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Online interactive storytelling: Evaluation of the viewer experience of 360-degree videos

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Abstract

Aim/purpose – This article aims to examine the relationships between the 360-degree viewer experience and video genres.
Design/methodology/approach – The presented empirical study was based on the respondents' evaluation of two 360-degree videos: a documentary film and an episode from a web series.
Findings – The viewers evaluated the 360-degree video documentary as more interesting, more engaging, creating deeper immersion in the plot, and delivering more information compared to their experience when they would watch video if it were produced as a traditional film format. The study showed the differences in viewers' evaluation of 360-degree documentaries and web series episodes. The evaluation of 360-degree videos was different between the two groups of respondents varying in their perception of navigation.
Research implications/limitations – Our study suggests that by implementing 360-degree video features in documentary films, we can evoke a more intensive viewer experience compared to the situation when the viewer would watch videos in the tradi-

tional film format. It also indicates that film production should take into account the different viewer's perceptions of being actively engaged in the navigation. The limitations of the study: the qualitative study with the convenient respondent sampling, the subjective evaluation of respondents' statements, and the subjective choice of the evaluated 360-degree videos.
Originality/value/contribution – The study contributes to film production by highlighting the significance of viewer perception of navigation and the video genre as factors impacting the viewer experience.

Keywords: 360-degree video, viewer experience, online film interactivity.
JEL Classification: O33, Z11.

1. Introduction

The 360-degree video can be placed within the overlapping fields of the interactive film, traditional film, computer games, virtual reality, 3D cinema and 3D online presentation. However, this new technology is none of the above mentioned, and the similarities with other technologies depend highly on the video genre. For example, a 360-degree video presenting the environment of a museum or hotel (promotional film) is often close to a virtual tour, but the 360-degree thriller filmed from the first-person is similar to a computer game. The aspect separating the 360-degree video from most 'just solely interactive' forms of communication on an Internet website is the film itself: the 360-degree video consists of the story and the means to deliver the story to the reader (viewer).

In the narratology, a clear distinction is made between the story (what the story is about) and the discourse (the actual form of the story) (Brown, 2018), and the technology of 360-degree video significantly changes the discourse. The major difference between a 360-degree video and the traditional film lies in the viewer's ability to change the angle of view: the viewer watches the traditional film with a defined and set focus of view, while the viewer of the 360-degree video can select the camera angle to view a chosen part of the 360-degree sphere filmed around the camera. This interactivity of film induces the viewer's feeling of 'being inside the film' which can be further enhanced by watching the film in stereoscopic view through a head-mounted display.

So far, this new film technology raises much more questions than there are ready-to-use standards and solutions for how to produce a video and what the viewers' experience of it would be. The process of video shooting can still be described as 'experimental', although the scope of literature offering useful insights into the process of 360-degree video production and its distribution, and the

viewer interaction with this technology has been steadily growing (e.g. Borisov, Smolin, Stolyarov, Shcherbakov, & Trushin, 2017; Hussar, 2016; Kim, Yun, Jo, Kim, Chae, & Suh, 2018; Philpot, 2017; Pope, Dawes, Schweiger, & Sheikh, 2017).

In this paper, we present the results of the study aiming to capture differences in viewer experience when the viewer watches two video genres: documentaries and web series. The text is structured as follows: Part 2 highlights the spectrum of factors which can influence the 360-degree video viewer-experience construct. In Part 3, we present the research questions, and the methodology of the empirical study, and this part is followed by the presentation of findings (Part 4) and the discussion (Part 5). The paper ends with conclusions, the indication of limitations and the future research (Part 6).

2. The factors shaping 360-degree video viewer experience

In the literature, the art experience in areas such as painting or sculpture is discussed and modelled (at the psychological and/or neurological level) without mentioning the area of film (e.g. Cela-Conde, Agnati, Huston, Mora, & Nadal, 2011; Jacobsen, 2010; Pelowski & Akiba, 2011; Pelowski, Markey, Forster, Gerger, & Leder, 2017). However, some factors indicated in the literature seem to be 'transferable' to the situation of film watching. The 360-degree viewer experience is also linked with the interactive environment. Therefore, the viewer-experience construct can be shaped similarly as in the following two situations: when the viewer watches the traditional film, or when the viewer experiences virtual reality (VR). Table 1 summarises the factors affecting the viewer experience which are described from these three different perspectives: the 360-degree video as art stimuli, the 360-degree video as virtual reality and the 360-degree video as a traditional film.

Table 1. Different perspectives in analysing 360-degree viewer experience construct

The perspective	The aspects of viewer experience highlighted in given perspective	The aspects of 360-degree video viewer experience highlighted in given perspective
1	*2*	*3*
Art perception such as sculpture, painting	– The context of viewing. – The viewer characteristics, e.g. art training, mood of viewer. – The culture and the cultural background of the viewer. – The changes of the art perceptions over the time	– The impact of context built by the platform on which the video is distributed (e.g. the layout of the website, other content, the legal aspects of online distributed materials, user privacy concerns, sharing content with others)

Table 1 cont.

1	*2*	*3*
		– The context of watching built by mobile technology, smartphone, tablet (e.g. watching at home, work, school, bus stop). – The viewer characteristics including viewer's perception of novelty of technology. – The viewers' cultural differences of the film perception
Virtual reality (VR)	– The viewer/user experience is created exclusively in the computer. – Telepresence – the viewer's feeling of 'being inside environment – the virtual world'. – Telepresence can be influenced by the vividness and interactivity of the computer environment. – The user can interact with the objects inside virtual world. – Wide range of interactive tools in the environment (e.g. choosing avatars of users, communication with others online). – Social presence of others in the virtual environment	– The navigation of the video is created in virtual environment: the navigation can be based on clicking on the computer/ tablet/smartphone screen, using head--mounted display or rotating the smartphone/tablet. – Contrary to VR, the predefined story is being told to the viewer (the viewer cannot change the plot) and the viewer cannot interact with objects and people in the environment. Interactivity is limited to navigation. – Telepresence of viewer – 'feeling of being inside the story'. – Interactive elements can be added to the video leading to an increase of its interactivity (making the video 'more similar' to VR)
Traditional film	– Viewer narrative engagement and its outcome: enjoyment and viewer's story consistent attitude. – Important social aspects of watching film at home or at the cinema (e.g. watching film together with friends at the cinema). – The feature of film (e.g. genre, length of duration, topic, style of directing)	– 360-degree video changes the role of the viewer who can select the part of the filmed sphere which is being watched. – Unique viewing of 360-degree video leads to possible problems: the viewer does not focus on an important part of the filmed sphere (e.g. missing the protagonist entering the room). In order to prevent the occurrence of these 'missing' parts, the video can offer ways of assisting focus. – Social aspects of watching videos (watching video together) are usually very limited (though, the VR cinema has been opened, or the viewers can watch video together using tablet). – Similarly to traditional film, video 360-degree creates viewer narrative engagement

Source: Adapted from: Busselle & Bilandzic (2009); Jacobsen (2010); Pelowski, Markey, Forster, Gerger, & Leder (2017); Rupp, Kozachuk, Michaelis, Odette, Smither, & McConnell (2016); Steuer (1992); Tang & Fakourfar (2017); Zhou & Deng (2009); Lin, Chang, Hu, Cheng, Huang, & Sun (2017).

Looking from the perspective of interaction between the viewer and the 'product' (the film, VR, the art piece) is only one possible approach. Other approaches can be based, for example, on the analysis of viewer experience in the process of the diffusion of 360-degree video as a new technology, or the process of creating consumer's experience through the usage of the product (service-dominant logic). At this point of the paper, we would like to emphasise the service-dominant logic (Lusch, Vargo, & Wessels, 2008; Vargo, & Lusch, 2004) as an approach indicating the importance of the active role of the viewer. From this perspective, the producer of the video does not deliver the value itself – the value of the film is not created till the moment when the viewer watches the film. For example, in the situation where the viewer does not know how to use the navigation options, these interactive features offered by the film producer do not bring any value to the viewer experience. This approach emphasises that the viewer is always the co-creator of the product (video), the viewer is a prosumer whose resources should be applied to experience this product, and each aspect of the viewing matters (including the context of watching) as the 'value-in-use' is created at the moment of film consumption. In the case of 360-degree videos the co-created video can even be preserved by the viewer – in this hypothetical situation, the viewer can record their viewing and in this way they can create their own unique 'traditional' film (although within predefined possibilities).

To give examples of topics investigated by researchers within the broad area of the 360-degree video viewer experience, we can point to the following interesting studies:

1. The differences between the viewer's narrative engagement and empathy, and also the aspects of feeling of presence by the viewer and the role of the viewer in the film in high immersive environment and low immersive environment (Bindman, Castaneda, Scanlon, & Cechony, 2018).
2. The role of immersiveness and future virtual reality expectation on the subjective-experience of the viewer in the case of watching an educational video (Rupp et al., 2016).
3. The features of narrative and technical immersion of a 360-degree video (Elmezeny, Edenhofer, & Wimmer, 2018);
4. The process of two viewers watching a 360-degree video together (Tang & Fakourfar, 2017).

However, the results of studies published in the literature are often difficult to compare with each other and also with – presented in further in this paper – results of our study due to the differences in the analysed video genres (e.g. edu-

cational film vs. artistic film productions), the format in which the video was produced (feature films vs. animated films), the viewing-settings in which the analysis was conducted (head-mounted display, smartphone, computer, tablet), and more importantly – the differences in the research perspectives taken in study design.

3. The research problem and the methodology of empirical study

3.1. The research questions

The main research questions are:

- Research Question 1 (RQ1): To what extent does the viewer experience differ from viewing the film as a 360-degree video from what the viewer would experience if it were in a traditional film format?
- Research Question 2 (RQ2): To what extent does the 360-degree viewer experience of a 360-degree documentary video differ from watching an episode of a 360-degree web series?
- Research Question 3 (RQ3): To what extent is the 360-degree viewer experience shaped by the technology: the navigation?
- Research Question 4 (RQ4): To what extent is the 360-degree viewer experience influenced by different outside factors: the social aspect of film watching, and other potential aspects?

In order to answer these research questions, we designed the study in which the respondents watched two different 360-degree video, available on the Internet, free of charge – one documentary film, one episode of a web series – and then they answered the questions about their perception of these film productions.

In our approach, we designed the experience construct which emphasises the viewer perception of 360-degree features against a 'traditional experience' as the base-line. To more clearly illustrate the problem, let us consider the following example – if we just ask the respondent to rate the film as interesting ('Is the film interesting?'), we can presume that the respondents' evaluations will include all aspects of this film, e.g. story, sound, understanding of characters, navigation. As the documentary film or web serial are well-known genres, instead of asking respondents about their 'absolute' evaluation of the video, we asked respondents to evaluate the enhancement of the experience impacted by adding the features of a 360-degree video. In the questionnaire, the respondents

were asked to what extent they agree with the given statements, such as 'a 360-degree video is more engaging for a viewer than a traditional film' or 'a 360-degree video is more interesting for a viewer than a traditional film'. This approach was tested with good results in our previous studies referring to the promotional 360-degree video (Świerczyńska-Kaczor, Kotlińska, & Wachowicz, 2017). However, we note that:

- The comparison is hypothetical, and the respondents may refer more in their evaluation to their general attitude and expectations of the genre than to a particular film.
- We cannot also evaluate the video itself, meaning that we do not have a scale with a set 'zero' point for evaluating the video as 'interesting', 'creating telepresence', or 'being engaging'.

In Part 2, we pointed to the role of telepresence, navigation, and role of the viewer as a prosumer as factors impacting the viewer experience. Therefore, in this study we define the following variables:

1. The viewer feeling of telepresence (being inside the story) compared to what the viewer would experience if it were a traditional film.
2. The viewer engagement compared to what the viewer would experience if it were a traditional film. Viewer engagement is not necessary directly positively related to the immersion in the film story (for example, the internet user can feel being fully immersed in the virtual environment, but at the same time feel bored).
3. The viewer interest in the film compared to what the viewer would experience if it were a traditional film.
4. The viewer feeling of being informed compared to what the viewer would experience if it were a traditional film (this aspect can be particularly important for documentary films).
5. Understanding the plot on the first viewing.
6. Viewer experience of film navigation: 'ease of navigation' and 'the viewer's enjoyment to be able to control the navigation'.
7. Viewer potential interest in 'interfering with the plot' – this aspect was investigated only for the web series episode and refers to viewer's interest in having more control over the story development, such as selecting the protagonist's movement.

We also presume that the features of the 360-degree video, such as 'ease of navigation', 'the viewer's enjoyment in being able to control the navigation', 'understanding the plot on the first viewing' are related to the viewer's perception of 'film being interesting', 'being informative', 'creating engagement', 'creating intense feeling of being inside the plot'.

3.2. The study procedure

The study design was based on the respondents' evaluation of two 360-degree video film productions:

- a documentary film which is an interactive part of the article published by BBC – Damming the Nile: Explore with 360-degree video (BBC, 2018, February 20), English language film version;
- an episode of a web series titled 'Bar' ('The Pub') of the Polish web series 'Para nie do pary' available on the platform Player.pl (Rus, 2016) – Polish language version, with free-of-charge access with advertisements shown before the episode.

The selection of these videos was based on their very good quality of production, the adequacy of content to the genre, and their free-of-charge availability on the websites.

In April 2018, 56 respondents from two Polish universities took part in the survey, their area of studies was not linked to film or art. The design of the study was as follows: the respondent watched the video individually on a computer in a university classroom, and then they completed the questionnaire. The same procedure was repeated for the second video. After viewing the video, the respondents could add comments which they had not put in the questionnaire. The characteristics of the interviewees: 51.79% male (29 respondents), 48.21% female (27 respondents), the majority – over 83.93% (47 respondents) – were under 30 years old, the respondents had previous experience with watching 360-degree videos using a laptop/computer PC (42 respondents – 75.00%), smartphone/tablet (11 respondents – 19.64%) or a head-mounted display (3 respondents – 5.36%).

The respondents evaluated their experience with the film production using a semi-structured questionnaire. They were asked to agree or disagree with the given statements (positive or negative), and the respondents evaluated the statements with the scale from 1 to 4: 'I strongly disagree with the statement' (1), 'I disagree with the statement' (2), 'I agree with the statement' (3), 'I strongly agree with the statement' (4). The respondent could not choose the option 'I don't know', and therefore they had to express their positive or negative attitude (we purposefully did not to choose the Likert scale or other scale with neutral point). We analysed the open questions manually by seeking for the topics and sub-topics which emerged from respondents' answers.

4. Research findings

The respondents evaluated their experience with the film story and the navigation by comparing their experience to what they would experience if the film were made as a traditional film (Table 2, Figures 1-2). The results indicated that:

1. The documentary video was evaluated as more interesting, more engaging, creating deeper immersion in the plot, and delivering more information compared to a traditional production (statistically significant difference between the groups 'agree' and 'disagree', $p < 0.05$).
2. The documentary video was also not perceived as difficult to understand on the first viewing (statistically significant difference between the groups 'agree' and 'disagree', $p < 0.05$).
3. The episode of the web series was evaluated as allowing the viewer to be more immersed in the plot compared to what the viewer would experience if the film were produced as a traditional film. The respondents did not evaluate the other dimensions as giving a superior experience over the traditional film.
4. The evaluation of the viewers' experience with the documentary film was significantly statistically different to the evaluation of the experience with the web series (Wilcoxon test, $p < 0.0$; Table 2, Figure 2). For example, the evaluation of the statement – 'the 360-degree video documentary is more interesting than a traditional film' was different than the statement 'the 360-degree video web series is more interesting than a traditional film'.
5. The respondents' opinions about the statement that the episode of the web--series is difficult to understand during the first viewing was mixed: there is no significant difference between the two groups 'agree' and 'disagree'.
6. The respondents' opinions about the need of having additional options such as the selection of protagonist's movement were mixed for the web series episode.
7. The documentary video was evaluated as easy to navigate, and the respondents enjoyed being able to control the focus of the view.
8. The episode of the web series was evaluated as easy to navigate, although the respondents expressed varied opinions about 'enjoyment over control of navigation'.
9. There is a statistically significant difference between the two groups of respondents: first group 'enjoy having control over navigation' (responses 3-4), and second group with negative answers (responses 1-2) in the evaluation of 'docu-

mentary film being more interesting', 'film building more viewer's engagement', 'being more inside the plot', 'the film being more informative', and 'difficult to understand on first viewing' (U Mann–Whitney test, $p < 0.05$).

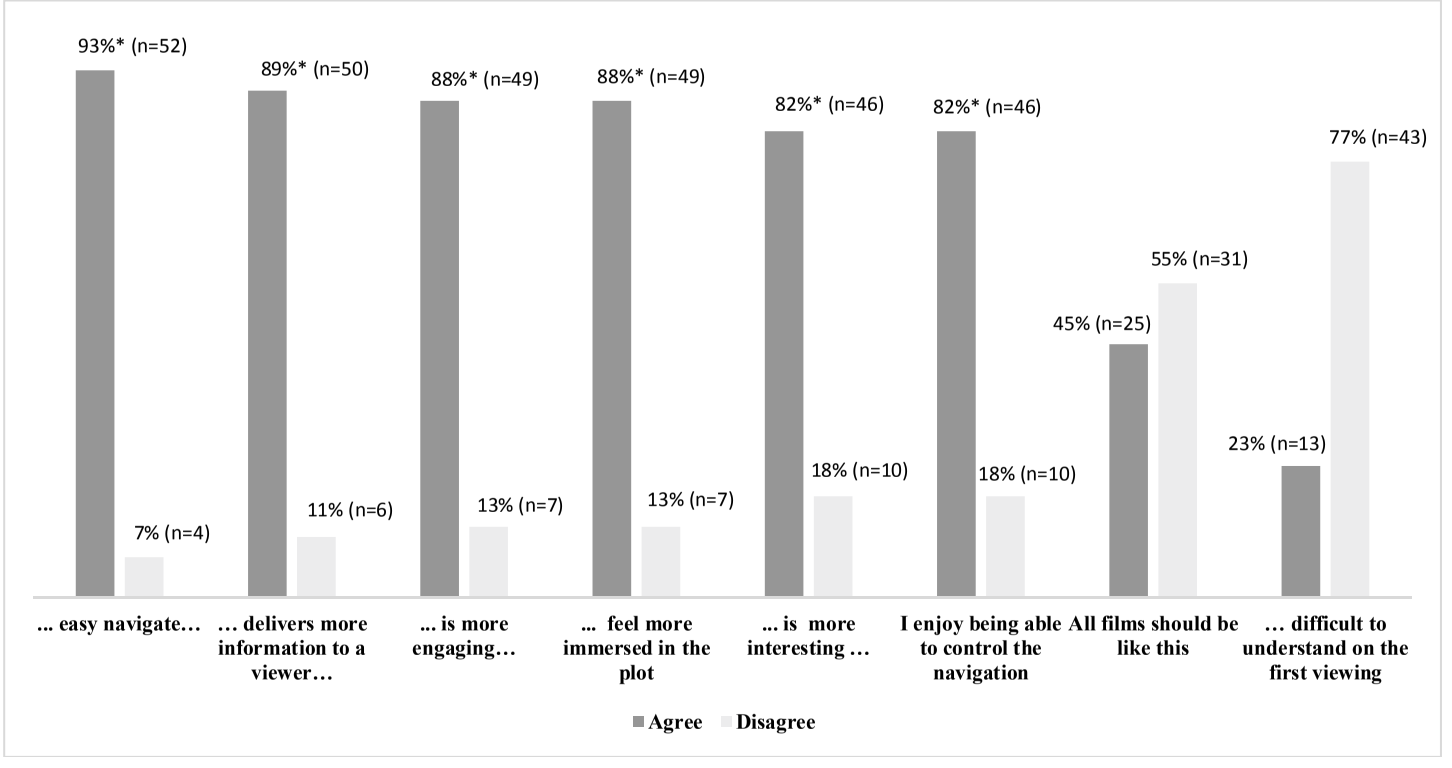
10. There is a statistically significant difference between the two groups of respondents: 'enjoy having control over navigation' (responses 3-4), and the group with negative answers (responses 1-2) in the evaluation of 'web serial being more interesting', 'film building more viewer's engagement', 'being more inside the plot', 'the film being more informative', and 'difficult to understand on first viewing' (U Mann–Whitney test, $p < 0.05$).

Table 2. The viewers' evaluation of selected aspects of video experience: scaled questions

Specification	N = 56	Documentary film		Web series episode	
		Agree (n)	Disagree (n)	Agree (n)	Disagree (n)
Navigation	Video is easy navigate	92.86% (52)	7.14% (4)	80.36% (45)	19.64% (11)
	I enjoy being able to control the navigation	82.14% (46)	17.86% (10)	60.71% (34)	39.29% (22)
The perceived enhancement of viewer experience by 360-degree video features	360-degree video delivers more information to a viewer than a traditional film	89.29% (50)	10.71% (6)	60.71% (34)	39.29% (22)
	360-degree video is more engaging for a viewer than a traditional film	87.50% (49)	12.50% (7)	57.14% (32)	42.86% (24)
	360-degree video allows the viewer to feel more immersed in the film story than a traditional film	87.50% (49)	12.50% (7)	80.36% (45)	19.64% (11)
	360-degree video is more interesting than a traditional film	82.14% (46)	17.86% (10)	57.14% (32)	42.86% (24)
	Film is difficult to understand on the first viewing	23.21% (13)	76.79% (43)	42.87% (24)	57.14% (32)
Other aspects	All films should be like this	44.64% (25)	55.36% (31)	32.14% (18)	67.86% (38)
	I think that it is fair, that I watch advertisements before the film and in return I can watch the film free of charge	–	–	51.79% (29)	48.21% (27)
	I would like to have even greater control of the plot, e.g. I can choose the option to determine the plot	–	–	46.43% (26)	53.87% (30)

Source: Authors' own results of study.

Figure 1. The evaluation of the documentary film: comparison between the two groups of respondents: 'agree' and 'disagree' with statement. The statistically significant difference marked * ($p < 0.05$)



Source: Authors' own results of study.

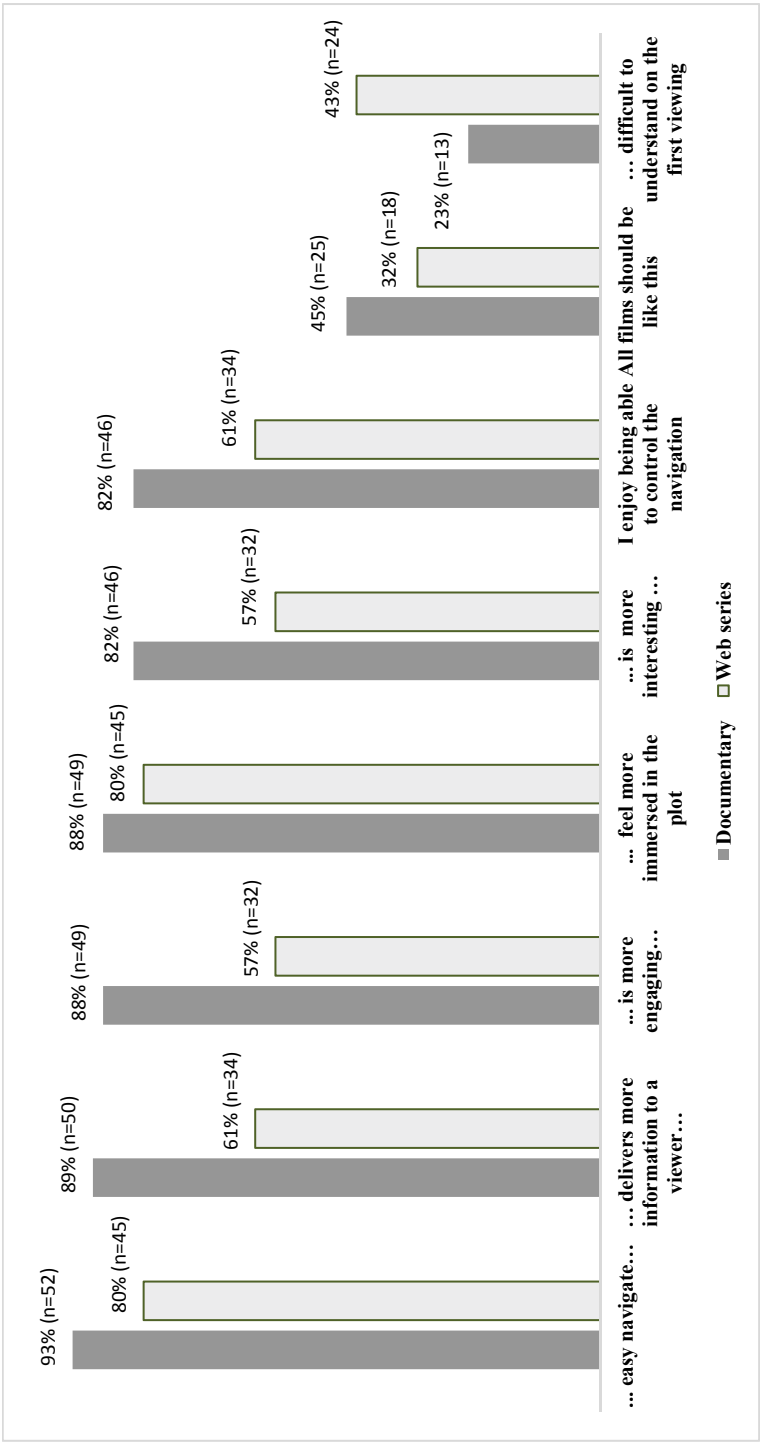


Figure 2. Documentary film vs. web series – the groups 'agree' only

Source: Authors' own results of study.

The analysis of open questions indicates that the respondents perceived the social aspects of watching and navigation as factors shaping their experience (Table 3).

Table 3. Problems indicated by respondents

The problem	The illustrative examples of the respondents' statements
Lack of social interaction with other viewers	"I cannot watch with friends or family." "There would be a quarrel as everyone wants to see different parts of the film."
Necessity of 'being focused on the film'	"I cannot make tea as I watch the film as I usually do – without missing the plot."
Difficulty of plot understanding	"I have problems to look at everything that I would like to, and if I want to see everything and understand the plot, I have to rush." "The 360-degree video technology is useful one, especially for weddings, or advertisements. But the technology is less useful for feature films. I have to concentrate more on navigation than on understanding the story." "For a documentary film the self-navigation is great, but for an episode of a web series I cannot concentrate on the plot while navigating."

Source: Authors' own results of study.

5. Discussion

We point to the following answers for research questions:

- RQ1: The superior experience of the film viewing as a 360-degree video was very prominent in the case of the documentary film in the dimension of being more interesting, more engaging, delivering more information, and with much deeper immersion in the plot compared to respondents' experience of watching if the film were produced as the 'traditional' documentary film.
- RQ2: Our study indicates that the respondents evaluated their experiences when watching the documentary film differently to the episode of web series. The results pointed that 360-degree format enhanced viewer experience more strongly for the documentary than for the web series.
- RQ3: To explain the difference between perception of the documentary and the web series, we can point to the navigation. The analysis shows statistically significant differences in film evaluation for the groups with different attitudes to 'enjoy having control over navigation'. Moreover, in open questions some respondents indicated that following the plot can be difficult when the viewer is engaged in navigation at the same time.
- RQ4: The respondents pointed to the lack of social experience and the breaking of their usual routine of watching films (e.g. making tea, family watching films together) as perceived problems.

The analysis of data suggests the importance of navigation: the easiness of navigation and particularly – the viewer enjoyment in having the control over

the navigation. We presume that the viewer's initial attitude to being engaged in the interaction and navigation may significantly shape the viewer experience. Therefore, there may be two different viewers' segments: 'seeking for the exploration' – the viewer would like to be involved in the interaction with video, and the segment 'going with the defined story' – viewers who prefer to watch the video with the default angle of view.

To sum up, in our study we measured the constructs of viewer experience defined as the enhancement of viewer experience by 360-degree video features, and more precisely, the viewer perception of this enhancement. This approach is different compared with other studies as we did not use scales allowing us to directly grade the viewer experience.

Due to the qualitative nature of our study, the results should be interpreted as indicating the possible trends in film watching rather than the results which can be broadly generalised for different viewing situations (e.g. the viewers from different cultures, different film format such as animated films).

6. Conclusions

6.1. Research contribution and implication

In order to produce the 'better 360-degree videos' we need to better understand the viewer experience. So far, it is difficult to point to a definitive catalogue of factors impacting the viewer's experience. Further development of the theoretical background should aim to build the multi-construct model integrating different approaches: from the perspective of viewer-product interaction to the perspective of the viewer experiencing new technology. We also presume that new forms of film interactivity (such as multi-ending films) will also be included in a 360-degree video, meaning that with the changes of 360-degree video features, the viewer experience will also evolve.

We would like to emphasise two aspects of this study as the contribution to film production. Firstly, the study points to the differences in the viewer experience of watching different video genres. Although much deeper research is needed in this field, our study suggests that we can enhance the viewer experience of a documentary film compared to watching of a traditional format by implementing 360-degree video features. Secondly, the study suggests that the viewer's attitude to 'being engaged' in storytelling may determine other aspects of experience. From a technological point of view, it is possible to produce

a video which at the same time fulfils the needs of two different segments of viewers – 'enjoying to have control over navigation and being engaged' and the segment which can be named as 'the passive viewer'.

6.2. Research limitation

The limitations of this presented study are linked to exploratory research, and they are: the convenient respondent sampling, the subjective evaluation of respondents' statements, and the subjective choice of the evaluated 360-degree video, and the impact on the results by some film features which were not specific to a 360-degree video (e.g. general style of directing, non-animated films, and length of films). However, the qualitative approach allows us to depict the actual process of usage technology by viewers (users) and to capture the aspects of viewer experience which otherwise may be omitted.

We can also evaluate the enhancement of viewer experience by 360-degree video features turning to an experiment based on the comparison of a film with the same plot produced in two different formats – as the traditional and 360-degree format. However, this method would be more costly compared to our study, and also not free of limitations, for example: subjective choices of the plot, the question of film evaluation while the respondents watch the film twice or the question about the similarity of groups in the case when comparison would be made between groups watching only one film format.

6.3. Future research

We point to the following fields of future research:

1. The extension of the research methods, including the above mentioned experiment aiming to compare the viewer experience by presenting a film produced as a traditional one and as a 360-degree video. Other qualitative methods allowing to capture the consumer's experience can also be very useful, for example, 'means-end' research, or the research based on metaphors (e.g. the methodology developed by Zaltman & Zaltman (2010)).
2. So far, the literature studies mostly focus on the features of a 360-degree video with limited analysis of viewer characteristics, such as differences in the cultural background of viewers or the viewer's age.
3. An interesting direction of future research is an experimental testing of different aspects of film screenwriting or film shooting. There is also a question as to what extent the new video technology induces and shapes the artistic film characteristics, leading to the possible emergence of a new film genre.

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