination intention between a lower social presence ($M = 5.80$, S*D* = 0.31) and a higher social presence ($M = 5.62$, SD = 0.30), $F = 0.19$, $p = 0.67$. Put simply, when the participants are exposed to a social environment, such as tasting room or workshop, the inclusion of social presence in a VR world will elicit a higher destination visit intention; however, in a nature-focused setting like a vineyard, the effect of social presence is less significant, as the intention to visit remains high regardless of whether social presence is felt.

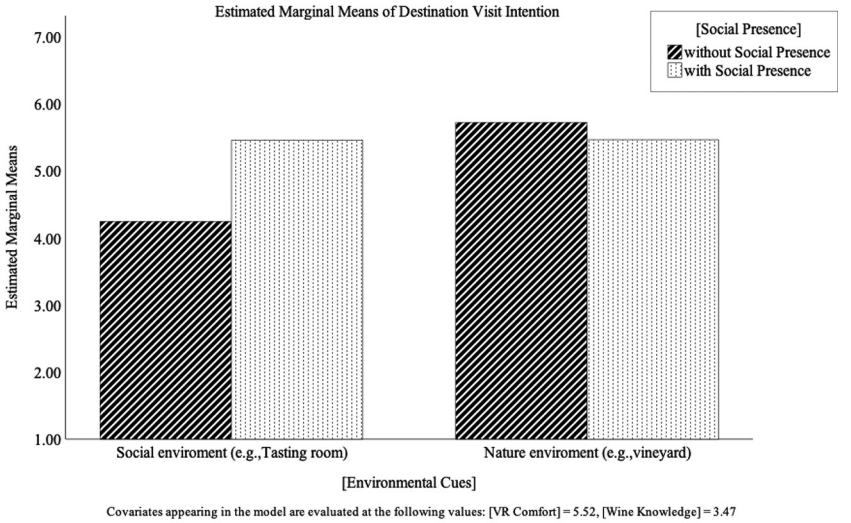
4. Discussion

Based on the main findings of this research, the perceived social presence was found to elicit a greater level of mental imagery and a stronger feeling of being "there" in a virtual world, leading to a memorable wine experience, drinking desire as well as a favorable destination

Table 1. Significant interaction

	Destination visit intention				
Source	Sum of squares	*df*	Mean square	*F*	*p*
Corrected model	37.64	5	8.02	4.04	<0.01
Intercept	55.96	1	55.96	126.91	<0.01
Wine knowledge	5.60	1	5.60	2.64	0.11 *ns*
VR comfort	2.58	1	2.58	1.33	0.25 *ns*
Social presence	4.74	1	4.74	3.22	<0.05
Environmental cues	11.59	1	11.59	7.64	<0.01
Social presence * environmental cues	10.99	1	10.99	5.67	<0.05
Error	163.86	79	1.99		
Total	2513.78	85			
Corrected total	201.49	84			

Note: *ns* stands for not significant
Source: Authors' own work



Source: Authors' own work

Figure 6. Interaction plot

visit intention. The entire path extended Pimentel and Vinkers's (2021) statement that the feeling of social presence and connectedness is highly related to positive social outcomes such as likeability and trust that eventually contribute to positive psychological states, and affective and cognitive responses such as plausibility illusions.

More importantly, the encouraging role of social presence in affecting decisions such as destination visit intention in our research echoes the positive influence of social presence in minimizing uncertainty when interacting with technology-based systems (Srivastava and Chandra, 2018). The positive relationship between social presence and destination visit intention in wine contexts further reinforced the positive role of social presence as a powerful marketing tool before the actual visit, even in the virtual world, as indicated by Oh *et al.* (2018).

Our findings on the significance of social presence in influencing mental imagery extended Cowan and Ketron's (2019) statement regarding the positive effect of product involvement in enhancing imagination. The inclusion of social presence in our research suggests a high level of wine tourism involvement, driven by the social value within a virtual world. The heightened social presence in the VR format facilitated positive perceptions of the stimuli in the mind's eye, even without direct involvement. Simply put, in wine tourism marketing within a VR environment, wine-centric products are not the only trigger to stimulate imagination. VR-enabled features, such as social presence, can also contribute to positive outcomes (i.e. higher mental imagery).

Furthermore, the discovery of the linkage between mental imagery and memorable experience is also congruent with Bogicevic *et al.* (2019)'s finding concerning the mediation role of a sense of presence in VR settings underlying the relationship between mental imagery from elaboration and quality processing and tourism brand experience from affective, behavioral and intellectual dimensions. The positive role of mental imagery in our study is consistent with Spence's (2022) advocacy of cross-modal mental imagery in

enhancing multisensory flavor and aroma perceptions. In other words, instead of examining mental imagery from elaboration and quality dimensions (Bogicevic *et al.*, 2019), it is possible to develop and understand the construct of mental imagery from the cross-modal perspective, such as smell, taste, touch, hearing and sight dimensions following Spence (2022) based on the nature of wine tourism.

Additionally, the discovered relationship between social presence in the VR setting and drinking intent, mediated by mental imagery, enhanced our understanding of how social influence can trigger drinking behaviors (Previte *et al.*, 2015). In essence, even virtual stimuli that emphasize social value can, to some degree, influence drinking intent through the cognitive processing of mental imagery.

It is worthwhile to pinpoint that the environmental cue was found to play an interesting moderating effect in influencing the positive relationship between social presence and destination visit intention. The welcomed role of social presence in a social environment, such as the wine cellar or tasting room, addressed the participants' desire for social interaction when the wine tourism scenario is inherent to a social vibe, even in a virtual setting. Interestingly, in serene natural environments like vineyards, the presence or absence of social interactions holds equal significance in shaping visitors' intentions. This observation aligns with the growing recognition of the wellness benefits of wine tourism from different perspectives (e.g. Kotur, 2022). While some visitors are drawn to the mindfulness evoked by remarkable landscapes, others prioritize social spirits in any context, even amidst natural surroundings infused with cues of serenity. In other words, wine tourists travel with different motivations; some tourists seek intricate interactions within a natural setting, encompassing wine, food, culture and people (Harsányi and Hlédik, 2022; Mitchell *et al.*, 2012), while some tourists purely seek psychological tranquility amid natural landscapes as a sense of escapism and aesthetics (Amaral *et al.*, 2024). Thus, distinct wine tourism environments (social versus nature) host different events and activities, catering to the diverse fundamental needs of wine tourists (Hannum *et al.*, 2019). The outcome of our study in this research provides valuable input for two dual contexts (nature versus social), illustrating divergent requirements in terms of the extent of value-laden wine tourism experiences.

5. Theoretical and practical implications

5.1 Theoretical contributions

Despite the fact that numerous marketing studies have examined the influence of social presence in various virtual environments (e.g. Sterna and Zibrek, 2021), our study is the first one to respond to the application of an immersive VR experience from both Web and HMD VR formats in wine tourism. Put simply, the findings extended the usage of social presence and shed light on the application of social presence in a new format (i.e. VR-enabled virtual format) in the wine tourism and hospitality spectrum. This pioneering research not only emphasized the role of social presence but also added contextual information by exploring the interplay between environmental cues (natural versus social) and social presence on positive outcomes such as memorable experiences, drinking intent and destination visit intention through mental imagery, drawing from the social presence theory and SOR framework.

Our findings contribute to the existing knowledge of the significant role of mental imagery in the virtual tourism literature. Specifically, mental imagery was identified as an essential mediator in explaining the impact of VR stimuli on some positive outcomes, notably memorable experiences. Contrary to some prior studies (e.g. Leung *et al.*, 2022), a direct relationship, such as the link between VR stimuli and memorable experiences, was not discovered in this research. Instead, this connection is elucidated through the underlying mechanism of mental imagery. The mediating role of mental imagery can also explicate the

relationship between the role of social presence in a VR setting and drinking intent, extending the literature of understanding social influence on drinking behavior (e.g. Previte *et al.*, 2015) in the real-life setting. Apparently, understanding the cognitive processing of mental imagery is pivotal in the virtual tourism area.

Furthermore, the empirical evidence provided valuable input in extending the VR literature in the tourism and hospitality spectrum. The application of VR in tourism has been acclaimed for offering a "try-before-you-buy" experience, addressing the challenges of tourism products' intangibility and reducing uncertainties related to unfamiliar destinations (Bogicevic *et al.*, 2019; Gursoy *et al.*, 2023). Admittedly, making a wine tourism travel decision is sometimes stressful due to the growing sunk costs, such as financial costs and psychological burdens. The utilization of social presence in the backdrop of a VR setting is proven to be an effective way of arousing positive consequences such as destination visit intention, memorable experience and drinking intent in wine tourism. The merits of VR technology have been enriched further from the theoretical perspective.

To the best of our knowledge, most of the existing literature (e.g. Wen and Leung, 2021) in the wine sector investigated the benefits of VR technology from a broader perspective, such as its advantages over traditional videos or still-image presentations. Our research extended the literature by focusing on specific stimuli features (i.e. social presence and environmental cues) by leveraging the advanced functions of VR technology. The findings of this research also added prominent theoretical support to the existing knowledge of wine tourism marketing in a VR context; the stimuli or marketing content can go beyond the wine-centric events or activities to attract a broader market segment, such as the tech-savvy Gen Z or potential winery visitors who are motivated by social rather than the wine-related product or service itself (Bruwer *et al.*, 2018; Gaetjens *et al.*, 2023).

5.2 Practical implications

The prominence of the social presence discovered in the current study provided a fresh way of promoting the wine tourism experience in virtual marketing. Wine tourism marketers are encouraged to think creatively about future marketing campaigns, especially in a VR format, based on the findings of this research. Instead of focusing solely on wine-related content such as grape variety, country of origin and sensory profiles, marketers might consider incorporating some non-wine-related elements. For example, showcasing other tourists' enjoyable moments at a winery or vineyard or using peer avatars to engage in more interactive activities could also be effective. The key is to emphasize the feeling of social presence in the virtual world, minimizing the feeling of isolation. Eventually, the sense of shared virtual experience can enhance potential customers' imagination in terms of quality and vividity, leading to positive decision-making, such as an eagerness to visit the destination in person, creating a lasting and affirmative virtual experience and increasing the desire to drink the wine products.

By leveraging VR technology within a budget, wine tourism marketers can create social presence-endorsed VR experiences that reach potential customers at home. The social presence-endorsed content may effectively stimulate customers' desire to consume wine through mental imagery processing. In other words, the customers will eventually purchase some wine products to meet their drinking desires even when they are not physically visiting a winery. This innovative marketing strategy not only enhances competitiveness but also opens up new avenues for wineries to generate additional revenues by tapping into the at-home consumer market.

With the advancement of virtual reality technology, such as the application of Metaverse, the notion of social presence deserves further emphasis to address the existing limitation in enhancing the existing virtual tourism-related experiences, particularly due to the lack of

face-to-face interaction (Yung *et al.*, 2022). An application of social presence in virtual reality technology such as the Metaverse enables friends and family members who reside in different physical locations in the world to wear VR gear and visit the same winery at each one's own homes, with no concern of any potential uncertainties and risks associated with an actual travel planning (e.g. unanticipated harmful climate, and unexpected overcrowding issues at destination).

More importantly, many exceptional wineries (e.g. Vin de Tahiti) are located in remote or rural areas that require additional travel arrangements and transportation. These locations will create natural obstacles for prospective wine travelers interested in the wine destination but face constraints such as mobility difficulty (e.g. individuals with disabilities or seniors). VR-based wine experience will easily overcome difficulties and allow travelers to enjoy an immersive wine tourism experience at their desired destination without leaving their homes. Similarly, this approach would also break down travel barriers for those who do not have the capacity to travel and still expose them to the wine tourism experience due to a variety of factors (i.e. senior living communities and those with physical or financial travel limitations In other words, when wine marketers aim to target new audiences or segments, they could leverage the benefit of VR technology, targeting those cohorts who are interested in a wine tourism experience but with some mobility or physical difficulties to travel to the destination in person.

Given the moderating role of environmental cues swaying between social presence and behavioral outcome, we recommend wine marketers take advantage of VR technology by developing distinct contextual modes (with and without social presence) with assorted environmental or eventual cues. For instance, our findings indicated that in a social-driven environment, with social presence function will significantly enhance visit intention. Hence, winery marketers should consider adding virtual others across all the social-related environments, such as tasting rooms, workshops and winery restaurants, when crafting marketing stimuli in the VR structure. The positive influence of social presence on the intention to visit a destination was found to not be significantly stronger than that of a VR scenario without social presence. Therefore, when designing the VR marketing stimuli in a nature-driven environment, if the production costs and other sunk costs differ significantly, it may be worthwhile to consider either option. If costs are not a major concern, incorporating both social and non-social presence modes/stimuli would allow VR users to switch seamlessly between them, catering to individual preferences and comfort levels. For example, individuals who prefer a serene and peaceful vineyard experience, free from disturbances by other virtual people, might choose the mode without social presence. In contrast, those who prefer a serene vineyard experience might choose the non-social mode, while those seeking an immersive, interactive wine tourism experience could opt for the social mode, which offers a vivid cellar-door tasting scenario with other virtual entities. Given that direct-to-consumer sales at the winery (e.g. tasting room) is still the strongest channel to contribute to winery revenues and profit, the leveraging of the interaction between social presence and environmental cues will benefit winery planners to attract more segments such as tech-savvy groups (e.g. Gen Z and millennials) and encourage them to visit the winery during the decision-making and eventually bring in more revenues.

6. Limitations and future research

Despite the merits of this research, our study has limitations that could be addressed in future research. The presentation of the social presence could be optimized with the evolution of VR technology for future studies. Specifically, future studies can measure social presence through the application of Metaverse by interacting with Avatar-based characters or in combination with augmented reality technology, such as the recently released Apple Vision

Pro, which allows simultaneous interaction among different users in a simulated environment and drives more robust perceptions related to social presence.

Furthermore, additional studies should optimize the stimulus and possibility of designing the marketing content based on a single winery. Due to budget and technology limitations, we can also source the marketing stimulus from public resources. The involvement of sensory modalities such as actual olfactory stimulus and wine-tasting elements (Krishna, 2012; Spence *et al.*, 2016) is suggested in future studies to test the effect of mental imagery, echoing the core of wine tourism from the sensational experience aspect to understand whether different sensory sources will induce a varying level of mental imagery as well as the subsequential outcomes.

Since our research targeted participants with prior VR experience, we captured a higher proportion of Gen Z and Millenials during the data collection. As a result, our sample is then representative in terms of gender identity, race and ethnicity but not in terms of age cohort. While findings are valuable for understanding the perception of VR stimuli – social presence, particularly among the younger market segment, we recommend that future studies expand the participants' pool to include a broader age range for greater generalization. Finally, the perception of the VR experience might be transient when taking off the VR gear; thus, physiological measurements are encouraged to capture the arousal and perceptions simultaneously if they involve any constructs related to affections.

References

Amaral, M.M., Kuhn, V.R., Dos Anjos, S.J.G. and Flores, L.C.D.S. (2024), "Experiences in a wine tourism destination from the visitors' perspective", *International Journal of Wine Business Research*, Vol. 36 No. 1, pp. 85-102, doi: 10.1108/IJWBR-05-2023-0028.

Biocca, F., Harms, C. and Burgoon, J.K. (2003), "Toward a more robust theory and measure of social presence: review and suggested criteria", *Presence: Teleoperators and Virtual Environments*, Vol. 12 No. 5, pp. 456-480, doi: 10.1162/105474603322761270.

Bogicevic, V., Seo, S., Kandampully, J.A., Liu, S.Q. and Rudd, N.A. (2019), "Virtual reality presence as a preamble of tourism experience: the role of mental imagery", *Tourism Management*, Vol. 74, pp. 55-64, doi: 10.1016/j.tourman.2019.02.009.

Bonn, M.A., Cho, M. and Um, H. (2018), "The evolution of wine research: a 26 year historical examination of topics, trends and future direction", *International Journal of Contemporary Hospitality Management*, Vol. 30 No. 1, pp. 286-312, doi: 10.1108/IJCHM-09-2016-0521.

Bruwer, J., Prayag, G. and Disegna, M. (2018), "Why wine tourists visit cellar doors: segmenting motivation and destination image", *International Journal of Tourism Research*, Vol. 20 No. 3, pp. 355-366, doi: 10.1002/jtr.2187.

Bulu, S.T. (2012), "Place presence, social presence, co-presence, and satisfaction in virtual worlds", *Computers and Education*, Vol. 58 No. 1, pp. 154-161, doi: 10.1016/j.compedu.2011.08.024.

Cheung, M.L., Leung, W.K., Cheah, J.H., Koay, K.Y. and Hsu, B.C.Y. (2021), "Key tea beverage values driving tourists' memorable experiences: an empirical study in Hong Kong-style café memorable experience", *International Journal of Culture, Tourism and Hospitality Research*, Vol. 15 No. 3, pp. 355-370.

Chi, C.G., Deng, D.S., Chi, O.H. and Lin, H. (2022), "Framing food tourism videos: what drives viewers' attitudes and behaviors?", *Journal of Hospitality and Tourism Research*, p. 109634802211230, doi: 10.1177/10963480221123097.

Cowan, K. and Ketron, S. (2019), "A dual model of product involvement for effective virtual reality: the roles of imagination, co-creation, telepresence, and interactivity", *Journal of Business Research*, Vol. 100, pp. 483-492, doi: 10.1016/j.jbusres.2018.10.063.

Coyle, J.R. and Thorson, E. (2001), "The effects of progressive levels of interactivity and vividness in web marketing sites", *Journal of Advertising*, Vol. 30 No. 3, pp. 65-77, doi: 10.1080/00913367.2001.10673646.

Deng, D.S., Seo, S., Li, Z. and Austin, E.W. (2022), "What people TikTok (douyin) about influencer-endorsed short videos on wine? An exploration of gender and generational differences", *Journal of Hospitality and Tourism Technology*, Vol. 13 No. 4, pp. 683-698, doi: 10.1108/JHTT-05-2021-0143.

Dodd, T.H., Laverie, D.A., Wilcox, J.F. and Duhan, D.F. (2005), "Differential effects of experience, subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing", *Journal of Hospitality and Tourism Research*, Vol. 29 No. 1, pp. 3-19, doi: 10.1177/1096348004267518.

Faul, F., Erdfelder, E., Lang, A.G. and Buchner, A. (2007), "G* power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences", *Behavior Research Methods*, Vol. 39 No. 2, pp. 175-191.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Frost, W., Frost, J., Strickland, P. and Smith Maguire, J. (2020), "Seeking a competitive advantage in wine tourism: heritage and storytelling at the cellar-door", *International Journal of Hospitality Management*, Vol. 87, p. 102460, doi: 10.1016/j.ijhm.2020.102460.

Gaetjens, A., Corsi, A.M. and Plewa, C. (2023), "Customer engagement in domestic wine tourism: the role of motivations", *Journal of Destination Marketing and Management*, Vol. 27, p. 100761, doi: 10.1016/j.jdmm.2022.100761.

Gao, D., Xia, H., Deng, W., Muskat, B., Li, G. and Law, R. (2024), "Value creation in wine tourism–an exploration through deep neural networks", *Journal of Vacation Marketing*, Vol. 30 No. 3, pp. 376-391.

Gastaldello, G., Streletskaya, N. and Rossetto, L. (2023), "Glass half-full? A comprehensive PLS-SEM approach to explore the pandemic's effect on wine tourism intentions", *International Journal of Wine Business Research*, Vol. 35 No. 2, pp. 322-345, doi: 10.1108/IJWBR-03-2022-0011.

Gursoy, D., Lu, L., Nunkoo, R. and Deng, D. (2023), "Metaverse in services marketing: an overview and future research directions", *The Service Industries Journal*, Vol. 43 Nos 15/16, pp. 1140-1172.

Haller, C., Hess-Misslin, I. and Mereaux, J.-P. (2021), "Aesthetics and conviviality as key factors in a successful wine tourism experience", *International Journal of Wine Business Research*, Vol. 33 No. 2, pp. 176-196, doi: 10.1108/IJWBR-12-2019-0063.

Hannum, M., Forzley, S., Popper, R. and Simons, C.T. (2019), "Does environment matter? Assessments of wine in traditional booths compared to an immersive and actual wine bar", *Food Quality and Preference*, Vol. 76, pp. 100-108, doi: 10.1016/j.foodqual.2019.04.007.

Harsányi, D. and Hlédik, E. (2022), "Attractiveness of wine region types: how less popular wine regions can attract wine tourists?", *International Journal of Wine Business Research*, Vol. 34 No. 4, pp. 627-642, doi: 10.1108/IJWBR-09-2021-0046.

Huang, M. (2006), "Flow, enduring, and situational involvement in the web environment: a tripartite second-order examination", *Psychology and Marketing*, Vol. 23 No. 5, pp. 383-411, doi: 10.1002/mar.20118.

Johnson, E.K. and Hong, S.C. (2023), "Instagramming social presence: a test of social presence theory and heuristic cues on Instagram sponsored posts", *International Journal of Business Communication*, Vol. 60 No. 2, pp. 543-559, doi: 10.1177/2329488420944462.

Kim, H. and Chen, J.S. (2019), "The memorable travel experience and its reminiscence functions", *Journal of Travel Research*, Vol. 58 No. 4, pp. 637-649, doi: 10.1177/0047287518772366.

Kotur, A.S. (2022), "Exploring the wellness dimensions of wine tourism experiences: a netnographic approach", *International Journal of Wine Business Research*, Vol. 34 No. 4, pp. 608-626, doi: 10.1108/IJWBR-07-2021-0040.

Kotur, A.S. (2023), "A bibliometric review of research in wine tourism experiences: insights and future research directions", *International Journal of Wine Business Research*, Vol. 35 No. 2, pp. 278-297, doi: 10.1108/IJWBR-07-2022-0024.

Krishna, A. (2012), "An integrative review of sensory marketing: engaging the senses to affect perception, judgment and behavior", *Journal of Consumer Psychology*, Vol. 22 No. 3, pp. 332-351, doi: 10.1016/j.jcps.2011.08.003.

Leung, W.K.S., Cheung, M.L., Chang, M.K., Shi, S., Tse, S.Y. and Yusrini, L. (2022), "The role of virtual reality interactivity in building tourists' memorable experiences and post-adoption intentions in the COVID-19 era", *Journal of Hospitality and Tourism Technology*, Vol. 13 No. 3, pp. 481-499, doi: 10.1108/JHTT-03-2021-0088.

Lu, L., Neale, N., Line, N.D. and Bonn, M. (2022), "Improving data quality using amazon mechanical Turk through platform setup", *Cornell Hospitality Quarterly*, Vol. 63 No. 2, pp. 231-246.

Lv, Z., Yin, T., Han, Y., Chen, Y. and Chen, G. (2011), "WebVR - Web virtual reality engine based on P2P network", *Journal of Networks*, Vol. 6 No. 7, pp. 990-998, doi: 10.4304/jnw.6.7.990-998.

Miller, D.W., Hadjimarcou, J. and Miciak, A. (2000), "A scale for measuring advertisement-evoked mental imagery", *Journal of Marketing Communications*, Vol. 6 No. 1, pp. 1-20, doi: 10.1080/135272600345525.

Mitchell, R., Charters, S. and Albrecht, J.N. (2012), "Cultural systems and the wine tourism product", *Annals of Tourism Research*, Vol. 39 No. 1, pp. 311-335, doi: 10.1016/j.annals.2011.05.002.

Ogonowski, A., Montandon, A., Botha, E. and Reyneke, M. (2014), "Should new online stores invest in social presence elements? The effect of social presence on initial trust formation", *Journal of Retailing and Consumer Services*, Vol. 21 No. 4, pp. 482-491, doi: 10.1016/j.jretconser.2014.03.004.

Oh, C.S., Bailenson, J.N. and Welch, G.F. (2018), "A systematic review of social presence: definition, antecedents, and implications", *Frontiers in Robotics and AI*, Vol. 5, p. 114, doi: 10.3389/frobt.2018.00114.

Oh, H.J., Kim, J., Chang, J.J.C., Park, N. and Lee, S. (2023), "Social benefits of living in the metaverse: the relationships among social presence, supportive interaction, social self-efficacy, and feelings of loneliness", *Computers in Human Behavior*, Vol. 139, p. 107498, doi: 10.1016/j.chb.2022.107498.

Park, J.-Y., Back, R.M., Bufquin, D. and Nutta, M.W.W. (2021), "Attraction, social presence, sociability, and booking intentions: the moderating role of homophily", *Journal of Hospitality and Tourism Research*, Vol. 45 No. 6, pp. 1044-1068, doi: 10.1177/1096348020988898.

Pimentel, D. and Vinkers, C. (2021), "Copresence with virtual humans in mixed reality: the impact of contextual responsiveness on social perceptions", *Frontiers in Robotics and AI*, Vol. 8, p. 634520, doi: 10.3389/frobt.2021.634520.

Previte, J., Fry, M.L., Drennan, J. and Hasan, S.F.E. (2015), "Friends or foes: group influence effects on moderate drinking behaviors", *Journal of Business Research*, Vol. 68 No. 10, pp. 2146-2154.

Rachão, S., Breda, Z., De Oliveira Fernandes, C., Joukes, V. and Ferreira, C. (2023), "Food-and-wine tourists' willingness to pay for co-creation experiences: a generational approach", *Journal of Hospitality and Tourism Management*, Vol. 56, pp. 245-252, doi: 10.1016/j.jhtm.2023.06.004.

Rice, R.E. (1993), "Media appropriateness: using social presence theory to compare traditional and new organizational media", *Human Communication Research*, Vol. 19 No. 4, pp. 451-484, doi: 10.1111/j.1468-2958.1993.tb00309.x.

Short, J., Williams, E. and Christie, B. (1976), *The Social Psychology of Telecommunications*, Wiley, London, Vols 1/19.

Silicon Valley Bank Wine Division (2024), "State of the U.S. wine industry 2024", available at: www.svb.com/trends-insights/reports/wine-report

Spence, C. (2022), "Tasting imagination': what role chemosensory mental imagery in multisensory flavour perception?", *Multisensory Research*, Vol. 36 No. 1, pp. 93-109, doi: 10.1163/22134808-bja10091.

Spence, C., Okajima, K., Cheok, A.D., Petit, O. and Michel, C. (2016), "Eating with our eyes: from visual hunger to digital satiation", *Brain and Cognition*, Vol. 110, pp. 53-63, doi: 10.1016/j.bandc.2015.08.006.

Srivastava, S.C. and Chandra, S. (2018), "Social presence in virtual world collaboration: an uncertainty reduction perspective using a mixed methods approach", *MIS Quarterly*, Vol. 42 No. 3, pp. 779-803, doi: 10.25300/MISQ/2018/11914.

Sterna, R. and Zibrek, K. (2021), "Psychology in virtual reality: toward a validated measure of social presence", *Frontiers in Psychology*, Vol. 12, p. 705448, doi: 10.3389/fpsyg.2021.705448.

Tafel, M.C. and Szolnoki, G. (2021), "Relevance and challenges of wine tourism in Germany: a winery operators' perspective", *International Journal of Wine Business Research*, Vol. 33 No. 1, pp. 60-79.

Tu, C.-H. (2000), "On-line learning migration: from social learning theory to social presence theory in a CMC environment", *Journal of Network and Computer Applications*, Vol. 23 No. 1, pp. 27-37, doi: 10.1006/jnca.1999.0099.

Tussyadiah, I.P., Wang, D., Jung, T.H. and Tom Dieck, M.C. (2018), "Virtual reality, presence, and attitude change: empirical evidence from tourism", *Tourism Management*, Vol. 66, pp. 140-154, doi: 10.1016/j.tourman.2017.12.003.

Van Kerrebroeck, B., Caruso, G. and Maes, P.-J. (2021), "A methodological framework for assessing social presence in music interactions in virtual reality", *Frontiers in Psychology*, Vol. 12, p. 663725, doi: 10.3389/fpsyg.2021.663725.

Wang, J. and Wang, X. (2019), *Structural Equation Modeling: Applications Using Mplus*, John Wiley and Sons.

Wen, H. and Leung, X.Y. (2021), "Virtual wine tours and wine tasting: the influence of offline and online embodiment integration on wine purchase decisions", *Tourism Management*, Vol. 83, p. 104250, doi: 10.1016/j.tourman.2020.104250.

Wine Enthusiast (2024), "What gen Z actually thinks about wine, according to gen Z", available at: www.wineenthusiast.com/culture/gen-z-wine-drinking-trends/

Xu, X., Huang, D. and Shang, X. (2021), "Social presence or physical presence? Determinants of purchasing behaviour in tourism live-streamed shopping", *Tourism Management Perspectives*, Vol. 40, p. 100917, doi: 10.1016/j.tmp.2021.100917.

Ye, S., Lei, S.I., Shen, H. and Xiao, H. (2020), "Social presence, telepresence and customers' intention to purchase online peer-to-peer accommodation: a mediating model", *Journal of Hospitality and Tourism Management*, Vol. 42, pp. 119-129.

Ying, T., Tang, J., Ye, S., Tan, X. and Wei, W. (2022), "Virtual reality in destination marketing: telepresence, social presence, and tourists' visit intentions", *Journal of Travel Research*, Vol. 61 No. 8, pp. 1738-1756, doi: 10.1177/00472875211047273.

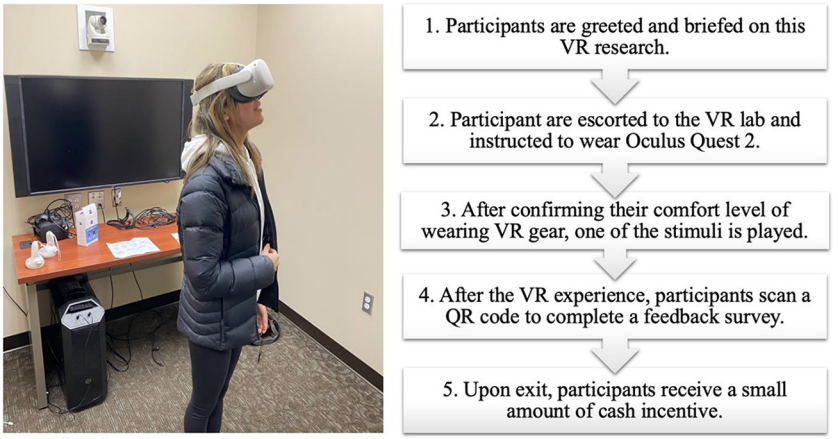
Yung, R., Le, T.H., Moyle, B. and Arcodia, C. (2022), "Towards a typology of virtual events", *Tourism Management*, Vol. 92, p. 104560.

Zarantonello, L. and Schmitt, B.H. (2023), "Experiential AR/VR: a consumer and service framework and research agenda", *Journal of Service Management*, Vol. 34 No. 1, pp. 34-55, doi: 10.1108/JOSM-12-2021-0479.

Further reading

Santos, V., Dias, A., Ramos, P., Madeira, A. and Sousa, B. (2023), "Mapping the wine visit experience for tourist excitement and cultural experience", *Annals of Leisure Research*, Vol. 26 No. 4, pp. 567-583.

Appendix 1



Source: Authors' own work

Figure A1. Example and Sequences of a participant's lab-based VR experience in Study

Appendix 2

Table A1. Measurement scales

Factors/items	Factor loading	AVE	Cronbach's α
Mental imagery		0.81	0.94
The WebVR experiences contain helpful information that helps me imagine a wine trip	0.89		
The WebVR experience brings to my mind some mental images of wine tourism	0.87		
The WebVR experience helps me visualize an actual wine trip	0.93		
The WebVR experience assists me in recalling some similar experiences	0.91		
Drinking intent		0.74	0.90
This WebVR experience evoked my desire to drink wine	0.87		
I would like to drink a glass of wine after watching this WebVR wine experience	0.87		
This WebVR experience increases my desire of wine consumption	0.84		
Memorable experience			0.90
It is memorable because I enjoyed this WebVR experience	0.86		
I have a good impression on this WebVR experience	0.83		
I feel this WebVR experience extended my worldview	0.90		
It is a memorable experience because I am interested in this WebVR form of presentation	0.89		
Destination visit intention.		0.82	0.93
This WebVR experience evoked my desire to go to this destination for fun	0.93		
I would like to go to this place after participating this WebVR experience	0.89		
The WebVR experience increase my desire of visiting this destination	0.91		
Wine knowledges		0.88	0.96
I am confident in my wine knowledge	0.93		
Among my friends, I am a wine expert	0.95		
I know more about wine than others do	0.95		
Video quality		0.64	0.87
Graphical quality	0.78		
Audio quality	0.83		
Content quality	0.80		
Overall quality	0.80		

Source: Authors' own work

Appendix 3

Table A2. Sociodemographic result of Study 1

Characteristics	*n*	%
Gender identity		
Male	113	63.8
Female	63	35.6
Other	1	0.6
Age cohort		
Gen Z (13−26)	68	38.4
Millennials (27−42)	73	41.2
Gen X (43−58)	29	16.4
Baby Boomer (59−77)	7	4.0
Marital status		
Single	40	22.6
Married	133	75.1
Divorced	3	0.9
Widowed	2	1.1
Separated	1	0.6
Ethnicity (multiple choices apply)		
White	161	91.0
Black or African American	2	1.1
American Indian or Alaska Native	1	0.6
Asian	4	2.3
Other	9	5.1
Education		
Less than high school	0	0
High school graduate	21	11.9
Some college	13	7.3
2-year degree	9	5.1
4-year degree	115	65.0
Professional degree	18	10.2
Doctorate degree	1	0.6
Annual income		
Less than $10,000	13	7.3
$10,000−$29,999	23	13.0
$30,000−$49,999	56	31.6
$50,000−$79,999	74	41.8
$80,000−$109,999	7	4.0
More than $110,000	4	2.3

Source: Authors' own work

Appendix 4

Table A3. Sociodemographic result of Study 2

Characteristics	*n*	%
Gender identity		
Male	38	44.7
Female	46	54.1
Other	1	1.2
Age cohort		
Gen Z (13 − 26)	70	82.4
Millennials (27 − 42)	14	16.5
Gen X (43 − 58)	1	1.2
Baby Boomer (59 − 77)	0	0
Marital status		
Single	81	95.3
Married	4	4.7
Other	0	0
Ethnicity (multiple choices apply)		
White	46	54.1
Black or African American	2	2.4
American Indian or Alaska Native	1	1.2
Asian	23	27.1
Other	13	15.3
Annual income		
Less than $29,999	42	49.4
$30,000−$49,999	10	11.8
$50,000−$79,999	15	17.6
$80,000−$109,999	11	5.9
More than $110,000	13	15.3

Source: Authors' own work

About the authors

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