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Immersive Journalism: The Effect of System Immersion on Place Illusion and Co-Presence in 360-Degree Video Reporting

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Abstract: Immersive journalism has been promoted as an alternative way of producing content that allows users to experience first-hand the events depicted in the news story. This mixed-method study examines how immersive journalism impacts the user experience of non-fictional narratives in news practices. A between-subject experiment (n = 104) was conducted to inspect the effects of system immersion on place illusion and co-presence. Using a 360-degree video news report produced by the Spanish newspaper El País as a stimulus, two viewing conditions were compared: magic window and 360 degree with a VR headset. The results show that VR technologies determine the effective potential of immersive journalism, namely the experience of place illusion and co-presence and that audiences do not actually explore the so-called whole picture, as a 90–180° movement for exploration prevailed.

Keywords: immersive journalism; 360-degree video; VR storytelling; immersive storytelling; place illusion; copresence; social interaction; immersive witness

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1. Introduction

The concept of immersive journalism was introduced by de la Peña et al. [1] (p. 291) as "the production of news in a form in which people can gain first-person experiences of the events or situation described in news stories". A fundamental premise of the proposal is that participants gain "unprecedented access to the sights and sounds, and possibly feelings and emotions, that accompany the news" [1] (p. 291). The idea found a match in the industrial hype over the use of virtual reality (VR) technologies, such as 360-degree video and computer-generated imagery (CGI), which have proliferated rapidly in newsrooms across the globe over the past few years [2,3]. The adoption of these technological developments was part of a response to an imperative of innovation from news media outlets, taking advantage of the easier access to equipment and the lower entry costs into this segment to reach disenfranchised and fragmented segments of the audiences [4–6].

The use of 360-degree videos and VR immersive experiences were presented as a sort of "competitive edge for media houses competing in the information age" [7] (p. 12), as they introduced changes in news media reception. The viewing experience with a VR headset (e.g., Google Cardboard, Oculus Go, HTC Vive, Samsung Gear) distinguishes itself from traditional ways of news consumption: from passively seeing, listening and/or reading information, "news becomes an experience" [8] (p. 16) and the user is now conceived as "a participant in the virtual story" [9] (p. 33), being provided with the ability to choose where to look at in a surrounding scene [10], since the field of view is no longer limited to the traditional frame.

While aiming at placing the receptor at the center of the narrative experience—as a witness or as the protagonist in a simulation of the real [11]—immersive journalism has

been proposed as part of an emotional turn in journalism studies, stressing the need for a renewed attention not only to audience perceptions, but crucially to the emotional labor central to professionals' storytelling [12–15]. Nevertheless, until now, few studies have examined the relationship between distinct immersive technologies and journalistic narrative and particularly how they combine in the elaboration of the referred first-person experience.

How does immersive journalism impact the user experience of non-fictional narratives? In this article, we present the findings from a mixed-method study conducted at the receptor level and based on a between-subject experiment and non-participant observation. The objective is to inspect the effects of system immersion on place illusion and the sense of co-presence across two distinct technological systems using a 360-degree video news report as a stimulus. We examine the user experience across a VR headset and a mobile device, the two main options available on VR Apps and other digital platforms. At the methodological level, our purpose is to contribute to a clearer and more fruitful articulation between VR studies and journalism studies.

1.1. Virtual Reality and 360-Degree Video in Journalism

VR was recently proposed as part of reality media, i.e., a class of audiovisual media forms "that explicitly interpose themselves between us and our visual, auditory, or tactile perception of the everyday world and in this sense seek to redefine reality itself" [16]. Not yet stabilized as a narrative medium with a clearly defined grammar [17,18] and symbolizing the evolution of cinematographic language over two centuries, VR aesthetics attracts both practitioners and scholars due to its visual, aural, kinetic, haptic possibilities, and, more than separately, due to their "synesthetic encounters" [19] (p. 14) and considerable plasticity in terms of digital representation conventions and genres [20].

Two normative paradoxes have, nevertheless, been highlighted in immersive journalism conceptualization [21]: the first, the consideration that a 360-degree view provides a more accurate representation of events, while at the same time allowing viewers to freely choose a field of view that can lead to a less accurate picture of the story; the second, the expectation it generates more objective reporting, while greatly depending on staging scenes and image manipulation in post-production, as well on industry standards and practices [22].

One of the strongest postulates about the narrative merits of immersive journalism is the rhetoric around VR as an "empathy machine" [23]. The basic claim is that VR allows users an embodied first-person perspective from within the story world, generating a higher-level sensory response, prone to empathy. This proposition has led scholars to criticize the presumptions of empathy through digital simulations, with alternative concepts being proposed, such as radical compassion [24].

Additional recent examples of this ongoing endeavor are the works of [25], pointing out that the meaning of immersion strongly depends on the users' traits and contexts and that the function of immersion is strongly determined by the users' own cognition and intentions; of [26,27], drawing attention to the unresolved ethical issues associated with the representation of reality in virtual environments; and of [28], critically arguing that immersive journalism, instead of producing experiences tending to empathy, on the contrary, further distances human agents from the analogue reality of the actual world.

A growing number of studies have been particularly addressing the actual human experience of VR non-fictional storytelling in journalism, examining how it affects perceptions and cognitions in presence-related outcomes as the sense of being-there, social interaction, realism, source credibility, story-sharing intention, and feelings of empathy [7,29–32], as well as analyzing its potential to engage users and fight misinformation [33]. There are also proposals of new models and frameworks for the ideation and design of immersive experiences by practitioners [11,34–37]. In terms of the construction of the news story, some scholars have also focused on the specificities demanded by the 360-degree video, concluding that despite the opportunities that the format introduces for journalistic production and

consumption, many media outlets fell into the technological hype and pushed the special narrative and immersiveness demanded by the spherical video to the background [38].

1.2. Definitions: Immersion, Presence, Place Illusion

Despite the attempts of several researchers to improve the concept of immersion to be more precise and operationally useful, the term is still frequently used as a convenient all-purpose umbrella, often regarded as an ambiguous synonymous with different concepts such as presence, engagement, illusion, or involvement [39,40].

Immersion in virtual environments can be defined as a sense (psychological immersion) or as a property of a system (technological immersion). Applied to VR, [41] (p. 227) described the sense of immersion as "a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences". By contrast, technological immersion refers to the "the extent to which the computer displays are capable of delivering an inclusive, extensive, surrounding and vivid illusion of reality to the senses of a human participant" [42] (p. 3).

While immersion refers to the technical properties of a particular system, presence can be considered its "subjective correlate" [9] (p. 5), understood as the user's psychological response to the immersive system [43,44]. Formally described as a "perceptual illusion of non-mediation" [45], presence is an illusion experienced in a mediated environment that results in the feeling of being there [9,42,44,46].

In particular, place illusion is the qualia often used to describe the specific sense of "being there" [9], in the depicted news reality, even if users are aware of not being physically there [44]. According to research, place illusion is closely linked to the level of sensorimotor contingencies supported by a VR system [40,44]. Therefore, the more immersive the system, the higher the chances of experiencing the sense of being there [29,32,47]. This leads to the first hypothesis of the study:

Hypothesis 1 (H1): *While viewing a 360-degree video report, the use of a virtual reality headset leads to higher levels of spatial presence and involvement, and thus of place illusion compared to mobile view.*

On the other hand, when a viewer experiences the particular sense of being together or interacting with others—e.g., sources, journalists, characters—in the virtual environment or surrounding 360-degree scene, this phenomenon is referred to as social interaction [48] or co-presence [46]. Taking this into account, we present the following assumptions on the immersive journalism possibilities:

Hypothesis 2 (H2): *While viewing a 360-degree video report, the use of a virtual reality headset leads to increased levels of a sense of co-presence compared to mobile view.*

Hypothesis 3 (H3): *The sense of co-presence is positively related to place illusion.*

As a subjective human response, its measurement is complex and thus existing studies have used questionnaires to figure out to what extent a user feels present in a virtual environment [30,32,41,47,49–51].

In journalism studies, the research has mainly focused on how the senses of immersion and presence in VR news stories—360-degree video reports included—pose changes regarding the user news experience and also affect audience perceptions compared to conventional forms of storytelling. In this regard, previous studies have found a positive impact regarding engagement, empathy, enjoyment, authenticity, credibility, helpfulness, or story-sharing intention [7,30,32,47,52,53].

2. Materials and Methods

In order to understand the effects of system immersion on place illusion and on co-presence, we conducted a between-subject experiment with two main viewing conditions—tablet and VR headset. The participants assigned to the condition "Tablet" viewed the report using an iPad, an iOS mobile device, and were provided with stereo headphones. In this case, the participants explored the surrounding scene by moving and/or tilting the tablet, what is often referred to as the "magic window" or "mobile view" [54]. On the other hand, the participants in the condition "VR headset" experienced the 360-degree video report by using a VR Shark X4 headset with built-in stereo headphones. The device was equipped with an iPhone XR. In both conditions, the 360-degree video report used for the experiment was accessed from the El País VR mobile App, available on the App Store.

2.1. Stimulus

As the current study focuses on the reception level of immersive journalism, we have selected a 360-degree video report as our story stimulus. We used *Fukushima: Contaminated Lives*. This nine-minute video was published in 2016 by the Spanish newspaper El País and depicts how the 2011 Japanese tsunami turned towns into ghost cities due to the radiation. Thousands of people left their homes and five years later (2016) radiation levels were still far from "safe". The report includes first-hand stories of victims and former residents of the affected area.

We have selected this immersive news story for three key reasons. First, because this report was published both in Spanish and in Portuguese—and English too—enabling the use of the same stimulus material with both Spanish and Portuguese speakers by just changing the language on the mobile app (El País VR). Second, because the video is available on the above-mentioned app, where users can choose the way of consumption: mobile view—turning around while holding the tablet with the hand(s)—or VR headset—putting a smartphone inside a head-mounted device. This was a crucial option since the aim of this study was to compare both conditions regarding place illusion and sense of co-presence using the same stimulus material. Third, despite being an immersive news report, the video uses a conventional journalistic design: a storyteller offers background information in voice over and several sources appear on screen to reinforce the story and tell their testimonies first-hand. Therefore, the face-to-face encounters caused this video to be a convenient option to measure the sense of co-presence.

2.2. Participants

A total of 104 participants (57% females, 43% males) were recruited from the Universidade de Santiago de Compostela and the Universidade Nova de Lisboa via personal contact, posters, e-mail, and a Facebook post about "Watching a 360-degree video in a VR mobile app". The participants ranged in age from 19 to 73 years old (Mage = 32.02, SDage = 11.58); 61.54% of the participants on the tablet viewing condition had previously watched at least one 360-degree video using a mobile device—e.g., smartphone or tablet—while 42.31% of the participants of the head-mounted display condition reported having already used a VR headset to watch content. Further demographic information about participants is summarized in Table 1. As a research limitation, it should be noted that the sampling procedure is not intended to be sociodemographically representative of the Portuguese and Spanish populations.

Table 1. Sample distribution regarding viewing conditions and demographics of participants.

Characteristics	Categories	Tablet (N = 52)		VR Shark X4 (N = 52)		Total (N = 104)	
		Frequency	%	Frequency	%	Frequency	%
Gender	Male	25	48.08%	20	38.46%	45	43.27%
	Female	27	51.92%	32	61.54%	59	56.73%
	Non-binary	-	-	-	-	-	-
Age	<19	-	-	14	26.92%	14	13.46%
	20–24	12	23.08%	11	21.15%	23	22.12%
	25–29	11	21.15%	6	11.54%	17	16.35%
	30–34	4	7.69%	4	7.69%	8	7.69%
	35–39	9	17.31%	11	21.15%	20	19.23%
	40–44	2	3.85%	1	1.92%	3	2.88%
	45–49	10	19.23%	1	1.92%	11	10.58%
	50–54	3	5.77%	-	-	3	2.88%
	55–59	-	-	3	5.77%	3	2.88%
	>60	1	1.92%	1	1.92%	2	1.92%
	Mean	34.59		29.45		32.02	
	SD	11.02		11.67		11.58	
Level of education	Baccalaureate	1	1.92%	12	23.08%	13	12.50%
	Vocational training	4	7.69%	2	3.85%	6	5.77%
	Degree	18	34.62%	20	38.46%	38	36.54%
	Master	18	34.62%	14	26.92%	32	30.77%
	PhD	11	21.15%	4	7.69%	15	14.42%
Prior experience with VR headsets	Yes	32	61.54%	22	42.31%	54	51.92%
	No	20	38.46%	29	55.77%	49	47.12%
	Do not know/Do not remember	-	-	1	1.92%	1	0.96%
Prior viewing of 360° videos with a mobile device	Yes	36	69.23%	40	76.92%	76	73.08%
	No	14	26.92%	12	23.08%	26	25.00%
	Do not know/Do not remember	2	3.85%	-	-	2	1.92%

Source: own elaboration.

2.3. Procedure

Following the exact same research protocol, the recruitment process occurred at the Universidade de Santiago de Compostela and the Universidade Nova de Lisboa. For each call, the participants were invited to join "Watching a 360-degree video in a VR mobile app" and participate in an experimental study. The assignment to the two experimental groups/conditions (1 = Tablet; 2 = VR headset) followed a randomized procedure, although separately in the two locations of the study.

The participants were informed that they would participate in a 15–30 min individual session, which consisted in viewing a 360-degree video report and later answering a questionnaire. The experiment's sessions occurred under laboratory conditions. At the beginning of each session, the participants were specifically informed that they would first view a 360-degree video report about the 2011 Japanese tsunami published in 2016 by El País and, once finished, they would answer an online questionnaire.

The participants in the tablet condition were instructed to start the viewing standing but, if necessary, they could sit on a chair deliberately located close to them. Additionally, they were informed that to explore the 360-degree scene they could only move and tilt the mobile device, as their actions on the touchscreen would not have any effect.

The participants in the VR headset condition were instructed to stand during the viewing and that they could turn around and move their heads to discover the surrounding scene. However, before starting the experience, they viewed a short 360-degree video available on YouTube—*Lions 360-degree* published in YouTube by National Geographic)—in order to properly adapt the headsets to their head and eyes, ensuring a comfortable viewing.

The questionnaire consisted of two sections: the first contained questions related to place illusion and sense of co-presence; while the second included questions on individuals' demographic information and previous experience with VR headsets or 360-degree videos.

2.4. Measures

The questionnaire has been designed to use as a reference the instruments validated and used in previous studies on virtual worlds—computer-generated content—and real-image 360-degree videos. As previously mentioned, this study compares two different viewing modes—virtual reality headset and mobile viewing through a tablet—in order to observe whether the system used influences the sense of place illusion and the feeling of co-presence.

On the one hand, to assess the sense of place illusion, we start from the review of previous instruments used to measure the feeling of presence, place illusion, or 'being there' in virtual worlds [30,51,55]. Thus, a scale on place illusion was designed, which is further divided into two sub-dimensions: spatial presence and involvement. When defining the items to measure the sensation of spatial presence, we used as a reference the proposals of [51] for virtual worlds and the proposal of [30] applied to 360-degree videos. As for involvement, we have used as a reference the homonymous subscale of the Igroup Presence Questionnaire (IPQ) by [55]. With regard to the sense of co-presence, the measures were adapted from the scales used by [30,56]. All the variables are listed in Table 2, including the reliability values (Cronbach's α). All the items were scored on a five-point Likert scale from 1 (meaning completely disagree) to 5 (completely agree).

Table 2. List of items used for measuring place illusion and interaction and Alpha's Cronbach reliability test results.

Variables	Subscales	Items
Place Illusion (Cronbach's α = 0.840)	*Spatial Presence* (Cronbach's α = 0.812)	When watching the video, I had a sense of "being there", in the story environment
		There were times during the experience when the video world became more real or present for me compared to the "real world"
		I felt like I was visiting the places in the video environment
		When watching the video, I felt that my body was in the room, but my mind was inside the world that was presented in the story
		When the video ended, I felt like I came back to the "real world" after a journey
	Involvement (Cronbach's α = 0.783)	While I was watching the video, I was not aware of my real, physical environment
		While navigating the virtual world, I was aware of the real world surrounding me (i.e., sounds, room temperature, other people, etc.)
Co-presence (Cronbach's α = 0.861)		When watching the video, I had a sense of being together with the characters in the story
		There were times during which I felt like I was directly interacting with characters in the story
		I felt the characters in the story were aware of my presence
		When being face to face with the people of the story, I felt like they were talking to me
		When being face to face with the people of the story, I felt like they were staring at me

Source: own elaboration.

2.5. Non-Participant Observation

Since the key goal of the study was to ground knowledge on how people find meaning in their lived experience, in addition to the quantitative statistical data, we adopted direct non-participant observation [57] during the experience: while not taking an active part in the visualization practice, two of the three researchers watched the subjects while they interacted with the technological systems under scrutiny. In this way, we sought a contextual approach that would allow the identification of behavioral aspects emerging from the use of both technological systems examined through directly observed data.

Moreover, once the participants had finished answering the post-viewing questionnaire, we asked them about their experience in relation to the questions asked in the questionnaire and the reactions or behaviors we had noted while they were watching the report. The field notes have allowed us to extract trends and patterns regarding the system immersion—i.e., the viewing devices: tablet and VR headset—data that reveal both paradoxes of the immersive format itself and technical problems that interfere with the experience, as will be discussed in the results.

3. Results

3.1. What the Quantitative Data Shows

SPSS V25 statistical software was used for data analysis. An independent-samples *t*-test was conducted to determine if significant differences exist between viewing conditions regarding *place illusion* (and sub-dimensions *spatial presence* and *involvement*). We have also applied a gender perspective to examine if between male and female there are significant differences. Furthermore, a Pearson's coefficient was used to measure the extent to which some variables fluctuate together.

In addition to the mean comparison tests to identify significant differences between viewing conditions and the tests to measure the linear association between certain variables, we also conducted a mediation analysis using the PROCESS v3.5 macro for SPSS software developed by [58] which, through the bootstrapping technique, allows for the estimation of indirect effects in mediational models [59].

3.1.1. Place Illusion: Spatial Presence and Involvement

Regarding the sense of place illusion, the t-test results reveal significant differences between the viewing conditions (t (102) = −3.772, $p < 0.001$), i.e., between the tablet group and the VR headset group. Moreover, the analysis shows that users who watched the 360-degree video with the VR headset report a higher sense of place illusion (M = 3.5, SD = 0.747) than those in the tablet condition (M = 2.93, SD = 0.797), as shown in Figure 1.

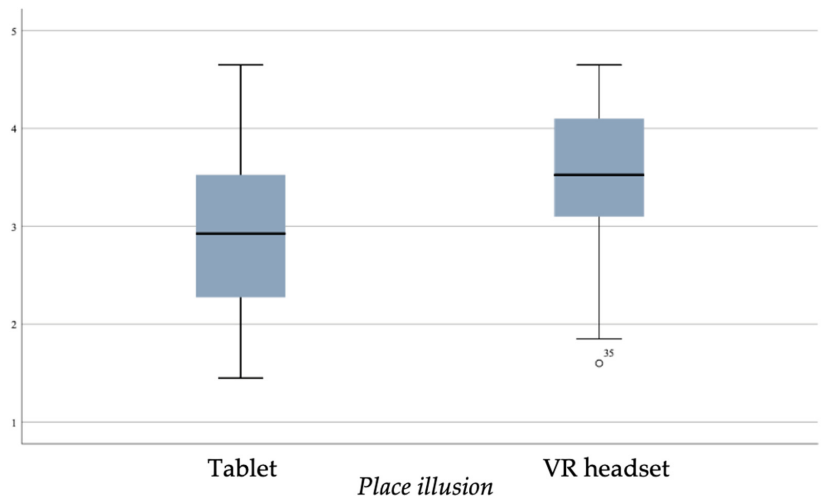

Figure 1. Boxplot of place illusion according to viewing condition.

Similar results regarding the subscales were found (see Figure 2). The *t*-test show the existence of statistically significant differences also between tablet and VR headset groups both in terms of spatial presence (t (102) = −2.843; $p < 0.01$) and involvement (t (102) = −3.649; $p < 0.001$). Furthermore, these differences are statistically significant in favor of the VR headset viewing condition, both in terms of the sense of spatial presence (M = 3.92, SD = 0.758) and the level of involvement (M = 3.08, SD = 0.997).

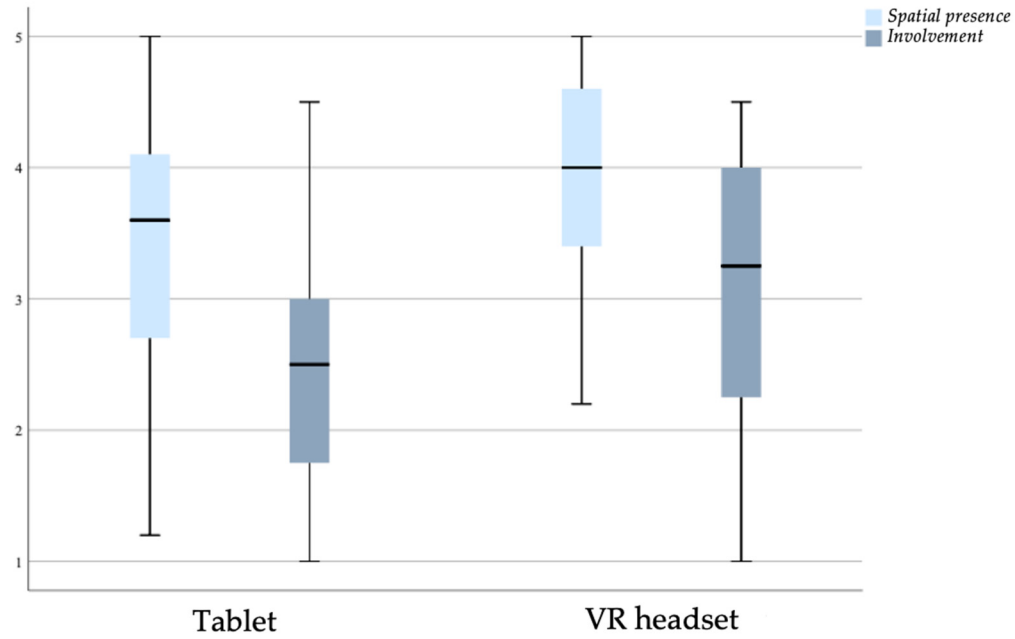

Figure 2. Boxplot of the sense of spatial presence and involvement according to the viewing condition.

On the other hand, there were no significant differences between males and females in place illusion ratings, neither in general (t (102) = −1.555, $p > 0.05$) nor according to viewing condition (tablet condition: t (50) = −0.318, $p > 0.05$; VR headset condition: t (50) = −1.568, $p > 0.05$) The contrast was repeated for the place illusion's subscales spatial presence and involvement and, on this occasion, significant gender differences were found for spatial presence in the VR headset viewing condition (t (50) = −2.833; $p < 0.01$), which were in favor of women, meaning that females (M = 4.14, SD = 0.616) experienced a higher sense of spatial presence than men (M = 3.57, SD = 0.842) during the viewing of the immersive report on Fukushima's tsunami using a head-mounted device.

3.1.2. Sense of Co-Presence

The *t*-test results reveal significant differences regarding the sense of co-presence between viewing conditions, i.e., tablet group and VR headset participants (t (102) = −4.363 $p < 0.001$). As shown in Figure 3, the differences are significant in favor of the VR headset viewing, meaning that the participants using this device report a significantly higher sense of co-presence with the characters of the story (M = 3.54, SD = 1.02) than those who use the tablet (M = 2.69, SD = 0.96).

We have used the *t*-test to check if significant gender differences exist about the sense of co-presence in the whole sample and in the tablet condition. Finally, no significant differences were found. However, to check the same in the VR headset condition, we have used the nonparametric Mann–Whitney U test as the group's samples are normally distributed ($p > 0.05$), but the variances are unequal ($p < 0.05$). In this case, females and males do differ significantly from each other (U = 214.5, $p < 0.05$) and, in particular, again women (Mdn = 3.8) scored higher than men (Mdn = 2.8).

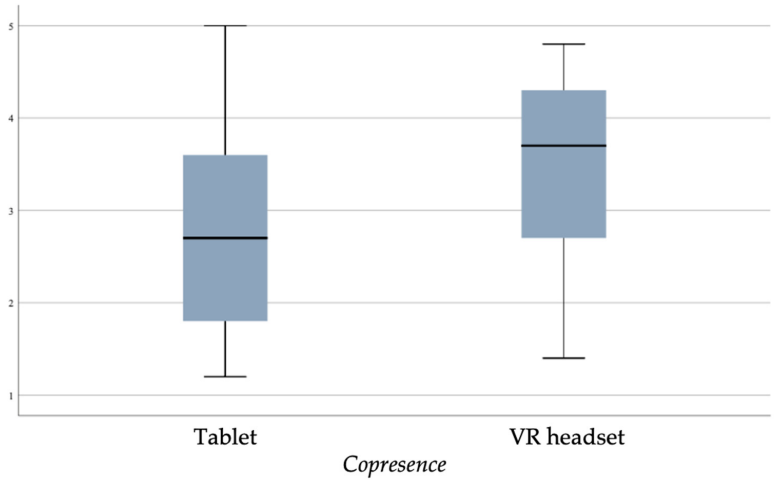

Figure 3. Boxplot of the feeling of co-presence according to viewing condition.

In short, the sense of co-presence—sometimes also referred to as co-presence—perceived by users varies according to the viewing device used to watch the 360-degree video report *Fukushima: Contaminated Lives* and, thus, the participants wearing VR headsets experience higher levels than those using a tablet.

3.1.3. Place Illusion and Sense of Co-Presence

Moreover, there is a significant correlation between place illusion and the sense of co-presence. In particular, the results reveal a moderate positive correlation (r = 0.684, $p < 0.001$), meaning that the higher the sense of place illusion experienced by the participants, the higher they feel as if they were interacting with the main characters of the report on Fukushima's tsunami. Similar correlations were found in both tablet (r = 0.608, $p < 0.001$) and VR headset groups (r = 0.662, $p < 0.001$) separately.

3.1.4. Mediation

The results of the analysis reveal that there is a statistically significant indirect effect between the viewing condition variable and the sense of co-presence through the feeling of place illusion (B = 0.46; ET = 0.13; 95% CI [0.21, 0.74]. Thus, the effect of the viewing condition on the sense of the co-presence is explained by the experienced illusion of place: viewing the 360-degree video report with a VR headset is associated with a higher illusion of place (B = 0.57; $p < 0.001$), which in turn is associated with a higher sense of co-presence (B = 0.81; $p < 0.001$). This is illustrated in Figure 4.

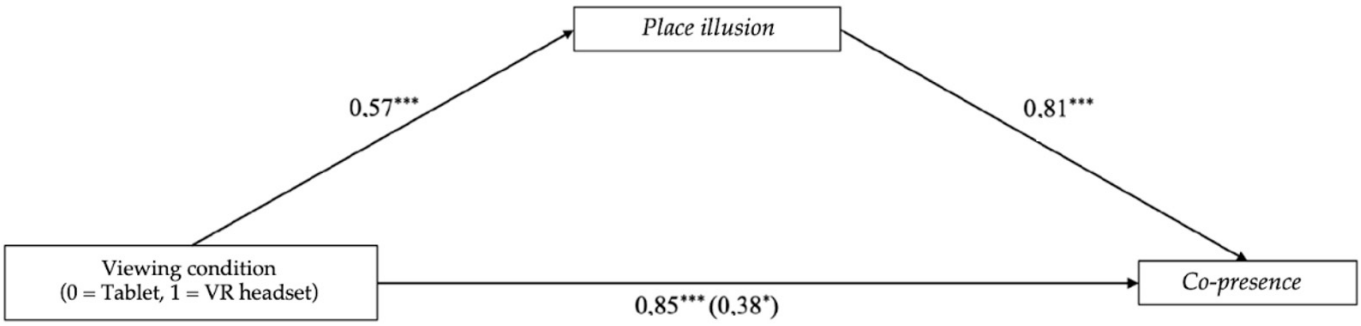

Figure 4. Indirect effect of viewing condition of co-presence. Source: own elaboration. Note: The figures show the unstandardized regression coefficients (B). The arrow relating the viewing condition (X) to the sense of co-presence (Y) includes the regression coefficients for the total effect and, within the brackets, for the direct effect of X on Y. * $p < 0.05$ and *** $p < 0.001$.

The analysis was repeated for the subscales 'spatial presence' and 'involvement' and the results revealed that, separately, both are also mediators in the effect on place illusion. In particular, when watching the 360-degree video report through a VR headset, the sense of spatial presence and involvement are higher and this, in turn, is associated with a greater effect on the sense of co-presence (see Table 3).

Table 3. Indirect effects of the viewing condition on the sense of co-presence.

Mediating Mechanism	Indirect Effect	Boot SE	Boot 95% CI
Spatial presence	0.38	0.13	[0.12, 0.64]
Involvement	0.31	0.11	[0.12, 0.53]

Source: own elaboration.

3.2. What Qualitative Data Reveal

The field notes allowed us to identify patterns and common behaviors that reveal three main aspects: problems of comfort and usability; the novelty effect of both the technology and the format; and the prevalence of a 90–180-degree field of vision. These qualitative results show that the 360-degree video format is still too new for many users, which causes them to imitate traditional audiovisual consumption and maintain a mainly passive physical attitude during the viewing, reacting only to stimuli—characters talking, persons or objects movements, and so on—or to scenes that for some reason are particularly attractive or interesting to the viewer. Furthermore, we noted that the discomfort experienced due to the viewing device, regardless of whether it is a tablet or VR headset, has a negative impact on the user experience and even affects usability.

3.2.1. Wearability/Usability

As documented in previous studies [60–62], embodied engagement with virtual environments, particularly when using VR headsets, implies significant physical workload by the end users to navigate the surrounding space. From our observations, it is suggested that this is also the case with the tablet viewing condition: several participants showed and verbalized signs of discomfort, while having to hold the tablet with both hands, sat down after a few minutes of exploration, and others expressed the strangeness of having to move a screen to view the scene, while having a character speaking in front of them. Most of the VR headset viewers showed a passive attitude during the viewing, just moving their head and not engaging with their entire body. Since the equipment is fixed on their head, several participants revealed signs of not knowing what exactly to do with their upper limbs: several crossed arms, while others held the headset, and others put their hands in their pockets. Some participants verbally expressed physical discomfort with the equipment, namely with its weight and a condensation effect. These observations suggest that wearability and usability issues with current VR headset models such as the ones identified can create distracting factors, causing users to lose important elements of the scene and even negatively affecting their immersion and engagement in the news story.

3.2.2. The Novelty Effect

From a user experience perspective, 360-degree video is still not yet stabilized as a narrative medium with a grammar of itself [17,18]. The participants in both groups (tablet and VR headset) reported that they became distracted/lost from the storyline while exploring the evolving scene and the associated technological capabilities of the device—e.g., turning around without a narrative cue, trying to walk. Furthermore, this novelty effect impacts, at least during the first few minutes or scenes, on the user's involvement in the story. In other words, we noted in both conditions a tendency to prioritize, especially at the beginning, the testing of the limits of the 360-degree video format and the viewing system while attention to the story is relegated to a second place. However, once the participant assumes and/or understands the logics and limits of the immersive experience, this novelty effect disappears to a greater or lesser extent and in most of the cases the

user decides to look for the main action in the surrounding image—most relevant object, character speaking, etc.—to finally focus on narrative. It is then when the user drops out of this continuous, meaningless exploration, triggered both by curiosity and novelty, and starts to focus his or her attention on a specific point in the scene, in such a way that we observe how the participant, who until now was in continuous movement—rotating, moving the device in all directions, and so on—adopts a more passive attitude with more reduced and punctual movements.

3.2.3. The 90–180-Degree of Framing

Beyond the initial moments in which the user, moved by curiosity and the novelty effect, rotates and moves/moves the device without an apparent narrative reason or, on the contrary, remains practically stationary because he or she ignores the possibilities of the spherical format, once the viewer understands and assumes the logics of the immersive format, the user limits his or her movement—or exploration visual range within the immersive scene—to 90–180-degrees and sustains it on the narrative itself. Therefore, the main action or point of interest would then be in front of the user and would correspond to a 90-degree field of view, while the sides—around 45 degrees, respectively—would provide some visual context, enough to avoid turning completely and exploring the whole scene, since this would imply losing sight of the area of interest or main action.

Thus, and using as a reference The Cone of Focus from The Soap Collective technology company [63], a technique for directing user's attention in spherical videos, we concluded that during the viewing experience of most of the viewers, the following behavior predominated: once they assimilated or understood the rules of the format, they focused their attention on the main action or area of the surrounding scene, so that they "framed" it—corresponding to a 90-degree frame within the immersive image—and moved their head/device sideways—approximately no more than 45-degree to each side—just to acquire visual context and/or widen the field of view of the place they were in, without losing sight of the important action, event, person, or element in a particular scene. This is illustrated in Figure 5.

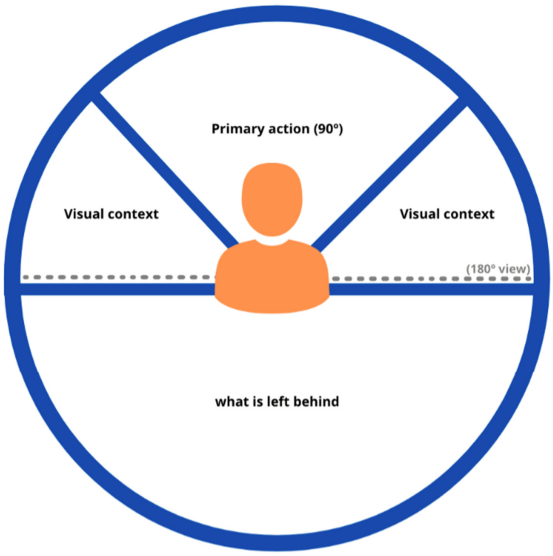

Figure 5. The 90–180° movement for exploration. Source: Authors' reinterpretation of the so-called technique "The Cone of Focus" (Dwight, 2016).

4. Discussion and Conclusions

4.1. Immersive Journalism, Technological Systems, and Immersion Modalities

As mobile viewing is still the most available form of 360-degree video reception, and as the use of VR headsets is not widespread, in this study we wanted to test if and how the device used to watch 360-degree video influences the experience of place illusion and sense

of co-presence—often referred to as co-presence—in journalistic reporting. Therefore, we have compared the two most common viewing possibilities—tablet and VR headset—and the results show that the experience of presence is mainly determined by the technological system used: the more the system immersion blocks external stimulus and isolates the users from their surrounding reality, the greater the chances of experiencing place illusion. As prior studies have found [32,47], our results show that wearing a VR headset leads to significantly higher levels of place illusion than the mobile viewing. The same applies to spatial presence and involvement (H1). Furthermore, and in terms of gender disparities, we found that women experience a higher level of sense of spatial presence than men while watching the immersive report through the head-mounted VR device. This result is in line with the findings of [64], who observed such differences in 360-degree 3D videos.

The findings suggest that the level of immersivity of the system used to watch a 360-degree video is a contributing factor to place illusion in immersive journalism storytelling: the higher the first, the higher the second. This means that the so-called first-person experience, a foundational idea in immersive journalism [1], is enhanced or weakened by the specific technological system in use and, thus, that immersive journalism only reaches a higher level of immersion—technological one—if the devices used for watching the news succeeds in isolating the user from his or her physical reality. The prior research on virtual worlds pointed out that technological immersion has an effect on the sense of presence [65]. However, what our results indicate is that this can also be extended to immersive mediated journalistic environments based on 360-degree video. Immersive technology succeeds in creating the feeling of presence, but the construction of the story is also central. From a narrative perspective, the place takes on a key role, as other scholars have argued [66]. In this sense, immersive journalism demands a spatial and immersive storytelling [67] to foster the sense of actually being there and provide realism to the news experience.

On the other hand, the sense of co-presence while being face to face with a character in the 360-degree environment notably varies depending on the viewing condition. The more immersive the technological system, the more the sense of co-presence: VR headsets succeed in this compared to mobile viewing (H2). In fact, the head-mounted VR device both leads to and predicts a higher sense of co-presence in a face-to-face encounter between the viewer and the characters of the news story. Similar to what occurred regarding the sense of spatial presence, women also scored significantly higher than men on the feeling of co-presence in the VR headset condition.

Furthermore, we found the sense of place illusion is directly related to the feeling of co-presence, meaning that the higher the first, the higher the second (H3). The effect of the viewing device on co-presence is explained by the perceived place illusion: viewing the immersive report with a virtual reality headset is associated with a higher sense of place illusion in the depicted reality, which in turn is associated with a greater feeling of co-presence. The potential of immersive reporting with 360-degree video to provide the user with the feeling of being in the scene with the protagonists contributes to reducing the distance between the viewer and the represented reality and this introduces an experiential dimension into news consumption [12]. Therefore, this reinforces the idea that immersive journalism can actually offer a first-person perspective of news events and stories, allowing the user to experience the depicted reality as a participant rather than a simple observer [68], even though passivity still prevails in terms of interactivity [69]. Some news outlets and humanitarian aid organizations [70] explored this possibility to bring distant suffering closer, causing the user what [26] is referred to as an immersive witness, which links the immersive experience with a moral attitude of responsibility toward the others.

Thus, we noted that VR technologies significantly determine the effective potential of immersive journalism. Unlike mobile devices such as smartphones and tablets, the penetration rates of VR headsets in households are still relatively low, closely related to gaming practices and not to news consumption. However, we found that VR headsets are in fact the tool that succeed in promoting the feeling of "being there" [32,47], i.e., the sense of place illusion and also co-presence, which is the main goal of immersive journalism in order

to bring distant realities closer to the audience [1,9]. Since the technology does directly influence the immersive impact of a 360-degree video news story, news media organizations face the need to develop strategies to disseminate these technologies to their legacy and potential audiences and/or to implement plans for distributing immersive content that fit the technological realities accessible to users, as in the recent past was experimented by *The New York Times* and *The Guardian* throughout partnerships with Google.

4.2. Immersive Storytelling and Narrativity in Journalism

Since its introduction in professional practice and in scholarly inquiry, immersive journalism has been promoted as a novel form and an alternative way of presenting and producing news content in such a way that it allows users to experience first-hand the places and events depicted in news stories [9], thus, allowing for a more immersive experience of proximity. Admitting as a premise that a news story structure is how the content of a narrative is organized in order to be conveyed to the audience [71], our findings suggest that immersive journalism, anchored in the development of emerging cinematic technologies, is stimulating an evolving (re)articulation between digital media representational properties and journalistic narrativity, i.e., how the story is told.

From our study, it becomes apparent how immersion design practices by news practitioners, while exploring the emerging communicative and expressive possibilities of the medium, with its more or less conventional narrative structures, encounter at the receptor level the ongoing domestication of a technology in the process of becoming media. This is particularly evident in the emerging relationship with a renewed notion of frame and scene reconfigured by a 360-degree omnidirectional view. Following the articulation between the ever-evolving material bases of journalism and specific narrativity elements, while constituting its own audiovisual grammar, immersive journalism is also establishing renewed relations between journalistic language and the social construction of reality.

The articulation of the journalist as a storyteller who (re)constructs the sense of the real in a now omnidirectional environment emerges in journalistic studies as a renewed reminder that, in modern societies, journalists act as narrators. To that extent, immersive journalism needs yet to improve clear guidelines and principles aimed at journalistic immersion and not just at technological immersion, i.e., to renew its narrative strategies by having as a reference its core social functions and the associated ethical frameworks. At the current stage of development, and based on our findings, the lack of a clear journalistic narrative model for immersive journalism compromises not only a user-centric experience of the news, as potentially its accuracy [21].

From our observation, we realized how the users are not prepared for discovering the so-called whole picture (360-degree view) since a 90–180-degree movement for exploration prevailed. Thus, while watching a 360-degree video report, both with a VR headset and a tablet, we have identified a common behavior: once users are familiar with the immersive narrative and the novelty effect is gone, they remain practically focused on a particular zone of attention, i.e., looking ahead, just changing their point of view if necessary—e.g., when a character appears in a different spot in the following scene. The fact that this behavior was common among most participants, and moreover in both viewing conditions, suggests that viewers tend to replicate traditional audiovisual consumption even though they are aware that the scene is no longer limited to a given frame. Prior scholars have found that immersive formats might cause the user to feel disoriented and lost, as they overwhelmingly become cognitive environments for them. Directional Cues are posed as a non-invasive solution that helps to guide users without negatively affecting the feeling of presence [72]. However, guiding the user in the immersive news scene becomes a paradox: the need to direct the user to explore the whole scene without losing relevant information confronts the freedom of exploration, a core value associated with the foundational idea of immersive journalism and the first-person experience of the news events [38].

The 90–180-degree viewing zone identifies another paradox in immersive journalism practice: although opening the possibility of a full visual frame (360-degree) for journalistic

storytelling and reality depiction, it is in fact serving as an anchorage for the prevalence of a certain region of framing and of the sights and sounds that correspond to it. This prevalence of a 90–180-degree movement by users must then be taken into consideration by practitioners when designing the narrative experience and scripting the news story. Taking as a reference the Cone of Focus technique designed by the technology company The Soap Collective [63], initially developed to direct audience attention, we proposed an outline on how to adapt 360-degree news video storytelling to journalism principles: placing the main action at a 90-degree frame, sides (approximately 45-degree right, 45-degree left) should provide visual context meanwhile the remaining 180-degree, excluded from the users' immediate field of view, should not include fundamental information or data to understand the news story. Thus, its function should be to provide a bigger picture of the location or space in which the user is immersed to avoid breaking the sense of place illusion if he/she turns to discover the whole scene.

Based on both quantitative and qualitative findings, there is evidence to suggest that, from a reception point of view, immersive journalism is not yet a stabilized medium. Despite the latest technological developments, users still report problems or negative experiences related to wearability and usability, regardless of the viewing device: physical discomfort, tiredness, and absence of a proper guidance around the surrounding scene, among others. Moreover, users still do not yet fully understand the particular audiovisual grammar of 360-degree videos, which differs from conventional audiovisual media.

Our findings provide practical implications for both 360-degree video journalists, VR news producers and system developers: there are usability and wearability issues that the technology industry must solve to improve the user's experience; 360-degree video reports need clear guidance or cues to ensure that viewers do not miss important elements of the story or experience fear of missing out (FOMO); and the common 90–180-degree movement for exploration must be taken into consideration while designing and producing non-fiction content to ensure users properly follow the narrative.

4.3. Limitations and Further Research

This study has some limitations, thus further research is needed as this experiment is based on particular stimulus material and two viewing conditions. Thus, for the future, it should be considered that other ways of consumption—e.g., text report, fixed frame video, and low- vs. high-end VR headsets—and different stimulus in order to test if the news topic, narrative design, structure, and sound, among other factors, have an effect on subjective perceptions. Furthermore, researchers would benefit from measuring narrative immersion to compare the results with the technological immersion. On the other hand, based on the qualitative insights, future research could benefit from implementing eye tracking methodologies to advance in the study of the 90–180-degree movement and to better understand the specific triggers of user's behavior while using a VR headset to watch news stories. It should be noted that further research is required to provide meaningful generalizations.

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