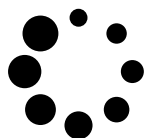


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Imagining
Sustainable

Futures: The Transformative Potential of Green Immersive Virtual Reality Experiences

by Eleonora Stacchiotti

Immersive experience

Virtual reality

Green media

Interactive media

Environmental literacy

AN-ICON

Studies in Environmental Images

Issue No1

Year 2024

→ Transformational Experiences.
The Role of Immersive Arts and Media
in Individual and Societal Change

Edited by Federica Cavaletti
and Katrin Heimann

Imagining Sustainable Futures: The Transformative Potential of Green Immersive Virtual Reality Experiences



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Abstract

This essay examines the transformative impact of Green Immersive Virtual Reality (IVR) experiences designed by artists to spread environmental literacy and societal change. Through methodologies like Critical Discourse Analysis (CDA) and Lars Elleström's framework, it analyzes the immersive artwork *Of Hybrids and Strings* (2021) by Lauren Moffatt to investigate if and how Green IVR challenges existing structures of thought while fostering alternative modes of being. By immersing users in multisensory virtual environments and incorporating intermedial connections with tangible artifacts, experiences prompt participants to reimagine their relationship with the natural world and envision more sustainable futures. Ultimately, the study highlights Green IVR as one of the catalysts for environmental literacy and societal change, emphasizing its role in shaping collective imagination and inspiring meaningful engagement with ecological issues.

Keywords [Immersive experience](#) [Virtual reality](#) [Green media](#)
[Interactive media](#) [Environmental literacy](#)

To quote this essay: E. Stacchiotti, "Imagining Sustainable Futures: The Transformative Potential of Green Immersive Virtual Reality Experiences," *AN-ICON. Studies in Environmental Images* [ISSN 2785-7433] 3, no. 1 (2024): 74-99, <https://doi.org/10.54103/ai/22526>.

Introduction

The Intergovernmental Panel on Climate Change (IPCC, 2021) – the United Nations’ body for the assessment of knowledge and science related to climate change – warned that we must make rapid, extensive, and unprecedented changes in all aspects of our society to limit global warming to 1.5°C. The extent and the success of adaptation strategies will of course vary deeply across regions and will strongly be influenced by levels of governance, wealth, technology, and infrastructures available. Accordingly, there will be disparities in how human health will be influenced by the health of our planet. As a matter of fact, societies that benefit the most from climate change-causing activities are not the ones that are suffering from their consequences the most. To avoid the exacerbation of these inequalities, it is necessary to understand on a collective level that we are all connected. It is undeniable that – as argued by Naomi Klein – no single career or lifestyle choice would suffice to slow down the effect of climate change and that we can do it only as part of massive local and global multi-issue, multi-generational and multi-identity movements.¹ Nonetheless, individuals must understand the potential to address and influence the environmental crisis. This means that people must be environmentally literate.

Doing and promoting environmental literacy is an arduous task. First, many factors causing climate change are invisible like, for instance, greenhouse gases. This implies that it is more difficult for people to understand the damaging aspect of their behaviour on the environment. Secondly, much of the environmental degradation takes place in areas that are far away, causing a psychological disconnect which leads to the unawareness of the severity of environmental issues.² This is also connected

¹ N. Klein, *On Fire. The (burning) case for a Green New Deal* (New York: Simon & Schuster, 2019).

² Y. Trope, N. Liberman, “Construal-Level Theory of Psychological Distance,” *Psychological Review* 117, no. 2 (2010): 440-463, <https://doi.org/10.1037/a0018963>.

to the third problematic aspect of doing environmental education, that is the relevance of experiencing nature first-hand. This is fundamental to establish a sense of connectedness, crucial to develop environmentally friendly behaviours.³

Over the last decades, digital technologies have provided a growing accessibility to information, knowledge, and experience. A key feature of digital technology is its multimodality – which is the ability of including texts, images, animations, sounds and haptic feedback to create engaging and interactive experiences.⁴ Through multimodality, digital technology enables the users to visualize things that would be otherwise be invisible. Therefore, it has been shown that digital technologies make it possible to engage with the environmental issues in more specific and engaging ways⁵ and allow people to visit places that are inaccessible, not easy to reach, do not exist anymore or even have never existed.⁶ For these and other reasons, contemporary media are increasingly used to persuade people to adopt more sustainable lifestyles. Such objects have recently earned the attention of scholars, that started to name them Green Media.⁷ In this paper, an example of Green Media will be analysed. More specifically, I will focus on a piece of Green Immersive

3 C.M. Bruni, R.C. Chance, P.W. Schultz, J.M. Nolan, “Natural Connections: Bees Sting and Snakes Bite, but They Are Still Nature,” *Environment and Behavior* 44, no. 2 (2012): 197-215, <https://doi.org/10.1177/0013916511402062>.

4 C. Kattenbelt, “Intermediality in Theatre and Performance: Definitions, Perceptions and Medial Relationships,” *Culture, Language and Representation* 6 (2008): 19-29.

5 S.J. Ahn et al., “Experiencing Nature: Embodying Animals in Immersive Virtual Environments Increases Inclusion of Nature in Self and Involvement with Nature,” *Journal of Computer-Mediated Communication* 21, no. 6 (2016): 399-419, <https://doi.org/10.1111/jcc4.12173>; G. Fauville, *Digital Technologies as Support for Learning About the Marine Environment: Steps Toward Ocean Literacy*. Doctoral thesis. Sweden: University of Gothenburg, 2017; G. Fauville et al., “The Carbon Footprint as A Mediating Tool in Students’ Online Reasoning About Climate Change,” in O. Erstad et al., eds., *Learning Across Contexts in the Knowledge Society* (Rotterdam: Sense Publishers, 2016): 39-60, https://doi.org/10.1007/978-94-6300-414-5_10.

6 A.R. Jacobson, R. Militello, P.C. Baveye, “Development of Computer-Assisted Virtual Field Trips to Support Multidisciplinary Learning,” *Computers and Education* 52, no. 3 (2009): 571-580, <https://doi.org/10.1016/j.compedu.2008.11.007>; W. Tarnig et al., “The Development of a Virtual Marine Museum for Educational Applications,” *Journal of Educational Technology Systems* 37, no. 1 (2008): 39-59, <https://doi.org/10.2190/ET.37.1.d>; W. Tarnig et al., “An Instructional Design Using the Virtual Ecological Pond for Science Education in Elementary Schools,” *Journal of Educational Technology Systems* 38, no. 4 (2010): 385-406, <https://doi.org/10.2190/ET.38.4.b>.

7 <https://greenmedia.sites.uu.nl/>

Virtual Reality (Green IVR). Research demonstrated that experiences in IVR can produce a change in attitude and in behaviour in users.⁸ Specifically, in the context of this research, Green IVR are thought of as instruments that work on the imagination of users. As supported by Roy Bendor, contemporary forms of media have the potential to influence social imaginaries, which are the modalities people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie such expectations.⁹ Such values, as stated by Charles Taylor, are currently in a complete crisis, as what we are witnessing is not exclusively related to climate, but has to do with crises of our economic, social, and political imaginaries.¹⁰ This paper supports the idea that Green IVR provides users with tangible visions and experiences of speculative scenarios that build on our imagination for the future to come.

In the following paragraphs, I will firstly introduce the main features of Green IVR with the aim to show its potential transformational role. Since imagination cannot be considered as a fixed concept but is always shifting throughout the history of human thought – probably also according to major changes in technological tools available – the current configuration of imagination will be introduced. Posthuman imagination is the conceptual frame through which the case study is analysed and interpreted. In the third section, I will introduce the methodology employed to analyse the case study - that is a combination of Critical Discourse Analysis as theorised by Norman Fairclough and Lars Elleström framework for the analysis of intermedial relations, which will be used to analyse the case study in part four.

8 G. Fauville, A. C. Muller Queiroz, J. N. Bailenson, “Virtual Reality as a Promising Tool to Promote Climate Change Awareness,” in J.K., Hayeon Song, ed., *Technology and Health* (Cambridge: Academic Press, 2020): 91-108, <https://doi.org/10.1016/B978-0-12-816958-2.00005-8>.

9 R. Bendor, *Interactive Media for Sustainability* (Leicester: Palgrave Macmillan, 2018).

10 C. Taylor, *Modern Social Imaginaries* (Durham: Duke University Press, 2004).

Green Immersive Virtual Reality: An Insight on Its Functioning and Its Potential

Using a head-mounted display, hand controllers, stereoscopic sound and haptic feedback, Immersive Virtual Reality (IVR) provides a first-person experience in a three-dimensional virtual environment augmented with multisensory feedback. IVR enables users to perceive with multiple senses as if they were in the real world. IVR is characterised by three specific features – dissected and taken into analysis for a long time – that are psychological presence, immersivity, and embodiment. As easily inferable, they are complementary, and their combination generates the possibility of empathy and perspective taking, which are two other key factors of immersive experiences. For what concerns psychological presence, it is described as the very sense of being there.¹¹ By means of the invocation of the sense of presence, IVR supports intensive feelings that make a user think, feel, and behave as if they are really living the experience in the place represented by the computer-generated virtual space.¹² This is strictly imbricated with the second key feature of IVR, that is immersivity. In 1998, researchers Witmer and Singer defined immersion as a psychological state of perception of oneself as enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences.¹³ For instance, highly immersive IVR tracks bodies' movements and renders them so precisely that the users feel like their arms and legs are easily moving in the virtual world, enacting in this way a

11 C. Heeter, "Being There: The Subjective Experience of Presence," *Presence: Teleoperators and Virtual Environments* 1 (1992): 262-271, <https://doi.org/10.1162/pres.1992.1.2.262>; M. Slater, S. Wilbur, "A Framework for Immersive Virtual Environments (FIVE): Speculations on the Role of Presence in Virtual Environments," *Presence* 6, no. 6 (1997): 603-616, <https://doi.org/10.1162/pres.1997.6.6.603>.

12 A. Felnhofer *et al.*, "Is Virtual Reality Emotionally Arousing? Investigating Five Emotion Inducing Virtual Park Scenarios," *International Journal of Human-Computer Studies* 82 (2015): 48-56, <https://doi.org/10.1016/j.ijhcs.2015.05.004>

13 B.G. Witmer, M. J. Singer, "Measuring Presence in Virtual Environments: A Presence Questionnaire," *Presence* 7, no. 3 (1998): 225-240, 227, <https://dx.doi.org/10.1162/105474698565686>.

stronger sense of presence.¹⁴ This connects to embodied cognition, the third feature of IVR. In IVR, users interact, communicate, and learn through movements, gestures, and physical activities.¹⁵ Research supports that designing learning activities that encourage actions stimulate the formation of memories, prepare users for future education, and help people connect visible and invisible phenomena.¹⁶ As mentioned above, these three characteristics work together and generate another relevant aspect of IVR, that is the possibility of empathy and perspective taking. This refers to the ability of taking the perspective of another entity, so that the possibility of becoming someone of a different gender, ethnicity, age, or species is immediate in IVR, and it has proven to support positive prosocial behaviours such as the activation of a helping behaviour,¹⁷ decreasing the racial bias,¹⁸ and decreasing the ageist bias.¹⁹ A recent analysis revealed that presence and immersion are related:²⁰ when users feel part of the virtual world, the technology enables the replication of their movements well enough, so that they can embody a range of characters. The combination of all affordances of IVR has the potential to create impactful experiences.

In this paper, the investigation is looking at the transformational role of forms of IVR as used to educate people as regards the climate crisis, an object of research I refer to with the term Green IVR. This draws inspiration from Joost Raessens and Stefan Werning's work on

14 W. Wirth *et al.*, "A Process Model of The Formation of Spatial Presence Experiences," *Media Psychology* 9 (2007): 493-525, <https://doi.org/10.1080/15213260701283079>.

15 M. Wilson, "Six Views on Embodied Cognition," *Psychonomic Bulletin & Review* 9 (2002): 625-636.

16 R. Lindgren, M. Johnson-Glenberg, "Emboldened by Embodiment: Six Precepts for Research on Embodied Learning and Mixed reality," *Educational Researcher* 42 (2013): 445-452, <https://doi.org/10.3102/0013189X13511661>

17 S.J. Ahn, A.M.T. Le, J.N. Bailenson, "The Effect of Embodied Experiences on Self-Other Merging, Attitude, and Helping Behavior," *Media Psychology* 16 (2013): 7-38, <https://doi.org/10.1080/15213269.2012.755877>.

18 B.S. Hasler, B. Spanlang, M. Slater, "Virtual Race Transformation Reverses Racial Ingroup Bias," *PLoS One* 12, no. 4 (2017): 1-20, <https://doi.org/10.1371/journal.pone.0174965>.

19 S.Y. Oh, J.N. Bailenson, E. Weisz, J. Zaki, "Virtually Old: Embodied Perspective Taking and the Reduction of Ageism Under Threat," *Computers in Human Behavior* 60 (2016): 398-410, <https://doi.org/10.1016/j.chb.2016.02.007>

20 J.J. Cummings, J.N. Bailenson, "How Immersive Is Enough? A Meta-Analysis of the Effect of Immersive Technology on User Presence," *Media Psychology* 19 (2016): 272-309, <https://doi.org/10.1080/15213269.2015.1015740>.

Green Media, which are described as persuasive media productions that aim at raising awareness and changing attitudes towards the ecological crisis. Green Media Studies – a research group created by the two media theorists – attempts to contribute to the understanding of the interconnectedness of media representations, media use, media impact, and media technologies addressing the climate crisis and imagining sustainable futures. Among other things, they investigate the way Green Media impact ecological identities and forms of civic engagement on an individual and collective level, and they do so by analysing the representation of environmental issues like narratives and imaginaries in media of all kinds from a media-comparative perspective.²¹ Therefore, the object of this research concerns Immersive Virtual Experiences that make use of a head-mounted display, hand controllers, stereoscopic sound, and haptic feedback, enabling a multimedial first-person experience in a three-dimensional virtual environment which is augmented with a collection of multisensorial stimuli. The adjective Green specifies content and aim of these specific types of Virtual Reality, which are created to boost the degree of environmental literacy of users.

The Configuration of 21st Century's Posthuman Imagination

Imagination is not a fixed concept. Hundreds of philosophers, thinkers, intellectuals, but also artists and creatives have been pondering about the notion of imagination and have produced a lot of different definitions and ways of employment of this word.²² Basing her research on the awareness that imagination is not a fixed category and that is probably deeply influenced by the technical means available in a given moment of history, philosopher

²¹ As one can read on their website's homepage <https://greenmedia.sites.uu.nl/>.

²² For an understanding of the evolution of the concept of imagination, one can read, among others, F. Cavaletti, "Immaginazione," in A. Pinotti, ed., *Il primo libro di estetica* (Turin: Einaudi, 2022): 134-145; M. Ferraris, *L'Immaginazione*, (Bologna: Il Mulino, 1996); G. Currie, I. Ravenscroft, *Recreative Minds* (Oxford: Oxford University Press, 2002).

of technology and media scholar Galit Wellner has firstly introduced posthuman imagination in the paper “Posthuman Imagination: From Modernity to Augmented Reality” (2018), a work that enquires digital technologies with the theoretical tools of philosophy of technology, especially post-phenomenology. She describes posthuman imagination as the contemporary development of imagination, and grounds it on Don Ihde’s evolution of multistability theory²³ and post-humanist notion of the cognitive unconscious as theorised by Katherine Hayles.²⁴ In my understanding of the concept, I add to the discourse Donna Haraway’s signifier SF²⁵, as it enables the recognition of imagination as a faculty shared by humans, machines, and other species. In this paper, I will not go into detail with the theories developed by Hayles, Ihde and Haraway, as it suffices to state that the kind of imagination that Green IVR is presumably training can be described as it follows:

Taking as an assumption the fact that imagination shapes our worldview, posthuman imagination is a speculative form of imaginative activity devised to question or criticize our vision of and behaviour toward the world, other species, and ourselves by adding layers to reality. This type of imagination is posthuman because it is co-shaped, mediated and exercised also by digital technology, which is then inextricably involved in the processes of modification of our worldview.

23 D. Ihde, *Experimental Phenomenology: An Introduction* (Albany: SUNY Press, 1986); D. Ihde, *Postphenomenology and the Technoscience. The Peking University Lectures*. (New York: State University of New York Press, 2009).

24 K. Hayles, “Cognition Everywhere: The Rise of the Cognitive Nonconscious and the Costs of Consciousness,” *New Literary History* 45, no. 2 (2014): 199-220, <https://www.jstor.org/stable/24542553>.

25 D.J. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016). SF stands for, among others, Speculative Fabulation. Speculative Fabulation is a “mode of attention, a theory of history and a practice of worlding” (213) and is a type of narration that enables the unfolding of alternative realities by arousing a genuine curiosity for what is possible. Unlike Science Fiction, Speculative Fabulation requires a type of imagination that is grounded on what is already there. Differing from the excitement of the creation of a totally new world with no reference to the actual, Speculative Fabulation is about enlarging the spectrum of what is possible through new narrations. Haraway exemplifies the methodology of SF by proposing the practice of multispecies storytelling. This practice allows the emergence of knowledge in the meeting with other species, so that all elements taking part to the relational act are at the same time both subjects and objects of environmental justice.

This definition originates from the assumption that imagination has an impact and modifies our gaze on the world. Before doing anything, human beings project their creations and ideas into their head by making use of imagination. Supposing that all men have the capability to imagine, the question is about what elements influence their ability to imagine certain things at a certain moment. For example, why are not contemporary architects erecting monuments and buildings in the vein of Renaissance's architects? One could argue that the differences in their imaginative skills might be attributed to the available means, that can be assumed to be technologic. For example, erecting a building today requires a series of actions enabled by technical objects: the range of operations [...] of possibilities architects can potentially choose from in order to build their own creation. Erecting monuments and building in the vein of Renaissance's style nowadays would entail the combination of designs and operations that are not "implied" by the current set of technologies at our disposal, resulting in the further research and study of techniques and materials apt to reconstruct the way Renaissance architects would do. Therefore, it is possible to affirm that technology influences our imagination. As highlighted by Wellner, the layered interconnection between technology and reality alters our worldview – and the way we look at it –, "imagination included".²⁶ Accordingly, different technologies mediate our worldview, so that different technologies mediate different worldviews. For this reason, shifts and evolutions in available technologies generate alterations in worldviews, just as much as in imagination, which varies according to evolutions in technology.

Looking at the current set of available technologies is fundamental to understand why our imagination is posthuman. The first reason is related to the position given to the humans within the (media) environment. If

26 G. Wellner, "Posthuman Imagination: From Modernity to Augmented Reality," *Journal of Posthuman Studies* 2, no.1 (2018): 45-66, 46, <https://doi.org/10.5325/jpoststud.2.1.0045>.

modern imagination – which dates back to the 20th century – puts the human behind the camera giving us the role to choose a point of view on reality –, posthuman imagination is situated in environments drenched in digital technologies operating at rhythms incomprehensible to humans,²⁷ making the human one among the several elements inhabiting real and digital spaces. Another aspect that makes the current configuration of imagination posthuman is associated to the experiences enabled by technologies and media. For example, artefacts like digital interactive media such as Virtual Reality enable users to experience the world embodying any kind of entity through the use of computer-generated environments and wearable devices. This is to say that technologies make the possibility of being in someone (or in something else)’s shoes tangible, making space for interpretations of reality from non-human perspectives. Human users in immersive virtual reality experiences can break out of their specific position in the world and gain information from (simulated) circumstances that differ from their everyday life. This happens thanks to the mediation of technologies, which are confirmed to be unavoidably entangled in the act of interpretation of any given input – may it be visual, kinaesthetic, or sonic. Posthuman imagination seems to have the potential to question and criticise our vision of and behaviour towards the world, other species, and ourselves by enabling a systematic manipulation of the real through a reasoned layering of elements put on top of the real, as supported by Galit Wellner.²⁸ She visualises posthuman imagination as an extensive application of Augmented Reality: the digital overlaps and mixes with the plane of existence of the real, organising into different layers, which do not support any hierarchy, can carry real and imaginary information indiscriminately and can influence reality as much as they can just add an aesthetic

27 M. Hansen, *Feed Forward: On the Future of Twenty-First Century Media* (University of Chicago Press, 2015): X.

28 G. Wellner, “Posthuman Imagination:” 49.

value to it.²⁹ Also through a spontaneous and disorganised way of distributing knowledge and information, posthuman imagination can nurture our critical conscience and yearns for our position in the world to change, as it enables the coexistence of elements from different sources without imposing any kind of order, forcing us to be in the middle of the “disorder” and the overlap of several elements. Therefore, the posthuman here emerges because such layers are created by combinations of both human and nonhuman elements, in a networked system that co-shapes and participates in the activity of imagination.

Posthuman imagination is the concept through which the case study is framed and interpreted: the Green IVR experience analysed in the last section is considered as a tool to train our ability to imagine posthuman relationalities. Considering the stratified layers of signifiers and meanings as introduced by the posthuman account, I am introducing a methodology of analysis that examines various levels of meaning-making.

Methodology: Critical Discourse Analysis

Similar to other kinds of media, Green IVR emerges in a precise social and historical context, meaning that it relates to a specific configuration of meanings. Therefore, here it will be put into use a methodology that can look at the material and media specificities of the case studies while putting them into relation with the contexts they originated from. To take into analysis Green IVR as a material media object and, more broadly, as a cultural object, I use Norman Fairclough’s approach to Critical Discourse Analysis. In his work, Fairclough proposed a methodology that enables the analysis of the relation between language and meaning, with a focus on the power relations inherent to all acts of communication and knowledge production. A Critical Discourse Analysis (CDA) approach “wants to [put into contact] systematically

29 G. Wellner, “Posthuman Imagination:” 47.

often opaque relationships of causality and determination between (a) discursive practices, events, and texts, and (b) wider social and cultural structures, relations, and processes” to explore how these practices, events, and texts result from relations of power and struggles over it.³⁰ CDA, then, does not consider discourses of any kind in isolation from the context they are generated, since they inform and are informed by wider processes within society. CDA requires an onion-like structure which takes into analysis all layers of meaning – going from the textual to the way it is perceived on a social level.

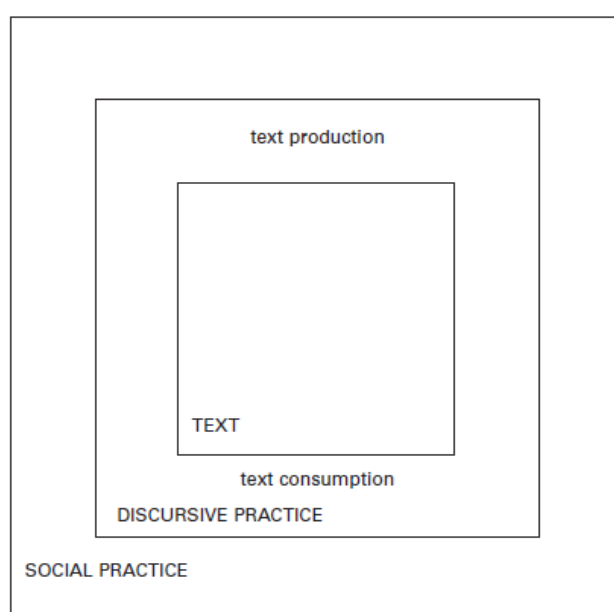


Fig. 1. Norman Fairclough's model for a Critical Discourse Analysis (CDA).

The first level of analysis in Fairclough's CDA is constituted by a written or spoken text, which is later contextualised into discursive practices and social practices. The analysis of the discursive practices is based on the analysis of opinions, interviews, reviews and, more generally, on what has been said or written on the case study. This is functional to scrutinize into the social practices, which is the wider social context within which the object is framed. For example, in the case of a movie, the discursive practice will read into declarations of the directors, of the reviewers and of the general public, if possible. The social practice's analysis would take into

30 N. Fairclough, *Critical Discourse Analysis* (London: Longman, 1995): 132.

consideration other movies released in the same period, or movies of the same genre. These three steps – especially the second and the third – need to be made with a critical inquiry focused on the power relations, the dynamics of production and the implicit political discourses.

Since my object of analysis does not consist of a written or a spoken text, I will implement CDA with the theoretical frame by Lars Elleström. He proposed a very detail-oriented analytical tool that allows to look at media and art production both from a pre-semiotic and a semiotic point of view. Departing from the reinterpretation of intermediality – which is considered as the primary feature of all media objects necessary to be perceivable rather than a relation between different media objects, Elleström starts off with the awareness that all media are material interfaces situated in social, historical, communicative, and aesthetic circumstances that are originated as the complex blend of the material, the perceptual, and the social contexts where communication takes place. For this reason, his method looks at media production from several perspectives, while working towards a general depiction that considers all its aspects.³¹ His framework of analysis departs from the definition of the basic categories of which a media object is composed, which are called media modalities. Media modalities are four and consist of the most visible and tangible characteristics of the media object, which go from the material it is built with, to the semiotic signs it carries. Since a media object without media modalities cannot be perceived, media are necessarily realised in the form of all four modalities, implying all media products can be analysed in terms of four kinds of basic traits. The first three are pre-semiotic and refer to the material aspects of the media objects: they are the material modality, the sensorial modality, and the spatiotemporal modality; the fourth modality is semiotic

31 L. Elleström, *Media Borders, Multimodality and Intermediality* (London: Palgrave Macmillan UK, 2010); L. Elleström, "Identifying, Construing, and Bridging over Media Borders," *Scripta Uniandrade* 16, no. 3 (2018): 15-30, <https://doi.org/10.18305/scripta%20uniandra.v16i3.1162>

and concerns signifiers and their related meaning generated in the social context.

Before moving to the analysis of the case study, it follows a short description of media modalities that will be useful to understand the table in the next page. The material modality concerns the corporeal interface of media, in the sense that they can be, for instance, solid or non-solid, organic, or inorganic. For instance, the material modality of a book is paper, or ink. The spatiotemporal modality considers the spatiotemporal traits, which means that media products have at least one spatial or temporal extension, consisting of modes like temporality, stasis, and spatiality. For instance, temporality is an aspect of songs, gestures, and dance. Instead, a photograph has two dimensions, that are width and height, while a sculpture has three different spatial dimensions (width, height, and depth). A mobile sculpture has all four dimensions – that are width, height, depth, and time. As “all media products [...] are necessarily perceived in time and space before they create cognitive import,”³² all media have at least one spatiotemporal aspect. The sensorial modality concerns sensorial media modes. All media products have sensorial properties, in the sense that their materiality – existing in time and space – must be perceived by one or more of our senses in order to reach semiosis, that is the process of meaning making that occurs in the human mind. The five senses correspond to the five main modes of sensorial modality: seeing, hearing, feeling, tasting, and smelling. The visible is a mode of films, websites, images, signboards, tattoos. The audible is the mode of instrumental music, spoken word, movies, radio. The surface of a gift can communicate something, as much as the smell of a flower. For what concerns the semiotic modality, the main media traits are iconicity, indexicality, and symbolicity. Icons represent their object based on similarity;

32 L. Elleström, *Media Borders, Multimodality and Intermediality* (London: Palgrave Macmillan UK, 2010): 48.

indexes do so based on contiguity; and symbols rely on habits or conventions.

The combination of the Cultural Discourse Analysis framework of investigation and the analysis of media modalities approaches the case study with a complete set of lenses through which it is possible to inspect into the media object's material and semiotic features while establishing a connection with the context it appeared in and it speaks to.

Of Hybrids and Strings: The Transformational Role of Green IVR Analysed

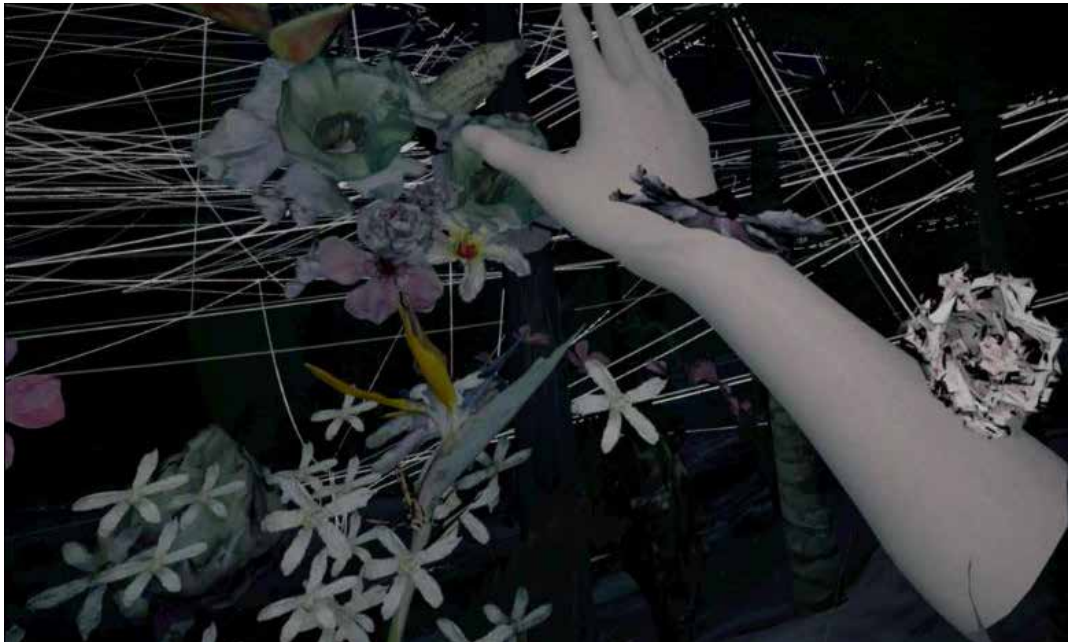


Fig. 2. Screenshot from the experience by Lauren Moffatt, *Of Hybrids and Strings* (2021)

As you step into *Of Hybrids and Strings* (2021) – an immersive virtual reality experience designed and directed by artist Lauren Moffatt – you enter a forest bathed in moonlight, a vibrant pastel-coloured forest. You are surrounded by swishy branches, leafy bushes, floating flowers, animals, and the roar of the cicadas. After some seconds, you realise that you have your own avatar into the virtual world and start using your hands to interact with all species. All creatures – comprising you – are connected to each other by thin white strings, which weave together throughout the forest. While interacting with the forest, your avatar starts to slow down, and you start

slowing down your rhythm of exploration likewise. After nine minutes of various encounters with creatures of all kinds – including a flower hybrid avatar, whose movements mirror yours – the forest starts turning into a quiet crystal world and all living creatures melt together in irregular solid shapes. In the end, you sink into the darkness and find yourself at the start of the experience again.

Text Analysis: Media Modalities

Media Modalities	<i>Of Hybrids and Strings</i>
Material	VR headset or procedural cinema. 360° immersive world, with 3D objects, nature sounds, background music; bidimensional print book covers in exhibitions.
Spatial and Temporal	The space is freely explorable but there are fixed meetings with various entities. Semi-fixed sequentiality.
Sensorial	Sight, touch, hearing, haptic stimulation.
Semiotic	Iconicity: single elements are reproduced with photogrammetry and digital painting.

The original design for the exhibition of this piece provides a VR headset and controllers which allow the visitor to interact with the environment. An alternative version has been developed in parallel which works as a piece of procedural cinema. The descriptions above and below are based on the immersive experience enabled by the Twitch livestream³³ by Fabbula, a curatorial team working with cultural practices around the idea of “worlding with” (that is, to create worlds by use of) digital media. In fact, *Of Hybrids and Strings* has been commissioned

33 Fabbula, #8.2 Worlding with Lauren Moffatt – *Of Hybrids and strings*. <https://fabbula.com/artists/of-hybrids-and-strings-by-lauren-moffatt/>

by Fabbula, in their curatorial programme Worlding with the trouble.

The spectator is immersed into a 360° virtual world, which is inhabited by 3D flowers, animals, and all kinds of plants. Plus, there are nature sounds and background music. I experienced the piece on my flat screen in a desktop-based version of the Green IVR, but the original engages the spectator into a fully immersive experience. The human spectator is positioned into the forest as one of the many entities populating the woods. The high degree of immersivity into the 3D generated world is built by several elements, which contribute to the peculiar atmosphere of this experience. Among these, non-human entities slowly roam around, while the soundscape remind of the sounds one would hear when in a forest by night. It requires, then, a multisensory approach: sight, hearing, and touch are included in this piece. Moreover, as soon as your avatar slows down, the sense of embodiment grows, and your real body is affected by the deceleration of the whole environment. Therefore, it makes sense to say that also the haptic perception is stimulated here. Since the experience is structured on the exploration of the scenery, there is a semi-fixed sequentiality in terms of the internal narration, which is regulated by fixed encounters that allow the experience to proceed. From a semiotic perspective, objects in the experience are constructed on the base of similarity. The general meaning produced by the intersection of these media modalities is an intense feeling of entanglement with the surrounding environment, so much that the spectator gets influenced by the slowness of the scene and the deep connection of all species in the experience.

It is fundamental to add that – when physically exhibited – this art piece has an extra component, that is a series of painted book covers attributed to a fictitious author named Suzann B. Clair. This means that *Of Hybrids and Strings* is a multimedia experience that includes two-dimensional paintings reproducing the same objects that the users find into the virtual experience. Between

the virtual world and the material book-covers there is a relation of intermediality in a narrow sense, meaning that they are media with different media modalities. In fact, the book covers are bidimensional, flat objects without any spatiotemporal coordinates which express their meaning through drawings and sketches. However, the relation of similarity between the drawings on the book covers and the flowers into the experience create a sense of continuity between the inside and the outside, the tangible, and the imaginary. As said by the artist in the Twitch streaming held by Fabbula, the main technique used to create the virtual world is photogrammetry, which is based on the following steps. First, Moffatt takes – or collects from friends living in distant areas – hundreds of pictures of any kind of natural species. For each flower or plant, she meshes the photographic materials into 3D renderings of it. After this, she paints on the 3D object and combines her handcraft with the computer-generated three-dimensional design. When she reaches the desired result, she turns it into a version suitable for Immersive Virtual Reality. I will discuss this technique in the next paragraph, as it is fundamental to understand the role artistic creation has played in the making of this specific case of Green IVR.

Discursive Practice Analysis

As already mentioned, *Of Hybrids and Strings* has been commissioned and financed by Fabbula, a curatorial practice and journal focused on digital media and immersive technologies with the aim of “worlding” with game engines, XR, metaverse and livestreams.³⁴ Produced between Australia, France, and Spain, it premiered at SXSW 2021, a film festival dedicated to virtual cinema in Austin, Texas that was entirely online but not for free. In this discursive practice analysis, I am considering what the artist said in the video exploration of the Green IVR as streamed on Twitch by Fabbula, descriptions of the artwork as presented in the Fabbula’s website by the curator

34 Fabbula, <https://fabbula.com/about-us/>.

and an interview of the artist released on the Fabbula's website. I could not find reviews of articles written online on the artwork. The absence of reviews of IVR experiences might be investigated in further research. *Of Hybrids and Strings* was presented by the artist as a trans-species experience in which the spectator slows down and becomes entangled with human and non-human intelligences. It is displayed as a virtual space to practice new ways of being-in-the-world and to acquire new modalities of action. In the interview, the artist declared that *Of Hybrids and Strings* is a real scale VR environment that does not reproduce a world, but *makes* a world, a world originated from the will to create something where the human spectator is affected by the environment, so that by the end of the experience you are modified by the surroundings. The pivotal idea for Moffatt was to reinterpret interactivity. If usually an IVR is interactive in the sense that it lets the users modify the virtual world, in this case the IVR is interactive because the virtual environment interacts and is meant to modify the spectator. This aims to change the way the spectator is positioned within the virtual experience: the need for the user to keep a correspondence of movement between the avatar s/he is embodying and his/her body – something that is needed in order not to incur into a dissociation between how the body is seen and how it is felt – makes it sure that the transformation of the user's rhythm of movement actually takes place. The original research question of her creative process was about the possibility of engaging with a medium that is currently mostly used for video games in the entertainment industry. In fact, she wondered how immersive technologies – an expression of all the acceleration of big tech and consumer electronic culture – can be exploited as “an engine for slowness and gentleness.” She observed that VR is often seen as a tool to generate escapism and for “the expression of violent desires forbidden in civil life,” responding to the same “hopelessness, cynicism, and blind anxiety” that makes us feel completely frustrated by the crisis menacing life on Earth. In opposition to the creation

of worlds where the cruellest instincts of human beings can find an outlet with violent gaming engines, Moffatt conceived a slow cosmos of peaceful exploration. Moffatt added that she considers the whole experience as a path going from a point A to a point B, where point A consists of an environment that really looks like a realistic place, while point B corresponds to the end of the experience, where all creatures – including the spectator – melt with the environment, in a process of decreasing rhythm and broader interactions. Lauren declared that the choice to make the virtual world so slow that “it is difficult for the spectator to move without being calmer” was made to work with the idea of deceleration. “Deceleration is functional to take moments to think about the environment that we cross everyday, so that the human users can realise about the deep entanglement of all beings with human and non-human entities.” In open contrast with the Accelerationist movement, Moffatt maintained that the only way to find new ways of living faced with the climate crisis is to freeze ourselves in the moment where we are now so to imagine our future. Therefore, she used deceleration as an instrument to pay homage to “the invisible forces of the world” and to give herself space to create beyond what we are used to because of the game engines. Put in this way, the medium becomes more than just a game engine and is used to create narratives that engage with “mind and body in a simultaneous rhythm” in a process of mediation. Moffatt said that immersive digital artistic creation “allows [her] to create dreams for the audience to experience wide awake.”³⁵ Moreover, on the Fabbula website, the curator wrote that the project creates an absence, a void of meaning as a strategy to stimulate the imaginary potential lying inside the human spectator. Such hidden imaginative potential lies below “the physiological and psychological defences” that slowly taught us how to survive only by avoiding collective systemic problems and

35 Fabbula, “#8.2 Worlding with Lauren Moffatt — 'Of Hybrids and Strings',” <https://www.twitch.tv/videos/955347028>

escaping our potential capability to face them. *Of Hybrids and Strings* proposes a space of “stillness and absence,” that the human spectators can infuse with curiosity, inventiveness, and imagination to achieve desirable futures.³⁶

As hinted above, the book covers – the analogue component of the whole Green IVR experience – are attributed to Suzanne B. Clair, a fictitious author living in a parallel version of our world. As declared by the artist in the Twitch presentation of her artwork, Suzanne Clair was borrowed from James G. Ballard’s book *The Crystal World*,³⁷ a novel in which she is a secondary character. Suzanne, considered as an eccentric woman belonging to the literary topos of the crazy woman, is instead a prolific author of science fiction. Moffatt reported that she fed on her curiosity to look at the world from the perspective of the secondary character, who, in this way, turns into the main protagonist and author of a whole reality. Moffatt calls attention on the substantial difference between her world and ours. If in our world Suzanne Clair’s work has never been published and her existence is tied to just one book written by a white male author, in Clair’s parallel reality, speculative fiction written by authors that are not white heterosexual males has been prolifically published throughout the 20th century. Since the 1970s Suzanne B. Clair writes “science fiction projecting desirable outcomes for our kind” by promoting radical association between human and non-human species, “the atonement of the body to its environment and the cultivation of and reverence for human creativity and imagination.”³⁸

Social Practice Analysis

Of Hybrids and Strings materializes the theories at the ground of this research. In the first place, this Green IVR uses a language and symbolisms that place it among works produced as an answer to Donna Haraway’s

36 Fabbula, “Of Hybrids and Strings by Lauren Moffatt.” <https://fabbula.com/artists/of-hybrids-and-strings-by-lauren-moffatt/>

37 J.G. Ballard, *The Crystal World* (London: Jonathan Cape, 1966).

38 Fabbula, “Of Hybrids and Strings by Lauren Moffatt.” <https://fabbula.com/artists/of-hybrids-and-strings-by-lauren-moffatt/>

call for the need to experiment modes of living and of being that are in close contact with the trouble.³⁹ Lauren Moffatt openly wanted to work through Speculative Fabulation, one of the many practices that Haraway describes as worlding. Worlding is a particular blending of the material and the semiotic that removes the boundaries between subject and environment, to create the opportunity for the cessation of habitual temporalities and ways of being.⁴⁰ Moreover, speculation is a practice in which real elements are used to create new theories and conjectures that have no clear evidence but that can easily be imagined as if they were real. In this sense, this Green IVR experience works with what is already on Earth and creates the space the spectator needs to learn how to establish new connections with entities surrounding us in the real world, while facing the threat of climate crisis. This emerges also in the technique used to create the virtual world. As described above, Lauren Moffatt departs from pictures of flowers, combines them with her digital painting, and achieves the glitched virtual artefact by blending photos and artistic production. In addition, she asserted that she wanted to focus on the fragments rather than “on the whole” so to focus on connections, interactions, and horizontal exchanges among the parts. As a matter of fact, while being outside the virtual world thanks to their material existence, the human user engages in interactions with the virtual creatures and participates to the crystallisation of the forest, that is to say that the human user takes part to the group of digital creatures and contribute to “make something happen.” The process of speculative creation is also visible at the level of the collaborative aspect lying behind the accumulation of photographs, which is the result of the effort of multiple people taking photos all over the world. In this sense, the technique used by Moffatt falls into the category of sympoiesis, the activity

39 D. Haraway, *Staying with the Trouble*: Introduction.

40 H. Palmer, V. Hunter. “Worlding,” *New Materialism How Matter Comes to Matter*, March 16, 2018. <https://newmaterialism.eu/almanac/w/worlding.html>

of making-with other people, other species, and alterities of any kind – going from the flower in the rainforest to the devices used to design the VR objects. Seen from this perspective, *Of Hybrids and Strings* is an artistic creation that announces – and performs – new forms of making, so to give space to other human beings to stop for some minutes and reflect on alternative possibilities for the present and the future to come. Seen from this point of view, this case study is a piece where the transformation from a world of clear separations and hierarchies among species is deconstructed on more than one level (interactive, technical, performative). *Of Hybrids and Strings* welcomes the spectators, invites them to enter the virtual world, and to immerse themselves in the slowness of objects interacting: the main aim is to create a safe space for the elucubration of alternative ways of being on planet Earth. Such sense of “welcoming emptiness” is reached with a bodily relation with the technological instrument, that is IVR. In addition to being critical of the current way to enter in relation with nature, Moffatt gives humans the chance to isolate themselves from the rules of contemporary society and discover what is beyond the conventional positioning of humans above all things. Not only does it give the spectator the opportunity to engage with the world in a way that is removed from the ordinary – from the point of view of a “crazy” female author – but it also gives the spectator the effective possibility of experimenting new bonds in the immersive experience. *Of Hybrids and Strings* is an example of Green IVR that succeeds at creating a specific space to experiment and train our posthuman imagination, where the user is invited to criticise their usual position in the world while adding layers of experimentation of alternative worldmaking interactions. In this way, this artwork goes against the hegemonic order of things, and it does so mainly at two different levels. The first is related to the medium, which is employed in a way that goes against the hegemonic use of VR. In contrast to the traditional perception of the medium, Moffatt engaged with it by working in the opposite direction. She

tried to accomplish the creation of an alternative world where the power dynamics at the stemming core of the (re)production of a reality of distrust, competition, and discouragement are deprived from their traditional centrality and are substituted with slowness, calmness, and the emptiness necessary to build the abilities to produce desirable futures. The second one pertains the way the virtual environment encourages the deconstruction and the research for innovative interactions with all kinds of human and non-human intelligences. By using the escamotage of looking at the forest from the point of view of Suzanne B. Clair, she forces the spectators to put themselves in decentralised positions, and to live for some minutes into the shoes of a person that in the real world is just the “crazy woman” relegated to the secondary role in a science fiction novel. It is by entering this parallel world full of entangled entities that the spectator leaves for a moment the reality of individualist society and spends time with virtual entities so to train themselves “to become entangled in each other’s lives,” “to need each other in diverse, passionate, corporeal, meaningful way”⁴¹. Surprisingly, it is by feeling a sense of embodiment, of presence and by taking perspectives different from their own – the three basic features identified by research reported in the first section of this paper – that the human user effectively makes experience of an entangled world and enters the realm of possible transformation in their everyday life.

Conclusion

This paper reports some of the results of a two-year long research that aimed at understanding the transformational role of Green IVR experiences designed by artists within environmental literacy. Departing from the belief that Immersive Virtual Reality offers unprecedented levels of psychological presence, immersivity and interaction, this research wanted to understand in a speculative

41 D. Haraway, *Staying with the Trouble*: 72.

way what kind of individual or collective transformation Green IVR can ignite in users.

To do so, I proceeded as it follows. In the first part, I offered a view of the features and applications for Immersive Virtual Reality and provided a definition of Green Media. As a second step, I introduced the concept of posthuman imagination, a speculative form of imagining activity aimed at interrogating and challenging our perceptions and behaviours towards the world, other species, and ourselves by augmenting reality through layers of digital mediation. Based on the conviction that imagination cannot be considered as a fixed concept but that is an always shifting notion that might be influenced by technologies available, posthuman imagination is characterized by its co-shaping, mediation, and exercise by digital technologies, which play a central role in modifying our worldview. After this, I proposed an analytical methodology combining Norman Fairclough's Critical Discourse Analysis and Lars Elleström's framework for the analysis of media. With this analytical structure, I took into consideration Lauren Moffatt's *Of Hybrid and Strings*. Rooted in speculative fabulation and worlding practices, this immersive experience challenges traditional power dynamics and encourages alternative modes of being. By immersing users in multi-sensory environments that provoke imagination and reflection, this piece of Green IVR offers a space to envision a pathway towards more sustainable futures. Crucially, the peculiar choice to decelerate the virtual world serves as a counterpoint to contemporary agitated lifestyles, fostering contemplation and alternative narratives emerging within the collaboration between species and reverence for the natural world. Through intermedial connections and layered meanings, these experience challenges conventional modes of thought and invite participants to explore new perspectives. Green IVR experiences of this kind represent a convergence of technological innovation, educational imperatives, and artistic expression, offering a tangible and testable manifestation of posthuman imagination. As we confront the complexities of climate change and

ecological degradation, it is crucial that we harness the transformative potential of these immersive technologies to cultivate environmental literacy and inspire collective transformative action towards a more sustainable and equitable future for all species.

AN-ICONOLOGY

History, Theory, and Practices of Environmental Images



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AN-ICON has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme. Grant agreement No. 834033 AN-ICON.
The project is hosted by the Department of Philosophy "Piero Martinetti" – Department of Excellence at the State University of Milan.