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Images
vol. XXI/no. 30
Poznań 2017
ISSN 1731-450x

Modern documentary in the age of virtual reality: Deapening engagement with nonfiction storytelling through technological innovation

Abstract. Pomianowska Iwona, *Modern documentary in the age of virtual reality: Deapening engagement with nonfiction storytelling through technological innovation*. „Images" vol. XXI, no. 30. Poznań 2017. Adam Mickiewicz University Press. Pp. 45–64. ISSN 1731-450X. DOI 10.14746/i.2017.30.04.

After decades of research, technological development as well as few discouraging setbacks, virtual reality (VR) appears to be on the cusp of its settled adoption. The incorporation of VR technology into the palette of everyday communication media is not only exciting for filmmakers and game designers, but also for every manner of storytellers: documentarians, journalists, educators, scientists – all professions involved in clarifying surrounding us reality and communicating about it. They all discovered that social change can be valuably stimulated by development of new technology – technology that serves in the same time as a classic medium to communicate and spread this news around. Considering the factors enabling us to capture and disseminate "a true story" in a highly captivating, immersive way (which previously has been preserved exclusively for entertainment and commercial productions), we should mention at least 3 crucial elements: technological innovation, psychological evolution of the viewer, application of VR beyond storytelling. The first two factors mutually interact and play off each other in terms of the changing threshold of perceptual tolerance as well as rising needs of the new spectator. The first part of this paper deals with the interdependency of these two elements. Structured conclusions will be enumerated as a practical reference for VR storytelling productions. The second part of the paper will deal with the third element enumerating the most inspiring cases from recent years – eye-openers for instigating social change, adding value and promoting wellbeing via VR technology. The engagement of VR in social change, innovation and nonfiction storytelling introduced the VR technology within the current media palette. It not only changes the nature of storytelling about reality, but fulfills the story that our reality builds.

Keywords: virtual reality, spectatorship, perception, documentary storytelling, immersion, feeling of presence

After decades of research and technological development, as well as a few discouraging setbacks, virtual reality (VR) appears to be on the cusp of adoption. The incorporation of VR technology into the palette of everyday communication media is not only exciting for filmmakers and game designers, but also for every manner of storyteller: documentarians, journalists, educators and scientists – all professions involved in explaining the reality that surrounds us. They have all discovered that social change can be valuably stimulated by the development of

new technology[1] – technology that serves both as a classic medium to communicate and as a means to spread this news.

Considering the factors enabling us to disseminate stories captured by documentalists in a highly captivating, immersive way, we should mention at least three crucial elements:

– the conceptualization of reality in the context of the perceptual evolution of the spectator,

– the factors determining the immersive strength of the story,

– the implications of technological innovation on non-fictional storytelling.

All three of these factors interact and play off each other in terms of the changing threshold of perceptual tolerance, and determine the engagement of the spectator. The different parts of this paper deal with these elements leading to conclusions about the future of non-fiction storytelling and the evolving role of the viewer in it. This paper will also deal with particularly inspiring, recent cases of VR technology implementation in non-fictional storytelling, which has the power to influence attitudes and to instigate social change. New media technology not only changes the nature of storytelling about reality, but also fulfils the story that our reality builds. The paper's conclusion offers as a practical reference for VR storytelling practitioners.

Evolution of documentary storytelling

The path defined by documentary storytelling evolved from still photography, and later advanced from better picture quality to high-definition video, and now, to virtual reality. The premise of the latest technique is to provide a "true experience", to bring audiences closer to a story, to give them a feeling of presence, participation and sense of agency. By allowing a first-person experience of events, immersive storytelling offers the opportunity to personally engage a story, to witness or even participate in the event by experiencing the perspective of a character depicted in the story.[2] In that sense, the audience can be given unprecedented access to the sights and sounds, as well as to the feelings and emotions, which accompany a particular experience. The added value of such a medium is that the technique required for

[1] E. Mutekwe. *The impact of technology on social change: a sociological perspective*, "Journal of Research in Peace, Gender and Development (International Research Journals)" 2012, Vol. 2(11), pp. 226–238, November, <http://www.interesjournals.org/JRPGD>, (accessed 11.11.2016). B.C. Bruce, J.K. Peyton, and T.W. Batson. *Innovation and Social Change,* Chapter 1 (1993) Bertram C. Bruce University of Illinois at Urbana-Champaign Champaign, IL 61820 <https://www.ideals.illinois.edu/bitstream/handle/2142/43892/Innovation%20and%20Social%20Change.pdf?sequence=2)> (accessed on 26.08.2016). E. Özlem Yiğit, *Science, Technology and social change course's effects on technological literacy levels of social studies pre-service teachers*, "TOJET: The Turkish Online Journal of Educational Technology" 2013, Vol. 12(3), July, <http://www.tojet.net/articles/v12i3/12313.pdf)> (accessed on 15.09.2016).

[2] Y. Wang, *Virtual Reality: A New Perspective in Storytelling*, 2016, <http://www.newinc.org/blog-post/virtual-reality-a-new-perspective-in-storytelling> (accessed on 3.12.2016). N. de la Peña, P. Weil, J. Llobera, E. Giannopoulos, A. Pomés, B. Spanlang, D. Friedman, M.V. Sanchez-Vives, M. Slater, *Immersive Journalism: Immersive Virtual Reality for the First Person Experience of News*, "Presence: Teleoperators and Virtual Environments", 2010, 19, no. 4, pp. 291–301.

such an experience is available to almost everyone by means of a smart phone or tablet.

There are a number of articles dealing with the state of virtual reality in journalism and documentary filmmaking today.[3] It is not easy to categorize the particular cases, as the line between the immersive journalism and cinema vérité, where audio and video are being captured live from the physical world, is often unclear. Astonishingly, the palette of media that non-fiction authors can use to present their documentary content, is growing wider each day, at an incredible pace. Each medium has its own characteristics that can enhance different aspects of the story content – depending on the creative strategy. Game designers, for example, put enormous effort into reproducing the conditions under which particular events unfold (a procedure called "engine design"), whereas creatives designing linear narratives are mostly focused on outlining the logic of the events themselves.[4] As these forms have long functioned apart from each other, we see an active effort within the industry to establish an active dialogue among them. Games are getting richer in narratives and more able to modify the storylines by offering the player more freedom of choice. "Games allow us to be who we are not, to do what we cannot, to be in places and times we cannot go… Through entertainment and action, we can educate in novel and powerful ways", says Keith Halper, CEO of KUMA Reality Games. By immersive journalism, we often understand embodied experience that allows queries of the environment, but it is set within an unchangeable narrative and an individual's story trajectory. Such embodiment helps an audience better understand the dynamics of a situation and generate empathetic responses to nonfiction content that might otherwise be more difficult to convey.[5] According to Vivian Carol Sobchak, "embodiment" is an "irreducible ensemble" that entails both the body and consciousness, the objective and subjective perception of the environment. According to her, we owe our sense-making processes as much to our carnal existence as to our conscious thoughts.[6] Such a concept of the radically material condition of the human being is in line with the

[3] C. Garling, *Virtual Reality, Empathy and the Next Journalism*. WIRED magazine, <https://www.wired.com/brandlab/2015/11/nonny-de-la-pena-virtual-reality-empathy-and-the-next-journalism/> (accessed on 03.01.2017). R. Aronson-Rath, J. Milward, T. Owen, F. Pitt, *Virtual Rality Journalism* via: <https://towcenter.gitbooks.io/virtual-reality-journalism/content/> (accessed on 13.02.2017). L. Cosmides, J. Tooby, *Evolutionary Psychology and the Emotions,* Handbook of Emotions, 2nd ed. New York 2000.

[4] K. Halper, *CEO of KUMA Reality Games*, <http://www.mediafieldsjournal.org/physical-world-news-in-virtual/2011/7/22/physical-world-news-in-virtual-spaces-representation-and-emb.html> (accessed on 26.01.2017).

[5] J. Farman, *Stories, spaces, and bodies: The production of embodied space through mobile media storytelling*, "Communication Research and Practice" 2015, Vol. 1, Iss. 2, pp. 101–116, <http://www.tandfonline.com/doi/full/10.1080/22041451.2015.1047941> (accessed on 27.02.2017). L-C. Hydénjava, *Storytelling in dementia: Embodiment as a resource.* 2013, Vol. 12 iss. 3, pp. 359–367, <http://journals.sagepub.com/doi/abs/10.1177/1471301213476290> (accessed on 20.02.2017).

[6] V.C. Sobchak, *Carnal thoughts: embodiment and moving image culture*, 2004, <https://culturetechnologypolitics.files.wordpress.com/2015/10/vivian-sobchack-carnal-thoughts-1_2.pdf> (accessed on 6.08.2017).

thoughts of the existential phenomenologist Maurice Merleau-Ponty, who said: "the greatest lesson of the phenomenological reduction is the impossibility of a complete reduction", which gives meaning to experience as it is embodied and lived in context.[7]

The potential of virtual reality within the "non-fiction storytelling" domain has been intensively "tested" by consumers over the last two years. Along with an application it released to present viewers with a spherical short "point-of-view" video on the plight of refugees, the *New York Times* distributed more than 1 million virtual reality cardboard glasses.[8] ABC News provided their viewers with the spherical view of a military parade in North Korea and of artefacts threatened by war in Syria.[9] The *Los Angeles Times* let people land next to a crater on Mars.[10] *USA TODAY* provided their customers with a sort of "travel time" experience – visitors went on a ride in a bright pink '57 Havana Ford at Universal Studios.[11] Even a situation of domestic violence has been brought into an immersive medium.[12] Significant effort is being put into such experimentation in order to determine whether VR can be a feasible way to present news. The result of each trial is however dependent on the interplay between technological innovation, the psychological evolution of the viewer and the factors determining the level of immersion.[13]

An illusion of an external reality or a non-illusory experience of a virtual reality?

Extrapolating Marshall McLuhan's approach to the interplay between media, the *sensorium*, and reality,[14] which are still unfolding with regard to the impact of the virtual reality medium, new technology introduces a new layer to the phenomenological experience of reality. By introducing the term of *engelism*, McLuhan claimed that *electric media* give us a dimension of a supernatural being.[15] *Electric man* as a disembodied spirit that exists everywhere has little chance of dealing with the given reality.[16] "When social reality moves to the

[7] H. Spiegelberg, *The Phenomenological Movement: A Historical Introduction*, 2nd ed., 2 vols., The Hague 1965.
[8] New York Times; VR platform, <http://www.nytimes.com/marketing/nytvr/>, (accessed on 26.01.2017).
[9] ABC News (16.09.2015) <http://www.theverge.com/2015/9/16/9336647/abc-news-virtual-reality-syria> (accessed on 26.01.2017).
[10] A. Emamdjomeh, *Discovering Gale Crater*, "Los Angeles Times" 26.10.2015, <http://graphics.latimes.com/mars-gale-crater-vr/> (accessed on 26.01.2017).
[11] P. Doyle, M. Gelman, S. Gill, *Viewing the future? Virtual Reality in Journalism*. Knight Foundation, <http://storynext.usatoday.com/state-of-vr.pdf> (accessed on 16.11.2016).
[12] K. Ziulkowski, *Vicious Circle,* created by NEW INC, <http://www.karolinaziulkoski.com/> (accessed on 16.11.2016).
[13] B.G. Witmer, M.J. Singer, *Measuring Presence in Virtual Environments: A Presence Questionnaire,* "Presence: Teleoperators and Virtual Environments" 1998, 7(3), pp. 225–240.
[14] G. Genosko, M. McLuhan (eds.), *Critical Evaluations in Cultural Theory*, Vol. I, II & III. London, 2004.
[15] P. Peyton, *Interview with Marshall McLuhan on Television Show*, "Family Theatre", 14 November 1971, <https://www.youtube.com/watch?v=1uZYR3jm-Mng#t=16> (accessed on 2.08.2017).
[16] M. McLuhan, *Understanding Media. The Extensions of Man*, New York 1964.

space induced online, not only do facts mutate to factoids, but also one's experience becomes virtual, meaning omnipresent and omnivorous."[17]

Closely related to this concept is the notion of post-truth, which was selected by the Oxford Dictionary as the 2016 Word of the Year. Post-truth is defined as relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief.[18] Virtual reality technology gives one a chance to perceive the factual events again from a very concrete point of view and to personally experience a visceral reaction to an action that a spectator is exposed to. Does such embodied storytelling produce the illusion of an external reality? Or does it produce non-illusory experiences of a virtual reality? David Chalmers compared this dilemma to the *mirror illusion*: "When one looks in a mirror, does one undergo the illusion that there is someone on the other side of the mirror, or does one have a non-illusory experience of someone on this side of the mirror? I will argue that at least for familiar users of mirrors, there is no illusion. Knowledge of mirrors provides a sort of cognitive orientation (a variety of cognitive penetration) that affects the content of visual experience and renders it non-illusory."[19] A similar cognitive orientation is presumably present with users familiar with virtual reality devices, which allow them to render their experience as non-illusory. The fact that the virtual is not definable as an opposition to realism has led to two different paths of theoretical thought: one movement reassessed the illusionism as an aesthetic value on its own,[20] the other one has accentuated the enunciative function of such an illusion as deixis that works as "indexes" and refers to elements of our reality.[21] Elsaesser and Hagener state, however, that "both these contexts break, at the conceptual level, with our traditional definitions of cinematic "realism", because "reality" in virtual reality is no longer understood as index, trace and reference of an elsewhere, but as a total environment: it thus is a function of a coherence theory (of truth), rather than a correspondence theory (of the sign)."[22] Independently of this discussion, virtual reality has made it possible to involve the spectator's presence even more deeply. An experienced VR story is being compared to an *imaginary reality,* representations to which a spectator's mind grants reality status through verbal, auditory and visual references. Alexander

[17] A. Mir, *The post-truth world: how social media destroy the absolutism of the "objective" truth. Human as media*, 2017, <https://human-as-media.com/2017/02/22/the-post-truth-world-how-social-media-destroy-the-absolutism-of-the-objective-truth/> (accessed on 3.08.2017).

[18] Post-truth, in: *Oxford English dictionary online*, 2016, <https://en.oxforddictionaries.com/word-of-the-year/word-of-the-year-2016> (accessed on 8.08.2017).

[19] D. Chalmers, *Spatial Illusions, from Mirrors to virtual* reality, 2017, <https://www.youtube.com/watch?v=RKRX6CZLZOw> (accessed on 7.08.2017).

[20] S. Garrett, *Between Film and Screen: Modernism's Photo Synthesis*, Chicago 1999.

[21] G. Deleuze, *Cinema I: the Movement-Image and Cinema 2: the Time-Image* (both trans. Hugh Tomlinson), Minneapolis 1989.

[22] T. Elsaesser, M. Hagener, *Film Theory Introductioin through the senses*, New York 2015.

Galloway[23] has even concluded that in a video game it is difficult to distinguish the diegetic acts from non-nondiegetic ones, because for the sake of game continuity, these facts are fused as seamlessly as possible. In this sense, the body of an operator (in this case, a player), the control of the game, and the action on-screen fuse to create an imaginary reality[24] that connects the machine and the human. Virtual reality appeals thus even more directly to a human's senses and body, but not in a straightforward, physical way. Thus, as narratives used to establish their diegesis by allowing the viewer to sense a consistent, temporal continuity and spatial contiguity, virtual reality and game environments establish diegetic coherence by directly co-opting the body of the player into diegetic space. However, a great deal of emphasis is placed on the body-based nature of the experience and the tactile and haptic properties, while the bodily sensations within virtual reality are still often considered distinct from pictorial illusionism. It seems that several different perceptual and cognitive systems are being deployed together to render the virtual reality effect – a continuous field, which in its amalgamation sucks a spectator into a fascinating state of immersive self-presence. Psychologists Witmer and Singer have distinguished and classified particular factors that influence the level of immersion while perceiving a story[18] – these factors as well as their operationalizations will be analyzed later in this paper.

'Immersion' versus 'feeling of presence' – defining the terms

It is not easy to outline the relationship between the concepts of *immersion* and the *feeling of presence*. According to Slater and Wilbur's framework for immersive environments, we can be *immersed* within the movie to the extent that computer displays are capable of delivering an inclusive, extensive, surrounding and vivid illusion of reality to our senses.[25] Therefore, the more we forget about the medium through which we perceive the story, the more *immersed* in this story we are. Behind the concept of *presence*, we understand a state of consciousness, a psychological sense of being in the virtual environment (VE). Therefore, we experience a high *feeling of presence* when we have a more vivid memory "as if we were there". Such internalization of generated memories takes place not only via the illusion that immersive media are able to evoke, but also through our imagery and mental representation. Elizabeth F. Loftus, an American cognitive psychologist, concluded from her extensive research on human memory that we have a natural

[23] A.R. Galloway, *Gaming: Essays on Algorithmic Culture*, Minneapolis 2006.

[24] L. Stark, Y. Choi, Y. Yu, *Visual Imagery and Virtual Reality. New Evidence Supporting The Scanpath Theory Explains the Illusion of Completeness and Clarity*, in: V. Lakshminarayanan (ed.), *Basic and Clinical Applications of Vision Science: The Professor Jay M. Enoch Festschrift Volume*, Dordrecht 1997.

[25] M. Slater, S. Wilbur, *A Framework for Immersive Virtual Environments (FIVE): Speculations on the Role of Presence in Virtual Environments,* "Presence: Teleoperators and Virtual Environments" 1997, 6(6), pp. 603–616.

tendency to create false memories – internalizing facts just by thinking about them or visualizing them.[26] Another issue she was concerned with was how subsequent information can affect an eyewitness's account of an event. Her main focus has been on the influence of (mis) leading information in terms of visual imagery as well as the wording of questions in relation to eyewitness testimony. She has been heavily involved in applying her research to the "misinformation effect" by showing the enormous impact immersion has on our statements about the real life settings.[27] She has indicated that a memory of an event that has been witnessed is highly flexible, and that it can be modified or supplemented once a subject is exposed to new information just after the event. New information may dramatically influence what they recall. In that sense the experiences we gather in our daily, real life can get confused with the realistic information passed to us via an immersive medium as VR and vice versa.

Creative factors in virtual and gaming platforms that strengthen the immersive effect.

Immersive storytelling can be encountered currently at least in three common forms:

– virtual reality, which creates environments that allow people to be "present" in an alternative environment;

– augmented reality, which starts with the real world and overlays virtual objects and information;

– spherical video, which captures an entire scene that viewer can visually explore by looking around 360 degrees.

What psychologists have been scrutinizing for years seems to be now the major driver of technological advancement. Immersive media have developed rapidly to satisfy psychological needs, motivational expectations as well as perceptual comfort. In the paper "Measuring Presence in Virtual Environments: A Presence Questionnaire" Bob G. Witmer and Michael J. Singer distinguished four types of factors that determine the level of immersion and the feeling of presence once being exposed to a Virtual Reality stimuli:

1) Sensory factors,
2) Control factors,
3) Realism factors,
4) Distraction factors,

In the following sections, these factors will be successively analysed from within the psychological and technological domains.

[26] E.F. Loftus, (1979). Cambridge, MA: Harvard University Press. (National Media Award, Distinguished Contribution, 1980). (Reissued with new Preface in 1996), idem, *Reading,* MA: Addison-Wesley 1980. (Reprinted by NY: Ardsley Press 1988).

[27] E. Loftus, *Planting misinformation in the human mind: A 30-year investigation of the malleability of memory*, "Learning & Memory" 2005, 12 (4), pp. 361–366. DOI: 10.1101/lm.94705.

1. Sensory factors

Sensory factors refer to the first stage of information processing[28] – processes specified and described by cognitive psychologists. The sensory stage of cognition, and thus, the bottom-up intake of information[29] is counterbalanced by the "top-down" processing of information[30] (see: control factors). Establishing sensory congruence within a virtual reality set-up is at this moment the biggest challenge for VR designers to advance in the process of immersing the viewer. Witmer and Singer classified the sensory factors determining the level of immersion according to the following keys:

Modality of sensory information: The hierarchy of modalities involved in cognition may influence how much "presence" is experienced. In fictional, cinematic storytelling, the visual layer is usually the richest one. However, because of the inherent multiplicity of information layers within documentary materials, other sensory channels may be evenly important in conveying the content – often compensating for the imperfections of spontaneously recorded visual materials. Surprising reports on VR experience contain frequent statements that the realism of the audio track is much more important for creating the immersion effect than the visual one and that the imperfections in the audio can be much more distracting for the virtual experience than visual ones.

Environmental richness: "The greater the extent of sensory information transmitted to appropriate sensors of the observer, the stronger the sense of presence will be".[31] Sheridan emphasizes that such sensory richness should be structured within a particular set of attention cues that the audience learns to follow. In the case of non-structured, spontaneous 360 recording, these attention cues are missing, which can lead to confusion and the disengagement of the audience.

Multimodal presentation: In the case of multimodal presentation, all sensory information has to be presented completely, and all the senses coherently stimulated in order to increase the capability for experiencing presence. Held & Durlach (1992) refer, for example, to a situation where kinaesthetic motion can be enhanced with proprioceptive feedback.[32]

Consistency of multimodal information: The supposition is simple: if the sensory description of reality from one modality differs from that received through another modality, presence may be disrupted. This occurs when, while experiencing VR, we simultaneously receive background information from the external world. As the fictional and

[28] F.I. Craik, R.S. Lockhart, *Levels of processing: A framework for memory research,* "Journal of Verbal Learning and Verbal Behavior" 1972, 11(6), pp. 671–684.
[29] J.J. Gibson, *A theory of direct visual perception*, in: J. Royce, W. Rozenboom (eds.), The *Psychology of Knowing*, New York 1972.
[30] R. Gregory, *Concepts and Mechanisms of Perception*, London 1974.
[31] T.B. Sheridan, *Musings on Telepresence and Virtual Presence*, "Presence: Teleoperators and Virtual Environments" 1992, 1(1), pp. 120–125.
[32] R. Held, N. Durlach, *Telepresence*, "Presence: Teleoperators and Virtual Environments" 1992, 1 (1), pp. 109–112.

nonfictional information channels are not consistent, one channel will work as a "distracter" in relation to another one.

Degree of movement perception: Presence is enhanced when the observer is given the opportunity to perceive his/her own motion within the VE. The feeling of presence is enhanced even more once the objects appear to move relative to the observer, according to parallax motion.

Active search: Once the observer is granted freedom of exploration and the possibility of active searching, presence is enhanced. Sheridan calls this the "control of the observer" to relate his/her sensors to the environment by modifying the scope of vision or to fine-tune the binaural hearing. A step further is haptic exploration of the environment.

In 2016 at the USA Science & Engineering Festival, McCann New York debuted the project *Field Trip to Mars*,[33] a virtual reality experience has taken thousands of young attendees to the Martian surface. Young pupils travelled to another planet just by getting on a school bus, without realizing what was happening outside the bus. While the school bus was driving around Washington D.C., the passengers "were travelling" on the planet Mars, and exploring it scientifically through embedded storytelling and interactive infographics. This technologically advanced creation for educational and documentary storytelling became the most awarded campaign at Cannes 2016. Why? Framestore VR Studio succeeded in designing the first *group virtual reality experience*. It is one of the biggest "eye-openers"—showing that technology is no longer an obstacle once we strive to tell a good story by means of very well justified function of a VR medium. Thanks to this first-of-a-kind technology, an environmental richness was achieved: passengers could see, hear and feel the unknown environment. Thanks to an appropriate hierarchy between sensory channels, the presence of stimulation from the external as well as the virtual world did not interfere with each other. Proprioceptive information from the motion and balance trajectory of the bus was embedded within the virtual scene, through which perfect perceptual consistency was retained: every swing, turn or speed change of the bus was perfectly synchronized with the flow motion perceived on the virtual screens. Because of such a deeply created immersion effect, students were extremely focused on the presented "visual material" and explored vividly the new environment through four senses all at the same time.

2. Control factors

Control factors are in the dialogue with the sensory factors – they respond to "bottom-up" informational input with the "top-down" motivational, cognitive and control factors. The degree and immediacy

[33] Framestore Studio. *The Field Trip to Mars*, <http://framestorevr.com/field-trip-to-mars/> (accessed on 18.01.2017).

of control, the user's ability to anticipate the action, mode of control and the modifiability of the physical environment, are the most important psychological issues determining technological advances.

Degree of control: The more the user can control his task and interact with the environment, the greater the feeling of agency and information intake he experiences.[38] Some researchers consider control over the situation presented in VR as a separate concept related to the feeling of presence,[34] which is naturally strengthened by agency, engagement and the perception of causality.

Immediacy of control: Any delay (temporal lag) between the user's action and the result of his action will seriously diminish the sense of presence in VE.[35] When such a causality effect is maintained, and the continuity of action is perceived as realistic, the feeling of presence will not be interrupted.[36]

Anticipation: Apart from the perception of causality, individuals experience a greater sense of presence if they are able to anticipate or predict certain events of the scenario – independently of whether these actions depend on them or not.

Mode of control: The more natural the interaction with the virtual environment being experienced and the fewer learning processes required to interact, the more immersed the audience will become. If the modus of control is perceived by the user as artificial, the feeling of presence will be diminished. It can be increased again, though, once the responses become habituated.

Physical environmental modifiability: The ability to modify physical objects within the virtual environment enormously increases the feeling of presence. The biggest technological challenge for spherical video currently is to accommodate physical interaction within the environment, with 3D game design allowing one to move around and manipulate objects. Such simple actions give the user a feeling of control over the virtual situation.

The importance of *control factors* has been researched by Ume.net Tech Lab in Sweden, which designed a virtual experience of visual lag.[37] They showed how the "story of our everyday life" changes dramatically once we perceive actions with temporal delay. This temporal gap varied between one-third of a second up to three seconds. As a technical set up, the Oculus Rift development kit (virtual reality display with built-in displays) was used in combination with Raspberry Pi (a single-board computer programmed to adjust delay, resolution and buffering of the visual material). The temporal lag interrupted the perception of the con-

[34] G. Fontaine, *The experience of a sense of presence in intercultural and international encounters*, "Presence: Teleoperators and Virtual Environments" 1992, 1 (4), pp. 482–490.

[35] R. Held, N. Durlach, op.cit., pp. 109–112.

[36] M.W. McGreevy, *The presence of field geologists in Mars-like terrain*, "Presence: Teleoperators and Virtual Environments" 1992, 1 (4), pp. 375–403.

[37] O. Willems, *Even Pastors Hate the Inconvenience of Computer Lag*, 2015, <https://www.psfk.com/2015/06/connection-lag-umenet-b-reel-anr-bbdo-living-with-lag-series.html> (accessed on 16.11.2016).

tinuity and accordance of the action. The mode of control was seriously disrupted, and perceptual anticipation was in the beginning impossible. Surprisingly enough, after a while, participants started to adjust to such incongruence and learnt the new perceptual frame of reference.[38] The insightful experiment of Ume.net Lab undermined through its demonstration almost all suppositions about top-down control of action that participants need while dealing with a virtual or real environment.

"I cannot resist fooling around with our established certainties. It gives me a great pleasure to deliberately mix up the second and third dimensions, flat and spatial, and make fun of gravity."[39]

M.C. Escher

3. Realism factors

While *sensory and control factors* affect the internal features of perception, *realism and distraction factors* focus more on the environment: virtual environment of creation or the real environment, where the creation is being exposed.

Scene realism: By scene realism, we do not necessarily assume real-world content, but the connectedness and continuity of the stimuli that is being experienced by the observer. When elements of the environment seem to be semantically related to each other and particular elements of the presented world (scene content, texture, resolution, light sources, field of view (FOV), dimensionality, etc.) seem to co-exist in a continuous, spatial and temporal way, the feeling of presence is enhanced.

Consistency of information with the objective world: Held & Durlach (1992) emphasize that the presented world needs to be consistent with common knowledge about the presented environment.[40] Such information we learn through experience from the real-world environment, from exposure to certain stimuli (e.g., gaming) or in a structural way (e.g., school). Inconsistencies in the reconstruction of previously known schemata's can be perceived as distracters.

Meaningfulness of experience: This factor determines the relevance of the VR presentation content to the particular observer. Personal relevance and adequacy naturally increases the motivation to participate and focus more deeply on the content, which results in a greater intake of information (learning effect). Other similar, personal factors are *task saliency* and *previous experience.*[41]

Separation anxiety: Once the "feeling of presence" within a particular VE experience substantially increases, the greater the disorientation effect the observer can experience once he "returns" to the real world. Losing the real *frame of reference* is also one of the better measures of immersion.

[38] M.A. Webster, *Evolving concepts of sensory adaptation*, "F1000 Biol. Rep." 2012, 4:21. DOI: 10.3410/ 4–21

[39] *Reflections on the life of M.C. Escher* (25.09.2012), <https://figbash.com/2012/09/25/reflections-on-the-life-of-m-c-escher-2/> (accessed on 5.01.2017).

[40] R. Held, N. Durlach, op.cit., pp. 109–112.

[41] M.H. Immordino-Yang, *Emotions, Learning, and the Brain: Exploring the Educational Implications of Affective Neuroscience*, New York 2015.

Realism is a crucial factor for nonfiction storytelling, and one that determines the value of virtual reality technology as a platform for documentary content. Knowing the factors increasing immersion, we can convey a real story in an experiential form. However, the immersion effect can also make us believe an event that actually never took place (see: Loftus' research[42]). Besides that, "real memories" even from a "not real situation" are filtered through individual associations and personal context. The question is thus not, whether VR can tell a non-fiction story in a realistic way, but whether a hyper-realistic fictive creation will not dominate the facts behind the story.

"We do have to have ethics conversations," but "the technology will be successful no matter what, […] every technology has downsides; the only question is how do we handle it as a society."[43] (Mike Rothenberg, head of Rothenberg Ventures).

One studio that has succeeded in presenting valuable VR documentaries with a high degree of realism is Felix and Paul Studios.[44] Its *The Nomads see gypsies* VR film, for example, provides an opportunity to encounter the Sama-Bajau people, who have lived for centuries on the sea coasts of Borneo. The studio has also introduced a new form of commercial entertainment, where the aesthetics and creation of a product still matter, but are based on a realistic set up, an almost non-fictive registration of a situation. The video clip "Strangers" featuring Patrick Watson and created by Felix and Paul studios[45] illustrates this concept very well. What is the measure of success of such a short, immersive form? Witmer & Singer speak about separation anxiety, the feeling that prevents us from leaving the virtual situation and coming back to the real environment.[46] Naturally, such an effect is increased once the virtual world is also partially based on facts and gives the possibility to participate in not easily accessible events.

4. Distraction factors

While the *realism factors* concern the VR content itself, the *factors of distraction* concern the environment in which such a VR experience has been exposed and its possible interaction with the VR content on a sensory and control level.

Isolation: According to the *consistency of multimodal information rule*, stimulation not belonging to the story (that is, from the actual,

[42] See footnotes 32, 33, 34.

[43] D. Seetharaman, *What does virtual reality do to your body and mind?* 2016, <http://www.theaustralian.com.au/business/technology/what-does-virtual-reality-do-to-your-body-and-mind/news-story/53d02a9c507f990da7ab00fa0088c8dd> (accessed on 15.02.2017).

[44] Felix & Paul Studios, *Nomads, See Gypsies*, <https://www.felixandpaul.com/?projects/sea_gypsies/credits> (accessed on 30.01.2017).

[45] Felix & Paul Studios, *Stranger*, <https://www.felixandpaul.com/?projects/strangers> (accessed on 30.01.2017).

[46] B.G Witmer, M.J. Singer, *Measuring Presence in Virtual Environments: A Presence Questionnaire,* "Presence: Teleoperators and Virtual Environments" 1998, 7(3), pp. 225–240.

physical environment) should be maximally limited in order to isolate users within the experienced storytelling. That is why it is impossible to compare the level of immersion achieved by the audio-visual storytelling conveyed via traditional AV media (e.g., a two-dimensional, flat-screen display) with the immersive storytelling conveyed by spherical (sometimes even interactive) video, as the conditions of experiencing these two media contents are totally different (e.g., because of the presence or absence of ambient noise, external distracters, etc.). The quality of the VR headset through which the synchronized visual and auditory VR inputs are provided is thus of crucial importance and one of the biggest technological challenges, as they should be capable of isolating the wearer from the external world and at the same time comfortable and as small and light as possible.

Selective attention: Referring to the freedom of sensory exploration (active search), the observer should be given the opportunity to explore the presented world according to his own processing style, intentional focus, interest and goals. Once such focus is possible, the observer can de-filtrate external, non-relevant and distracting stimuli from the external environment.

Interface awareness: Held and Durlach (1992) assert that in order to maximize the feeling of presence, the interface should be almost "invisible" so that the observer is no longer conscious of its presence. [47] Unnatural devices or artefacts should be thus avoided as interfering with the feeling of *being there* – beyond the interface.

Isolation from external stimuli, providing the freedom of attentional exploration and making the viewer forget about the interface are the key features of an immersive set up. We should be aware at the same time that the potential distraction can also work in the opposite way. The latest research explores the positive effects of the set up in which the virtual application is being explicitly used as a distracter towards the original, realistic perception:

"There are over 100 clinical research papers that are already published that show proven positive clinical outcomes using VR in managing chronic pain, anxiety and depression […] and in dementia patients, all those three elements are very common."[48] Dr. Sonya Kim treats her patient with VR exposure in order to help them deal with depression and anxiety. By providing fictive VR creation, she stimulates a non-fictive story in the patient's mind, so that the patient can refer his/her experience to another frame of reference. A similar use of immersive VR is performed for chronic pain management.[49]

[47] R. Held, N. Durlach, op.cit., pp. 109–112.

[48] K. Platoni, *Virtual Reality Aimed At The Elderly Finds New Fans*, 2016, <http://www.npr.org/sections/health-shots/2016/06/29/483790504/virtual-reality-aimed-at-the-elderly-finds-new-fans> (accessed on 3.02.2017).

[49] A. Li, Z. Montaño, V. Chen, J. Gold, *Virtual Reality and pain management: current trends and future directions*, "Pain Management" 2011, 1, pp. 147–157.

Conclusions on the factors determining immersion

Keeping all these aspects of immersion in mind, as well as the natural limitation of documentary filmmaking, the process of non-fictional storytelling is inherently an exercise in compromises and tradeoffs on a spectrum of time, cost, and the quality of the outcome. A combination of limitations in technology, narrative structure, and journalistic intent determine the degree of agency given to users in a VR experience. At the same time, there are ongoing debates questioning the ethics of showing a fully spherical view of a scene without the ability for a journalist to focus on a particular viewpoint. The question is whether the inconsistency between the six degrees of freedom in the non-interactive layer of 360 video won't reduce the authenticity of the journalistic story.

The technological and perceptual possibilities do not entirely determine the experience of virtual set up though. All the immersive factors – perceptual congruency, feeling of control, realistic set-up and reduced distracters[50] – function in storytelling to advance the author's objective as well as his impact on his recipient through the non-fictional creation. Nonetheless, does the individualization of experience individualize opinions about the experienced content as well? As media become more and more immersive and the authenticity of experience and semi-participation continues to improve, a new critical view on reality and currently produced documentaries will be needed. Virtual reality technology represents a revolutionarily new narrative form – even though the technical and stylistic norms are in their infancy.

Reflections of VR practitioners

In thinking about the immersiveness of non-fiction storytelling we should reconsider a few aspects of its narration, authorship, and content. The narrator, for example, can be present in the field of the viewer's spherical vision; however, we can also try to convey the author's point of view from a first-person perspective. The storytelling in this case becomes even more personalized, yet we can also try to universalize the story. We can consciously increase or decrease the spectator's *feeling of presence.* We can stimulate the spectator's independent exploration, or we can introduce "live narratives' guiding the attention of the viewers. Gradation of the self-exploration depth will affect the engagement, whereas replicating traditional film narratives can leave the viewers wondering where they should look and becoming concerned about missing the most crucial element of the action in the scene.

Multiple questions about the future of VR are being posed, mostly whether it will survive or lose out to a new medium on the market. There are voices claiming that the technological investment in VR is already too big to let it fail, whereas others assume that it has already reached a critical mass on the market. Analysts of immersive

[50] B.G. Witmer, M.J. Singer, op.cit., pp. 225–240.

journalism Migielicz and Zacharia claim "with the exciting content that has been produced so far, the trajectory for quality content in the VR space already has a foundation. Once you experience a VR 'ah-ha' moment, you can't wait to find the next one".[51] To allow VR to function within the palette of current, broadly used media, we should ensure that its use is justified and, once employed, the full potential of the spherical, 3D image is addressed. The advantage of the VR medium lies in letting viewers reach locations that are normally inaccessible, deepening their understanding of a witnessed story by being personally present at the location (beyond written narrative), and actively exploring the environment by turning their head side-to-side. Using the VR medium is not justified once the presented location or an event can be attended by the viewers in reality, once the introduced technology no longer provides any added value on the informational or emotional level, or when the action is centred and takes place only in front of the viewer.

The VR medium has specific dynamics, which distinguish its use from other platforms. Virtual experiences should be intensive but should not last longer than four or five minutes, otherwise the viewers get fatigued. VR storytelling also does not function thus far as a stand-alone independent channel – it can reach a much broader public once it is encompassed as an "add-on" within a broader campaign and distribution strategy. Finally, the extraction of the content is more efficient when the public is first briefed about the matter via traditional media.

Conclusion

Virtual Reality has enormous potential that goes beyond traditional storytelling – especially in terms of stories about us, human beings, our culture and surrounding reality. Medical and psychological applications of VR technology can improve the quality of life, bring people closer together and facilitate empathy, social behaviour and interrelations.[52] Referring to Metz's concept of the imaginary signifier, VR gives a spectator even better grounds to identify with himself in a pure act of perception.[53] In his essays on the psychoanalysis of cinema, Metz focused on the *affective dimension of vision*, an emotional tie that Freud placed at the origin of identification.[54] Metz argued that spectators are left to themselves, having to rely on their own perceptions and emotions. That effect seems to be even stronger in the case of VR reception, where the non-framed field of view without an editing structure provides the spectator with a level of freedom (s)he

[51] G. Migielicz, J. Zacharia, *Stanford Journalism Program's Guide to Using Virtual Reality for Storytelling—Dos & Don'ts*, 2016, < https://medium.com/@StanfordJournalism/stanford-journalism-programs-guide-to-using-virtual-reality-for-storytelling-dos-don-ts-f6ca15c7ef3c> (accessed on 26.01.2017).

[52] L. Hodges, P. Anderson, G. Burdea, H. Hoffman, B. Rothbaum, *Treating Psychological and Physical Disorders with VR*, "IEEE Computer Graphics and Applications" 2001, invited article, pp. 25–33, November/December.

[53] C. Metz, *The Imaginary Signifier: Psychoanalysis and the Cinema*, Bloomington 1982.

[54] S. Halperin, C. Shakow, *The development of identification in Freudian theory*, "Psychoanal Review" 1989, 76(3), pp. 353–374.

has never had before. At the same time, a VR platform enhances the exploration of cinematic diegesis through the engagement of a broad palette of senses. In that sense, the relationship between the cinema and spectator meaningfully evolves, which is accentuated by Elsaesser and Hagener in their book *Film Theory: an introduction through the senses*.[55] Highlighting the "reception of the story through senses" they point to increasing interactions between the screen and the spectator's mind, body and emotions, as well as the distinctive configurations of the senses engaged in varied VR creations. They conclude as well that in the age of the digital, film theory needs a revision and broadening of its philosophical framework in order to encompass these transformations, as existing theories limit the current act of reflection.[62]

VR is not only a medium that for the first time conveys experience from a first-person perspective. It can also serve as a virtual expansion of physical spaces, as cities, schools or museums.[56] The new virtual environment has modified the meaning of a key metaphor existing in film theory: "window versus frame", which has been often associated with the concept of "realism". According to the classical theories of Bazin and Eisenstein, frame and window have been perceived as oppositions, whereas the phenomenological conceptualization of Maurice Merleau-Ponty represents them as a "window/frame container" where the dimensions of time and space are compounded. The cinema has always been preoccupied with the dimensions of reality and bodily sensations of them by dealing with matters of life extending beyond the projected moment. The recent comeback of the documentary via digital media accentuates the realms of identity beyond individual experience, ''being-in-the-world". It is a significant player in the public sphere and is equally indebted to both the changes in technology and to those in the social and cultural sphere that emerged in the digital age. Bearing in mind the long history of anthropomorphism applied to the technologies of cinema, from the "camera eye" of Dziga Vertov[57] and Béla Balázs' *visible man*,[58] to Laura Marks' *skin of film*[59] and Gilles Deleuze's *the brain is the screen*,[60] the digital image breaks with the ocular-centric paradigm, by turning more to the concept of *haptic vision*, mainly due to the proximity, tactility and sense of texture intuitively perceived through the digital image. Deleuze's definition of cinema as the immediate expression of pure movement[61] put a "philosophical turn" on film theory, which coincided with digitization. In

[55] T. Elsaesser, M. Hagener, op.cit..

[56] B. Bonis, J. Stamos, S. Vosinakis, I. Andreou, T. Panayiotopoulos, *A platform for virtual museums with personalized content*, "Multimed. Tools Appl." 2009, 42(2), pp. 139–159.

[57] Dziga Vertov. *Kino-Eye*, 1924.

[58] B. Balázs, *Early Film Theory: Visible Man and the Spirit of Film,* ed. E. Carter and trans. R. Livingstone, Oxford 2010 [1924].

[59] L.U. Marks, *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses*, Durham 2000.

[60] G. Flaxman, *The Brain Is the Screen. Deleuze and the Philosophy of Cinema*, Minneapolis. London 2000.

[61] G. Deleuze, *Cinéma I: L'image-mouvement.* Trans. Cinema 1: *The Movement-Image* (1986), Paris 1983.

consequence, certain paradigms have been weakened, such as "subjectivity" and "representation", whereas the main definitions of cinema have been linked to the digitization process. The cinema as we knew it for its first 100 years is there no more. Whether film theory redefines itself around the digital concept (as suggested by Friedberg,[62] Cubitt[63] and Spicer[64]), whether the image-anthropologists will "inherit" film theory (as Belting[65] and Didi-Huberman[66] imply), or whether philosophy or cognitivism will become the master film discipline, it is certain that the complex relationship delineated between a body, its senses and cinematic interfaces will play one of the most important roles in the future evolution of the audiovisual medium of storytelling.

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[62] A. Friedberg, *Window Shopping: Cinema and the Postmodern*, Berkeley, Los Angeles & London 1993.

[63] S. Cubitt, *The Cinema Effect*. Cambridge, Mass. & London 2004.

[64] A.H. Spicer, *Film and visual culture*, in: I. Heywood, B. Sandywell, M. Gardiner, N. Gunalan, C.M. Soussloff (eds.), *The Handbook of Visual Culture*, 2012, <eprints.uwe.ac.uk/8379/1/FilmandVC6.pdf> (accessed on 10.08.2017).

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