

Inhabited stories: An enactive media archaeology of virtual reality storytelling

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Abstract

What makes a story designed for (and experienced via) real or imaginary VR systems so different from other stories and storyworlds? Through an enactivist perspective on media archaeology, I will address the issue by discussing the notion of virtual reality storytelling (VRS) as the art of crafting ‘inhabited stories’ and a discursive frame where VR narrativity has been articulated. In fact, narratives *of* and *for* VR identify a recurring discourse, or ‘topos’, that circulated from medium to medium during Western media history. After discussing theoretical notions such as that of ‘virtual reality’, ‘storyworld’, and ‘presence’, I will address the historical and cognitive relationship between VR space design and narrative of environmental storytelling by exploring different examples from peep media tradition, gaming, and VR cinema. Second, I will propose a media archaeology of ‘human enhancement’, a recursive topos in real and imaginary VR and haptic technologies. In doing so, I will highlight some recurring narrative strategies at the basis of VRS: the illusion of non-narration, i.e. the ability to direct the story-making activity of the virtual user without his/her awareness; the craftsmanship of paths of ‘attentional matching’ made of haptic responses and spatialised stories; and the design of new senses which can disclose enhanced processes of world- and story-making.

Keywords: virtual reality, enactivism, environmental storytelling, presence, media archaeology

Introduction: What is a 'virtual reality'?

In defining the ideal intermingling between theatre and life, in 1938 Antonin Artaud pioneered the term 'réalité virtuelle'. In a series of crucial passages for the history of Western theatre, Artaud evoked a dismantling of the bourgeois representational stage in favour of a 360-degree scene where the spectator – who was 'seated at the center of the action' in special 'swivelling chairs' – would have been 'encircled and furrowed by it'.^[1] For the French author, these and other implementations would have enabled the theatre to express its 'truly illusive nature' as a medium of 'virtual reality' (henceforth VR). Artaud's was a first Promethean theorisation of VR in the modern age which has recurred, with various heydays and waves, during the 19th and 20th centuries up to the recent VR craze of the 2010s.^[2]

Still today, VR is a compelling notion. As a technology, a VR system is a device whose design goal is to create the experience of feeling present within a technologically-mediated 3D artificial world (with different degrees of immersion and interaction).^[3] For media theory, a 'virtual reality' is not only VR-based media, but every world or 'space of possibilities' activated by a screen-based experience (such as that of 'peeping', 'moviegoing', and 'gaming'),^[4] whereas in contemporary popular jargon 'virtual realities' (such as that of the internet and social media) are synonymous with 'fictional' or 'artificial' experiences, often associated with a form of individual withdrawal from *real* reality. Moreover, the oxymoron of VR provided scaffolding for a metaphorical conceptualisation concerning mind/body, reality/simulation, and human/machine dualisms.^[5] Finally, VR interfaces, headsets, and gloves are recurring 'imaginary media' in sci-fi narratives, while in the last 40 decades real VR systems spawned in the field of aerospace, art, and the entertainment industry are demanding new approaches and understandings.^[6]

In particular narratives *of* and *for* VR became objects of research both for media theorists and tech-designers, since the notions of 'immersion' and 'presence' represent both phenomenological states *and* technical goals. But what makes the immersive nature of the stories so different from other narrative experiences like reading a book, watching a movie, or attending a theatrical show? Can we still talk about storytelling in a VR world, and if so what kind of stories are told? What is the medium specificity and design goals? And to what kind of fantasies and discourses do they relate to?

Inhabiting a story: A definition of VR storytelling

Storytelling is the process of extracting and telling stories from the world. Traditional narratology uses the term 'tellability' to highlight the variable potential of a story or what makes a story worth telling, while 'narrativity' refers to the way tellable events are told and, as an adjectival noun, to a felt quality that may emerge with different degrees in a reader's experience.[7] As in the contemporary transmedia domain users are identified as 'wreaders' or 'prosumers',[8] stories spread across media platforms, assuming the status of proper 'worlds'. From early conceptualisation of 'fictional' and 'possible worlds' in the domain of analytical philosophy and literary theory, with the complexified inclination toward new forms of spatiality and environmental mediation in the contemporary mediascape, scholars are more inclined to address the topic of narrativity as a shared 'space' or 'architecture' for the emergence of possible stories rather than a cause-effect series of events inscribed or ascribed to a text.[9] In this sense, Henry Jenkins' idea of 'environmental storytelling' has set the tone both in contemporary transmedia and game studies. In a multidisciplinary framework, Jenkins argues that space design is directly functional to the organisation of a narrative plot and to the extension of narratives across media. Accordingly, this spatialisation of stories could produce environments where narrative experiences are (i) *enacted* from the user's interaction, manipulation, and traversal into such a worlds (choosing a spatial path, for instance, might instantiate a new storyline); (ii) *embedded* within the constitutive elements of the worlds' mise-en-scene (like secret doors, backstory events, evidences, etc.); and (iii) *emergent*, as unstructured plots would arise in proportion to the space of possibilities left open by the media design (as it happens in the open-world rpg or sandbox games).

The emphasis on these three verbs (*enacted*, *embedded*, and *emergent*) would highlight Jenkins' alleged connection with the '4 Es' (minus one) underpinning the *enactivist* paradigm,[10] and whose theoretical diffusion in cognitive narratology helped in alleviating the ludologist vs. narratologist debate precisely around the idea of 'stoyworld'. [11] 'Storyworld', in such an enactive narratological perspective, is the term I will use in describing a 'distributed construct' co-determined by a media *apparatus* of events, characters, settings, and procedures, and the intersubjective meaning-making processes generated by its reception/enaction by the users.[12] This is particularly evident in the transmedia and gaming experience, as a narrative world arises from the 'duet' between the user's performative intervention in taking control of the story and an interactively designed text or platform, which redistribute narrative rules and routes accordingly.[13]

In this context, David Herman aptly differentiates between ‘worlding the story’ and ‘storying the world’ to underline the divergence between interpreting (and optionally exploring) a story as a fictional world, and the ability to employ narrative tools and strategies for the exploration of the actual world. As ‘places’ are narrative constructions built *over* a ‘space’, and stories are cognitive tools for enacting these narrative constructions, the author distinguishes between multimodal ‘exophoric storytelling’ or *place making*, when storytellers use pointing and gestures to refer to elements of the current scene of interaction by narrating the story of the space *on-site*; and ‘endophoric storytelling’ or *space making*, when the teller indicates an *off-site* storyworld, and the interpreters must relocate themselves to an alternative set of spacetime coordinates.[14] According to Herman, ‘narratives can be thought of as prostheses for performance, emulations of lived experiences, and narrative worldmaking as the coenactment of real or imagined *Umwelten* carved out of larger environments for action and interaction’.[15]

If in VR art history these processes of spatial storytelling are linked to the design of an ‘illusionary visual space’,[16] nonetheless this relation is not bi-unique: designing a world does not mean to design a VR story. On this subject, Matuszkiewicz & Weidle propose to distinguish between *inherent* and *ascribed* narrativity to highlight the difference between *being* narrative and *producing* a narrative. Accordingly, if storytelling is certainly an inherent sense-making activity, then narrativity should be redefined as a perspective on non-narrative media rather than a pre-existing quality of media.[17] To bypass the narrative/non-narrative dualism, they introduce the concept of ‘virtual fictionality’ as the ‘space of possibilities’ or the ‘worldliness’ of a responsive environment with specific agent-centred traits that characterise VR worlds.[18] Similarly, Eugeni embraces a definition of VR system as a ‘self-centred world’, enlarging the scale of such a world to any visual media that produce a sense of presence. In particular, the author distinguishes between proper VR systems (*Radical immersive media*) and augmented reality interfaces or screen-based videogames (*Bystanding-immersive media*) in regards to the different enunciative configurations and degrees of interaction employed to perform the user’s sense of immersion.[19] In this sense, as Modena & Parisi pointed out, stories become ‘expedients for entering in fictional worlds’ (whether interactive or not) which could not only sustain but aptly *enhance* states of flow and presence.[20]

These studies rely on the assumption that media are capable to modulate or enhance the sense of presence by crafting artificial spaces, and to do so their inherent or ascribed *storylikeness* plays a key role. In a nutshell, narrative worlds crucially rely upon their geographies and every spatial choice, so to say, has ‘narratological’ consequences. Therefore, addressing the notion of presence is crucial for anyone who aims to explore the relationship

between technical space design and narrative place and space-making in immersive systems; and for the purpose of this essay it would provide a first theoretical grounding for articulating an extensive definition of VRS.[21]

As for the case of 'storytelling', the concept of presence describes a wide range of mental phenomena. In the context of presence studies scholars, they refer to 'inner presence' to identify a generalised psychological state functional to the control of individual and social activities. They also rely on 'media presence' to distinguish the perceptual illusion of non-mediation generated by the use of media and simulation technologies.[22] In both views, the in-the-moment coupling between the user's body-mind and the surrounding world is recognised as the 'primary device' for the emergence of presence. Cognitive psychology, in particular, defines presence as the neuropsychological phenomenon evolved from our bio-cultural inheritance, whose goal is the control of agency and social interaction through the unconscious separation of both 'internal' and 'external', 'self' and 'other'. [23] Accordingly, elsewhere I defined 'presence media' as the ensemble of devices whose design goal is to mediate the state of human inner/media presence, and 'fields of presence' as the distributed enactive system which stemmed from the cognitive coupling between users' states and technical design goals.[24]

With his psycholinguistic background, Richard Gerrig was one of the first to interlink the construction of a 'narrative world' with the human sense of presence. Notably, he introduced the spatial metaphor of 'being transported' in understanding the sense of immersion of readers into the 'narrative world' of a book, emphasising the transmedia potential of the concept.[25] Gerrig, and later Kim & Biocca relating on television experience, also introduced a distinction between 'arrival' and 'departure', i.e. between the subjective feeling of being transported or re-located in a virtual/distal world and that of experiencing such a world only as something 'seen' at a distance.[26] It follows, for some, that a full *arrival* could arise only when a strong, transparent, and in-the-moment sensorimotor feedback loop between the user and the mediated environment is built, or what Andy Clark (by recalling an informatics jargon) defines an 'inhabited interaction'. [27]

Otherwise, scholars in cinema and media studies assert that presence is also related to the cognitive schema of 'environmental exploration', which could be activated even without an *actual* interaction with screen-based media.[28] Accordingly, the term 'social presence' helps in identifying the extent to which a mediated experience 'is perceived as sociable, warm, sensitive, personal or intimate when it is used to interact with other people'. [29] This recognition is pre-reflexive, predictive, and aims to produce communicative immediacy and

intimacy by generating in the subject an internal simulation of others' intentionality, thus providing more possibilities for the arrival and the immersion in a virtual/distal world.

Between the two positions, Marie-Laure Ryan remarks how, in order to be immersive, a VR world 'must construct the setting for a potential narrative action' which provides the foundational environment for the emergence of the user's sense of presence (be it a reader, a spectator, or a video gamer).[30] In the context of my research, I assume that dynamics of inner, media, and social presence in the VR experience depends both on the design of a self-centred artificial world (its 'virtual fictionality') as well as on the levels of presence activated by the user's story and place-making activity. However, to transform an explorable space in an intimate narrative place, media designers seem to rely upon the world's enacted, embedded, emergent, and sometimes 'enhancing' narrativity, without strictly implying interactivity.

Therefore, virtual reality storytelling could primarily be described as the art of crafting 'inhabited stories' that convert a surrogate self-centred virtual world into an intimate experience of storyworlding (from worlding the story to storying the world). To do so, VR designers share some recurring narrative strategies and settings. Accordingly, I also think of VRS as a place of trans-historical circulation of cultural fantasies and narratives whose genealogies can be traced back before the advent of interactive and digital technology which properly sustain the VR technology. I refer in particular to those presence media which, like the VR head-mounted systems, tend to physically encircle the spectator's eyesight, to blur the edge of the visual frame, and to involve all the senses. Following these assumptions, I will propose a media archaeology of two cultural discourses or 'topoi' which intermittently resurface the history of VRS: the first one regarding the *topos* of 'narrative exploration', the second one that of 'human enhancement'. If these two axes relate to specific epochs and technological traditions they are transpecific, as they recur in different media (cinema, television, literature, videogames, installation art), genres (sci-fi, adventure, fantasy, memoirs), and contexts (aerospace industry, pop culture, contemporary art).[31] Moreover, by adopting a cognitive perspective, my inquiry would provide evidence of recurring enactive strategies at the basis of VRS, including the 'illusion of non-narration', the design of 'attentional paths', and the seeking of 'new sensory' experiences.

The VRS of narrative exploration

Narratives regarding virtual voyaging into distal and exotic worlds persist in many early optical media. Specifically, in those which exclude the edge of the visual frame and rely on the binocular and multimodal dimension of human perception. As Huhtamo points out, VR

principles could be associated with the peep media tradition. His concept of 'peep media' refers to all media devices that interface with their user via 'peering into a hole, a lens, a hood' as an individual, private activity.[32] By displaying the Renaissance's inspired 'perspective views', for Huhtamo early peep media such as the peep box was a 'virtual voyaging medium', providing the peepers opportunities to 'visit' locations and events that most people could not have witnessed on site during their entire lifetimes.[33]

It appears that many pre-cinematic peep media were specifically designed to produce effects of arrival and place-making by leveraging the narrativity of voyage. Since the mid 18th century the contents of peeping boxes such as *Boite d'optique* in France, *Rerekiek* in Netherlands, *Guckkasten* in Germany, and *Mondo Nuovo* in Italy – along with early mobile peeping media such as the Zograscope (an optical lens-based device for magnifying flat pictures by enhancing their sense of depths) – regards the depiction of metropolises, landmarks, and faraway lands. 'In their virtual reality mode', Erin Blake argues, 'zograscope views provide what de Certeau would consider a maplike *sense of place* as the viewer's experience was like going on "tour" within the picture.'[34] According to Sandro Bernardi, typical of the Italian *Mondo Nuovo* were views that recounted real events (like the beheading of Marie Antoinette and other facts of the French Revolution): a sort of news bulletin by images where an off-site storyteller illustrates to the audience the events narrated on-site by the images.[35] Though lacking in realism and interaction, these early peep media combined highly-perspective landscapes with forms of placemaking to achieve a sense of immersion and inhabitance.

Following the advent of photography and the new possibilities disclosed by the Stereoscope in the early 19th century, the physician Oliver Wendell Holmes designed a specific type of handled stereoscope which became popular in the United States.[36] In one of his Promethean essays in *The Atlantic Monthly*, Holmes focuses on a particular stereograph depicting the ruins of Alloway Auld Kirk (Fig. 1).



Fig. 1: A stereocard depicting the Alloway Auld Kirk (anonymous, 19th century) from the Edward Jackson Holmes Collection of the Museum of Fine Arts Boston.

This distinctness of the lesser details of a building or a landscape often gives us incidental truths which interest us more than the central object of the picture. Here is Alloway Kirk, in the churchyard of which you may read a real story by the side of the ruin that tells of more romantic fiction. There stands the stone 'Erected by James Russell, seedsman, Ayr, in memory of his children,' — three little boys, James, and Thomas, and John, all snatched away from him in the space of three successive summer-days, and lying under the matted grass in the shadow of the old witch-haunted walls. It was Burns's Alloway Kirk we paid for, and we find we have bought a share in the griefs of James Russell, seedsman; for is not the stone that tells this blinding sorrow of real life the true centre of the picture, and not the roofless pile which reminds us of an idle legend? We have often found these incidental glimpses of life and death running away with us from the main object the picture was meant to delineate.[37]

The 'incidental truths' evoked by Holmes identifies the place-making activity revealed by reading the detailed epitaph shown in the foreground of the Alloway Kirk, which poses an embedded (to recall Jenkins) narrative path for the peeper to make sense of the stereographic space. However, Holmes' reported attitude of 'running away' from the main object of the pictures also signals the frustration of the stereoscopic viewer in not being able to fully inhabit the picture and its storyworld. This gap between the inhabitability given by adding textual tales on the 3D picture and the actual un-explorability caused by the lack of locomotion and manipulation in the fictional world was allegedly bridged during the 1850-1870s Western craze of mounted stereoscopic photographs. Charles Wheatstone, creator of the first model of stereoscope in 1838, also invented the Stereophantoscope, which replaced the stereoscopic slides with images animated by a Zoetrope; while in 1867 Gaetano Bonelli and Henry Cook presented an analogous optical device called Photobioscope, consisting of a stereoscopic viewer, whose left and right lenses are alternately obscured by a shutter, while a moving disk with images was driven by the viewer with a crank.[38]

Although these were pre-digital efforts, the issue of turning the still vision into an explorable 'panorama' was solved only by the introduction of the VR head-mounted display in the latter half of the 20th century. If, recalling Huhtamo, 'the head-mounted display is, after all, a new kind of interactive stereoscope', [39] it nonetheless resurrects and upgrades these pre-digital desires and designs for a presentification of spaces via the metaphor of narrative exploration. The advancement in the miniaturisation of electronic circuits during the Cold War era led the basis for the development of (at the time) sophisticated portable tele-visors and VR systems whose design goal was to transform the storyworld of peep media into something where you feel intimately present.[40]

With his transdisciplinary background, Morton L. Heilig is a key figure of the period.[41] Heilig's design of the Sensorama Simulator (1962, patented with the goal to '*stimulate* the senses of an individual to *simulate* an actual experience realistically'), and the Telesphere Mask (1960, under the subtitle of 'stereoscopic television apparatus for individual use') could be considered one of the first examples of electronic VR environments and head-mounted displays. For Heilig, if the 'cinematic mind' must merge a series of frames to create the illusion of motion, his VR systems aimed to immerse the user in an environment where all the senses are involved. Due also to his background as a filmmaker, Heilig's 'Proposal to build an "experience theatre"' can be identified as a fascinating example of a 'VR script':

The sound of a subway train grows louder, the seat and arm rests begin to vibrate, and the bright area grows rapidly larger – larger and larger – until as the train bursts through the mouth of the tunnel the audience is totally engulfed in an overwhelming three-dimensional image with wind conveying the scents of the city blowing through their hair. The excitement of this opening will be heightened further as the spectators are taken on an extraordinary 3-1/2 minute high speed ride across the United States – on the ground and in the air by train, car, hydroplane, helicopter and high speed jet. The viewer would get a thrill packed impression that no human has ever experienced before.[42]

This American visionary designer also devoted one of his early theoretical essays on 'the cinema of the future', focusing on the film editing techniques that could have been employed to 'master the attention' of the '3-D worlds' visitors of the future.[43] Heilig's view was particularly anticipatory, since early-cinematic 'headscratchers' such as camera movement, lighting, sound capture, 2D versus 3D, 'attraction' versus 'narration' has resurrected in today's VR cinema along with new storytelling issues regarding the mastering of the spectator's attention.[44]

Without being as interactive as a videogame, today VR films have the advantage of scenes looking completely real, relying on the VRS features previously discussed: first-person and highly-perspective views (like in the peep media tradition), and overlays of text-based interfaces (like in the Alloway Kirk stereoview). Moreover, through the employment of spatial sound microphones interlinked with systems of gaze detection, cinematic VR aims to trigger stories by dynamically reacting to the way users enact a virtual world. Michael Gödde and colleagues discuss the pivotal importance in VR cinema of placing ‘diegetic attentional cues’ by referring to the strategy of guiding the viewers’ attention to the relevant story elements without forcing his/her freedom to explore the virtual world. Along with faces, motion, sound, and vanishing points, they remark how

the story itself can affect the expectations of the viewer and thus also his gaze [and] if there is anticipation that something is about to occur with a certain scene element, then it will most likely attract and keep the viewer’s attention. By arousing and/or delaying expectations, context-related cues can create suspense.[45]

Rather than story-tellers, today’s VR directors are more akin to be ‘story-placers’, for they reason about the density of story elements that are embedded in the space of a scene and, simultaneously, they work in designing patterns of place making that direct the visitor’s attention. As VR director Jessica Brillhart aptly expresses, as a film editor proceeds ‘frame-by-frame’, VR filmmakers would go ‘world-by-world’, using a ‘spherical’ screenplay strategy which she labelled ‘unlocking the Hero’s Journey’.[46] As Brillhart argues,

I had to create a new visual in order to grasp what I was really trying to accomplish. Something that was more reflective of the spatial reality of the medium, more apt to its multi-verse tendencies where every path exists simultaneously.[47]

By echoing Walter Murch’s editing theory, Brillhart’s technique consists in shooting and lining up potential in-points (where a visitor’s experience is most likely to begin) and out-points (where it is most likely to end).[48] If at the core of VR cinema is the ability to create points of interest that solicit the attention of the visitor, the goal of its storytelling seems to reach a compelling balance between attentional matching and free explorative paths. Or, to recall Aylett & Louchard’s ‘narrative paradox’, to combine top-down design goals with the user’s explorative freedom.[49] Arguably, all these hints would suggest that in VRS the maximum of narrativity might correspond to a minimum of narrative awareness. Tjostheim & Waterworth have recently addressed the topic of telepresence (being there) in the context of tourism studies.[50] Considering the mental setting disposed both by physical and ‘digital travelling’ (consisting in pre-departure expectations, a relocation of the self in another

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space-time and, of course, of an arrival, a passage, and a return) the authors highlight the role of the metaphor of journey in VR environments in eliciting the user's placemaking:

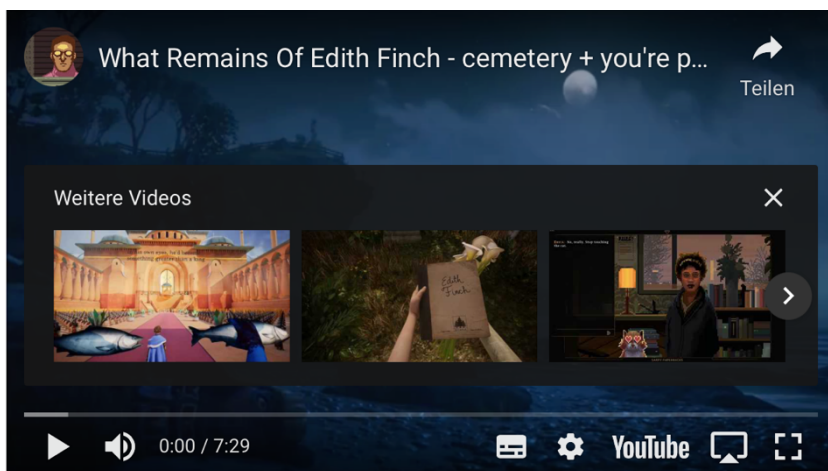
Tourism is, for good reasons, of interest to telepresence research because [...] the 'there' in *being there* (a characterization of telepresence) can be a tourist destination; some gamers visit and explore a game space in a manner similar to tourists exploring a physical space.[51]

Together with peep and film culture, in fact, the topic of narrative exploration has also found fertile ground in the history of game design. As a 'remediation' of game-book or fantasy role-play games such as *Dungeons & Dragons* (1974-ongoing), first experiments in text and graphic adventure videogames like *Colossal Cave Adventure* (1976), *Mystery House* (1980), and *Myst* (1993) set the foundation for a game logic which became staples for future ergodic storytelling and adventure game design which are all based on the narrative of exploration.[52] By employing the first-person perspective so to reproduce the dynamics of human visual perception, the contemporary walking simulator (also known as 'environmental narrative game') differs from the concurrent genre of the first-person shooter as it is explicitly designed to create compelling immersive experience based on exploration mechanics and shifts of attention.[53]

An example of this kind is *What Remains of Edith Finch* (Giant Sparrow, 2017), where you play different narrative-selves as you get access to the multiple rooms and stories nested in Edith's family house. Its game logic offers an updated example of Jenkins' 'embedded narrative' as, by returning to the author, the 'game space becomes a memory palace whose contents must be deciphered as the player tries to reconstruct the plot'.[54] The player, in fact, is 'environmentally' guided towards an abandoned country house and follows the 'storyline' which appears as a text superimposed on walls, furniture, and corridors of the family house. Echoing the experience described by Holmes, the Finch house is full of epitaphs and memoirs of dead relatives who formerly lived (and died) in that place. Instead of 'escaping' from the picture, the gamer progressively inhabits its storyworld thanks to a compelling combination of exophoric oral and text-based narration, and a truly enactive exploration of a self-centred world which produces sense of arrival and emotional attuning (Fig. 2).

Even though it was not specifically designed for VR systems, this game genre inherited the peep media tradition of crafting a highly-perspectival self-catered world along with the employment of multimodal place-making narratives with the aim of creating truly inhabited stories. Moreover, the act of space making is functional to that of place making, whereas stories (embedded or emergent in the fictional world) became affordances for enaction. As Herman would emphasise, such a walking simulator would 'recruit elements from the

current environment and use them to help interlocutors compute places, [...] and distributing the cognitive burden of cognitive place making across as many components of the material setting as possible'.[55] The Edith house walls, not by chance, are full of portraits and family photos, assuming a 'melodramatic' role that, in the words of Jenkins, helps the gamer to 'inhabit a space where every artifact recalls her predecessors'.[56] In this sense, *Edith Finch*'s VRS seems also to embody sociolinguistics insight by Barbara Johnstone, as 'coming to know a place means coming to know its stories: new cities and neighbourhoods do not resonate the way familiar ones do until they have stories to tell'.[57]



<https://youtu.be/hj0yx35FlnY>

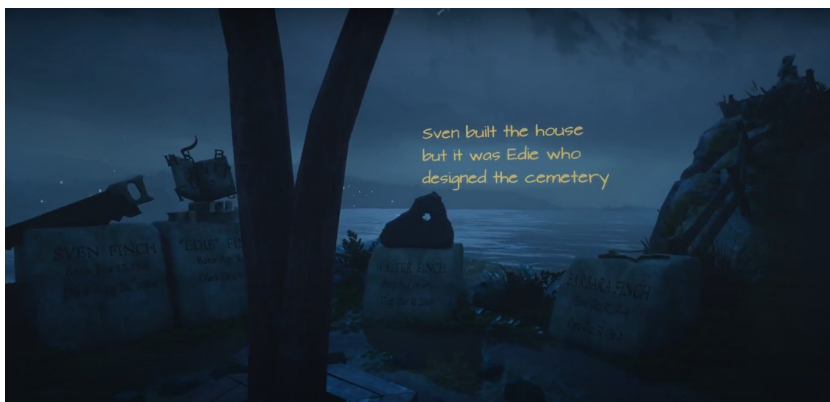


Fig. 2: A gameplay scene from *What Remains of Edith Finch* (2017). While you are visiting the family's cemetery nearby Edith's house, stories about the place and its past inhabitants 'float' on the graves, thus enacting further narrative explorations.

In the 2010s, with the rise of consumer VR systems such as Oculus, *Edith Finch* and other simulators became adaptable (or have been converted) for VR experiences. In 2014 the Google Cardboard project tried to popularise a 'new' peep media made of a fold-out cardboard viewer, while the first Oculus Gear-VR promised to 'transport users to immersive, 360-degree 3D worlds where they [the users] can game, learn, explore, and experience virtual reality like never before'.^[58] In the aftermath of the acquisition of Oculus VR by his company, Facebook (now Meta) CEO Mark Zuckerberg aptly expressed the social (and economic) implication of the convergence between VR and storymaking that would guide the following decade:

This is really a new communication platform. By feeling truly present, you can share unbounded spaces and experiences with the people in your life. Imagine sharing not just moments with your friends online, but entire *experiences and adventures*.^[59]

As 'media presence' refers to the illusion of non-mediation, the genealogy of narrative exploration discussed so far provides hints for an analogous concept that seems at the core of diverse early and contemporary VRS. I term this phenomenon the 'illusion of non-narration', as the media ability to generate a VR narrative where the user, equipped with the traveller's mindset, pretends to experience a free exploratory journey without following any pre-ordered narrative route. Arguably, as the 'being there' of VR travel is often short and volatile due to digital glitches, power outages, or other distractions from the actual world,^[60] the 'illusion of non-narration' could help to rewire the user in the virtual fictionality of its journey. Moreover, if the 'mind' of the traveller is what facilitates the VR user to storying the world (i.e., to make sense of the virtual environment through an arrival-passage-return cognitive schema), a virtual storyworld designed around the idea of narrative exploration (such as the peep media cases discussed so far) could certainly foster the user's immersive presence and worlding of the story. Therefore, ludo-immersive experiences such as that of VR cinema or walking simulators, if enriched with explorative/tourist expectations and narrativity, could elicit an 'illusion of non-narration' which is functional to the emergence of media presence and its endurance.

The VRS of enhancement

At the turn of the new millenium, Hollywood's sci-fi and cyberpunk-inspired films such as *Tron* (1982), *Brainstorm* (1983), *Videodrome* (1983), *Total Recall* (1990), *The Lawnmower Man* (1992), *Johnny Mnemonic* (1995), *Strange Days* (1995), *The Matrix* (1998), *eXistenZ*

(1999), along with the Italian *Nirvana* (1997) – just to name a few iconic ones – remediated the tales of VR in different genres and imaginary media.[61] Around 2000, according to Sconce, ‘Hollywood’s current tales of virtual reality come alive and run amok [as] American culture remains intrigued by the capacity of electronic media to create seemingly sovereign yet displaced, absent, and parallel worlds’.[62] More specifically, well before the spring of the Spiritualist movement of the mid-19th century, we could trace the genealogy of this motif also in the ‘conflictual’ community of European hypnotist and somnambulist performers which, analogously, came under intense scientific scrutiny for its alleged capacity of extension and manipulation of the mind and senses.[63] The Mesmerist movement of the 19th century first, and the mentalist tradition later, provided an imaginary background for cultural narratives regarding telekinesis, body transcendence, clairvoyance, telepathy, ‘esp’ (extasensory perception), and other forms of ‘mind empowerment’ which proceeded in strict relation with the advent of presence media[64] and, as I will outline, found their most recent outcome in the VRS of ‘human enhancement’.

In the narrative universe of *Brainstorm*, a prototypical corporate head-mounted device called the Hat allows the user to record and revive the experience of him/her-self and the others. In addition to experiencing electronic *vue d’optique* (like in the modern tradition of ‘armchair travel’ where the audience could enjoy a ‘virtual’ trip on the rollercoaster), in a key scene the protagonist Michael (Christopher Walken) witnesses a disembodied ‘near-death experience’. In fact, his colleague Lillian (Louise Fletcher) who suffers a heart attack while working alone, decides to record her experience into the Hat a few seconds before dying. Soon after, Michael chooses to experience Lillian’s recording by wearing the device. Michael not only sees short memory sequences from Lillian’s past (inducing a sense of arrival in him) but he feels a painful sensation of departure when her (then his) body simulates the heart attack. After disabling the bodily feedback from his Hat, Michael replays the scene until he faces an inconceivable disembodied experience while the ‘soul’ of her colleague flies away watching her dead body from above.

In *The Lawnmower Man*, Jobe Smith (Jeff Fahey) is an intellectually disabled greenskeeper who succeeds in filling his cognitive gap through a VR-based treatment developed by Dr. Angelo (Pierce Brosnan) for aerospace and warfare purposes. By wearing a head-mounted viewer and a pair of gloves, the imaginary device allows an active manipulation of human neural architecture that enhances Jobe’s intelligence and eventually gives him psychokinetic and telepathic powers which dematerialise him as a being of ‘pure energy’. In *ExistenZ*, *Total Recall*, and *The Matrix* people are neurologically connected to a VR system that plunges them into a seemingly ‘open’ virtual world where they can play different roles and narratives of themselves.[65] In particular, once within the simulated world of the Matrix users can

master particular top-quality skills by directly downloading data from a digital database. In doing so, the film – directly inspired by William Gibson's cyberpunk novel *Neuromancer* (1984) – embodies the fantasy of being able to elude the normal time of learning a determined notion or practice. Moreover, the Matrix experience leads the protagonist Neo (Keanu Reeves) to discover superhuman powers like flying, telekinesis, super strength, and extrasensory perception.[66]

If these films were also inspired by the actual relation between communication technology and aerospace industries in the field of teleoperation during the Cold War era, the video game industries leveraged the VR topos of 'sensory enhancement' by investing in new gaming controllers based on the peep media tradition. Sega's *3-D Glasses* (1987), Nintendo's *Power Glove* (1989), and *Virtual Boy* (1995) are among the best known examples. If Nintendo's *Virtual Boy* was designed as an advanced form of Holmes' stereoscope and promoted in the wake of the success of *The Lawnmower Man*, the technology behind the Power Glove was an adaptation of the 'DataGlove', a teleoperation technology patented a few years earlier by VPL Research for NASA.[67] Utilising two ultrasonic transmitters installed in the glove and three receivers placed around the television monitor, the Glove captures the yaw and roll of the hand, allowing the user to 'manipulate' what happens on the screen like the VR device imagined in *The Lawnmower Man* – or it would have done so. In fact, the Power Glove disappointed due to its manufacturing limits. Nonetheless, it succeeded in extending the topos of human enhancement via VR in film and popular culture. The Power Glove was in fact prominently marketed in two juvenile cult movies of the time: *The Wizard* (Holland, 1989) and *Freddy's Dead: The Final Nightmare* (Talalay, 1991), and it has recently reappeared in *8 Bit Christmas* (Dowse, 2021). In *The Wizard* the Power Glove was presented as modern wizardry used by the antagonist to show the improvements of his gaming skills through the new technology. 'I love the Power Glove. It's so bad!', the young Lucas (Jackey Vinson) exclaims while driving a sports car on the screen by handling an immaterial steering wheel. In *Freddy's Dead*, Freddy Kruger (Robert Englund) uses a 'powergloved' version of his famous clawed glove to remotely manoeuvre the body of one of his young victims in a gaming-style nightmarish virtual environment, and eventually makes him take a deadly fall off a cliff.

These narratives find a connection with Nintendo/Mattel's visual promotion of the Power Glove, which surrounds the device with an 'enhancement allure'. In a television commercial aired during Christmas 1989, a young boy enters a post-industrial dark setting to wear the Glove in front of a giant screen, which suddenly lights up. His hand movements are replaced by that of a virtual hand on the screen, persuading young buyers that they would experience a cutting-edge 'inhabited' gaming experience (Fig. 3).



<https://youtu.be/93iDhnBcMGo>

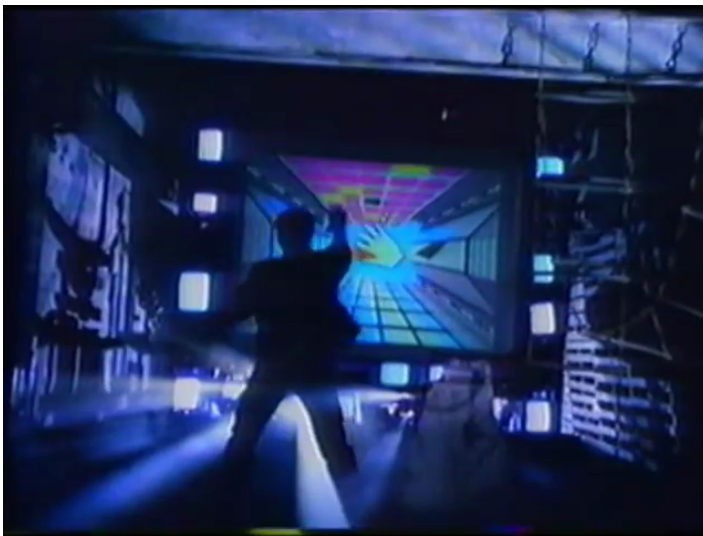


Fig. 3: The Nintendo Power Glove American television commercial of 1989.

However, such enactive promises were soon disappointed. As narrated in *8 Bit Christmas*, once kids discovered the glove as an obstacle rather than an advantage toward immersion and sensory augmentation, they were hit by strong disappointment and 'fists of rage'.^[68] After the sci-fi film tradition of the late 20th century and the Power Glove delusion, the narratives concerning human enhancement via VR returned in the 2010s thanks to the new VR craze stemming from the technical advancement developed by Palmer Luckey's Oculus Rift and its popularisation throughout the 2010s.^[69]

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In 2018, Steven Spielberg's film adaptation of Ernest Cline's novel *Ready Player One* (2011) consciously uses such a cultural cachet (and VR nostalgia) to bring on the big screen an imaginary VR system consisting of a visor, gloves, and a special suit, which allows a multisensory experience in a virtual agent-centred world called the OASIS (Ontologically Anthropocentric Sensory Immersive Simulation). The film protagonists could inhabit, as it were, several virtual storyworlds (from the pixelated one of *Minecraft* to the cinematic space of *The Shining*'s Overlook Hotel) and by inheriting their narrative logics (like competing in a virtual race game, or battling in a *Street Fighter* style game) they obtain super-human powers (such as hyper-strength and enhanced sense of vision). Notably, the inhabited experience of the virtual worlds becomes narratively enactive as the OASIS promotes a universal quest in discovering the three Easter eggs that its creator has veiled inside the simulation before dying. More than an immersive walking simulator, the state of media presence ensured by these imaginary VR media (from *Brainstorm* to *Ready Player One*) can provide a 'convincing pretence of reality', i.e. experiencing the VR world as a simulation of reality in-the-moment of its enaction (without the need of believing it is properly real).[70]

Leveraging on the same VR topos of enhancement, the near future of real VR technology seems to be oriented in designing new inhabited stories that challenge (if not utterly redesign) the human sensorium, seeking to genuinely 'augment' not only our field of vision but our intimate sense of presence. An example of this attitude in the art field is shown in Laurie Anderson and Hsin-Chien Huang's [*Chalkroom*](#) (2017). At the intersection of performance art, walking simulator, and VR cinema, in this VR installation the visitor floats as a disembodied entity around a hand-drawn universe of words and stories written in chalk on black walls. Guided by the exophoric narration of Laurie Anderson's voiceover, *Chalkroom*'s design and artistic goal aspire to elicit a sense of human disembodiment, transforming the user in a free-floating gaze surrounded by a world of stories in an immersive experience similar but not comparable to the 'way you read a book' (Fig. 4).[71]



Fig. 4: A view of *Chalkroom's* portion of virtual space. Words and stories are superimposed on the walls and interact with the user's exploration and manipulation.

In a different way, a second case of VRS oriented toward sensorial craftsmanship is in the field of the so-called 'haptic technology', whose principle consists of capturing sensory data around the user and translating them into complex patterns of vibrotactile pulses which, after a proper period of training, can reorient the user's proprioception, leading to new, subjective sensations about his/her sense of self-location, embodiment, and presence.[72] By referring in principle to the functioning of *Ready Player One's* 'haptic suit', wearable devices like Neosensory's 'Buzz', Woojer's 'Vest Edge', and (the soon to be released) 'Sentero' by Cyborg Nest are charting one of the most prolific horizons for disclosing new perspectives on environmental storytelling and sense enhancement. Sentero is a bracelet which will send vibratory stimuli to the user once he/she faces the magnetic north or other specific targets in the real world. Relying on the brain's neuroplasticity, the user will permanently sense where specific points/persons of interest are in the world by creating a 'neural point of reference' with the Magnetic North and other targeted entities. Accordingly, in the mind of its designers, Sentero will provide an enhanced permanent sense of orientation and social connectivity which might 'unleash our brains potential to think, explore and create with limitless possibilities' (Fig. 5).[73] If so, Sentero and other haptic technologies arguably make it possible to reach the status of 'hyperpresence', a concept so far postulated in presence studies to imagine the capacity of an immersive medium to 'create a greater intimacy than face-to-face communication'.[74]



<https://www.youtube.com/watch?v=KVVJCP1q37Y&feature=youtu.be>

Fig. 5: Introducing Sentero and haptic technology by CyborgNest (2020)

Linking the strategies of attention matching exposed by Jessica Brillhart in her VR cinema with the enhanced sensing possibilities offered by haptic technology, new ways of environmental storytelling could be disclosed. Will the future of VRS be to craft hyper-sensory experience within a virtual world which we occasionally peep into? Or, on the contrary, will it be to embed into the actual world ‘diegetic attentional cues’ which are specifically designed for our virtual, enhanced sensory field?

Conclusion

The goal of VRS is to build ‘inhabited stories’, i.e. a multimodal experience where users can promiscuously intermingle with the fictional world in order to transform space in place, giving cultural and emotional meaning to states of media presence, and in doing so they may increase or even enhance their sense of immersion and presence. To achieve these goals, many VR storytellers have employed and imagined innovative ways of telling stories by leveraging trans-historical topoi regarding procedures of narrative exploration and fantasies about human/sensory enhancement. I also highlighted some recurring narrative strategies at the basis of VRS: (i) the illusion of non-narration, as the ability to envelop the user within a fictional open world where he/she think to act without following any pre-ordered route; (ii) the craftsmanship of paths of ‘attentional cues’ made of images, sounds, haptic responses, and spatialised text-based stories; and (iii) the design of new senses which augment the processes of world- and story-making. In a media archaeological perspective, the topic of VRS seems to encompass a nebulous transmedia framework at the intersection of art, cinema, and video games. Concurrently, theoretical, artistic, and design topics regarding hyperpresence and haptic storymaking could inspire future research and archaeologies in the field of visual and enactive media studies.

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Notes

- [1] Artaud 1970, p. 74. For a discussion about the allegorical ambiguity of the term 'virtual reality' in the humanities see also Ryan 2015, pp. 7-8.
- [2] For other implications of Artaud's theatre theories in the conceptualisation of VR see Hillis 1999 and Ryan 2015, pp. 223-224.
- [3] See Sherman & Craig 2018 and Biggio & Dos Santos & Giuliana 2020.
- [4] See Ryan 2001; Anderson 2002; Huhtamo 2006; Liptay & Dogramaci 2016; Pinotti 2020.
- [5] See Metzinger 2018; Dalpozzo & Negri & Novaga 2018.
- [6] Gatti 2019; Arcagni 2021. For a theoretical introduction to 'imaginary media' as a media archeological tool see Kluitenberg 2006.
- [7] Abbott 2014.

- [8] See respectively Landow 1996 and Bruns 2008.
- [9] For a critical discussion about the early conceptualisation of fictional/story-world in the context of literary theory (including theories by Goodman, Doležel, Ryan, and Eco) see Ronen 2014 and, in a transdisciplinary perspective, Ryan 2015. For a brief theoretical history of the notion of ‘possible world’ and further references see also Ryan’s contribution in *The Living Handbook of Narratology* available at <https://www.lhn.uni-hamburg.de/node/54.html>.
- [10] Enactivism is a neo-cognitive theory based on the axiomatic assumption that cognition arises through the dynamic and constituent interaction between an organism and its environment. It generally refers to a cluster of concepts on cognition known as the 4Es: (i) Embodied (cognition involves bodily structure and sensorimotor process), (ii) Embedded (the environment is a constituent element of cognition); (iii) Enacted (cognition enacts a world as it implies an active transformation of things and organisms); and (iv) Extended (cognition transcends the ‘skin-and-skull’ boundaries and expands the human senses). From now on, I will use the verb ‘to enact’ and the noun ‘enaction’ according to the 4Es paradigm. For a general overview on enactivism and the 4Es paradigm see Gallagher 2017.
- [11] To confront the theories so far discussed with seminal contributions in the ‘ludologist’ context see Aarseth 1991 and Murray 1998. For a discussion of narrativity and dynamics of presence in contemporary game studies see Calleja 2011.
- [12] I draw this definition of ‘storyworld’ upon Jan-Noel Thon’s detailed theoretical reconsideration of the concept in the domain of cognitive narratology and transmedia studies (2016, pp. 35-70). In my definition of storyworld I have consciously employed the term ‘apparatus’ to pinpoint the concerted arrangements of narrative elements underpinning the recipients’ capacity to ‘fill in (or ignore) the gaps’ of narrative representation in order to co-enact a storyworld.
- [13] Here I rely on the seminal notion of ‘ergodic’ text introduced by Aarseth (1997) which, as mentioned before, paved the way for the ‘ludologist’ perspective on/of narratology.
- [14] Herman 2013, pp. 291-292. See also Herman 2011.
- [15] Herman 2013, p. 284.
- [16] See Grau 2002. Ryan (2015) proposes a nexus between VR and the ‘immersive’ quality of the 19th century novels, which she analyzes in great detail in two chapters of her book. Ryan highlights how these narratives strive to transport the reader into a ‘virtual body’ located into the scene of action (media presence) where he/she develops strong emotional ties with the characters (social presence). Alternatively, the scope of my article is to analyse similar dynamics of immersive presentification in the domain of peep and visual media.
- [17] Matuszkiewicz & Weidle 2019, pp. 7-8.
- [18] Ibid., p. 11.
- [19] Eugeni 2020, pp. 71-75.
- [20] Modena & Parisi 2021, p. 78.
- [21] For more issues and approaches regarding VR and environmental storytelling see also Jenkins 2004; Arcagni & D’Aloia 2021; Carocci & D’Aloia 2021.
- [22] See Lombard & Ditton 1997; Lombard 2015.
- [23] See Riva 2015.

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- [24] Gatti 2019, p. 210; Gatti 2021.
- [25] Gerrig 1993. For an introduction to ‘transmedia narratology’ see Ryan & Thon 2014, while for a more extensive discussion of Gerrig’s early conceptualisation of ‘narrative world’ in this same field see Thon 2016, pp. 43-44, 347n9, 348n14-15.
- [26] See Gerrig 1993; Kim & Biocca 1997. See also Thon 2014, p. 44.
- [27] Clark 2005, p. 192.
- [28] See Metz 2000; Anderson 2002; Grodal 2009; Carocci 2018.
- [29] Lombard & Ditton 1997, p. 3; Lombard 2015.
- [30] Ryan 2005, p. 9.
- [31] I draw the notion of discursive topos/topoi by Herkki Huhtamo for identifying the discursive phenomena that can reappear (consciously or unconsciously) within and across the cultural history of media systems. As Wanda Strauven has aptly noted: ‘A topos is – very literally – a place where century-old ideas manifest themselves, even if, at first sight, they might not be recognized as such because they are offered to us in a new (technologically updated) package’ (2018, p. 231). Due to space limits, my study will encompass selected media cases between the 18th and 21st centuries in the context of Western visual culture. For theories and applications which have guided the media archeological approach of this essay see, among others, Huhtamo & Parikka 2011, Parikka 2012, Elsaesser 2017.
- [32] Huhtamo, p. 142n.9.
- [33] Ibid., p. 96.
- [34] Blake 2003, p. 17.
- [35] See Bernardi 2007.
- [36] Silverman 1993, p. 736.
- [37] Holmes 1859.
- [38] See Mannoni et. al. 1995; Campagnoni 2007.
- [39] Huhtamo 2006, p. 140.
- [40] Not by chance, the notion of ‘tele-presence’ was introduced in the field of tele-operation systems by the American engineer Marvin Minsk in the 1980s. Remediating design goals and ergonomics of the peep media and ‘virtual realities’ of the 19th century, many real and imaginary multimedia ‘mobile media’ appeared and vanished during the 20th century. According to Huhtamo (2011, p. 37), ‘The multimedia mobile phone, even when used with a headset and a microphone, seems to allow a more radical and varied form of bi- or multi-location: the mind wanders between “here” and “there”, present and remote, physical and virtual, active input and passive reception, as the user switches between applications and modes.’
- [41] Quotations and historical notions about Morton Heilig’s patents and inventions are taken from the Morton Heilig Collection edited by the USC School of Cinematic Arts, and available on www.uschefnerarchive.com/mortonheilig/. For Friedrich Kittler (2009, p. 227), Heilig’s work provides evidence in how 3D immersive technologies are more akin to the development of film and television than to that of computers. Without reaching a complete manufacture, Heilig patented other immersive presence media such as the Experience Theatre, the Thrillerama Theatre, and the Big Pix 3-D Viewer. Heilig’s ‘Experience theatre’ could be considered as a remediation of the VR theatre made of ‘swivelling chairs’ and a 360-degree scene theorised by Artaud in the 1930s, thus re-connecting the genealogy of VR with that of the magical and avant-garde theatre tradition.

- [42] Heilig c.1969, p. 2. Notably, ‘cinematic’ has become synonymous with ‘narrativity’ in gaming jargon, and VRS were largely inspired by ‘cinematic’ film editing techniques and storytelling. The patent for Heilig’s Experience Theatre (complete with drawings) can be retrieved at <https://patents.google.com/patent/US3469837A/en>.
- [43] Heilig 1992.
- [44] To understand the unprecedented impact of this ‘back to the future’ of VR mania, just think of new VR enterprises such as ‘Within’. Founded in 2014, the goal of this VR company is ‘to create products, original content, formats, proprietary software and tools for virtual and augmented reality entertainment, fitness, and learning’. Venture capital investors for Within include ‘Andreessen Horowitz, Temasek, Emerson Collective, Disney, 21st Century Fox, Raine Ventures, WME, Live Nation, Vice Media, Tribeca Enterprises, Annapurna Pictures, and Legendary Pictures’. See <https://www.with.in/about>.
- [45] Gódde et. al. 2018, pp. 186-187.
- [46] Billhart 2016b.
- [47] Billhart 2016a.
- [48] Brillhart 2016b.
- [49] Aylett & Louchard 2004.
- [50] Tjostheim & Waterworth 2022.
- [51] Ibid., p. 6. For an extensive discussion on the act of ‘placemaking’ in virtual environments see also Tjostheim & Waterworth’s chapter ‘Visiting Places’ (2022, pp. 73-91).
- [52] See Lumpkin 2019. As Jenkins (2004, p. 121) remarks: ‘Performance theorists have described role-playing games (RPGs) as a mode of collaborative storytelling, but the Dungeon Master’s activities start with designing the space – the dungeon – where the players’ quest take place.’
- [53] On the subject see also Modena & Parisi 2021.
- [54] Jenkins 2004, p. 129.
- [55] Herman 2013, p. 291.
- [56] Jenkins 2004, p. 127. Here Jenkins proposes an intriguing parallel with game design and the visual repertoire of classic Hollywood melodramas such as *Gone With the Wind*, *Rebecca*, and *Dr. Zhivago*, all of them depending ‘on the external projection of internal states, often through costume design, art direction, or lighting choices’. In this cinematic tradition, Jenkins argues, objects and spaces contain powerful affordances that could evoke a sense of loss of nostalgia in the visitor/spectator. Melodrama, the author suggests, might be ‘studied’ by game designers interested in environmental storytelling.
- [57] Johnstone 1990, p. 16.
- [58] See Gatti 2019, p. 241n522.
- [59] <https://www.facebook.com/zuck/posts/10101319050523971> (italics mine). Notably, this early vision matured in Zuckerberg’s ‘metaverse’ building plan, announced in October 2021 at Connect Festival. The so-called ‘metaverse’, Zuckerberg argues, will design a mixed reality world where ‘we’ ll be able to feel present – like we’re right there with people no matter how far apart we actually are’. For Zuckerberg’s complete speech see <https://youtu.be/Uvufun6xer8>
- [60] Tjostheim & Waterworth 2022, p. 6.

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- [61] For an extensive discussion of this subject see McFarlane & Schmeink & Murphy 2020.
- [62] Sconce 2006, p. 25.
- [63] See Eugeni 2002, p. 2019; Tomatis 2020.
- [64] See Sconce 2015; Gatti 2019, pp. 193-287.
- [65] Although it does not foreshadow any empowerment of the senses, among this list of imaginary media the Star Trek 'holodeck' occupies a special place. This imaginary medium, which uses holograms to create a simulated environment into which participants can freely interact with characters in a predefined narrative world, gave the title to Janet Murray's seminal book *Hamlet in the Holodeck* (1998). Notably, the holodeck is employed by the author as an effective conceptual metaphor in understanding the sensation of being submerged, namely immersed, into an artificial reality during some gaming or VR experiences.
- [66] Notably, *The Matrix*'s technological design draws from the 'SimStim', an imaginary medium featured in *Neuromancer* which allows the user to re-embody another person's body remotely. The narrative of 're-embodiment' though VR keeps resurfacing in the sci-fi world and across media. Recent examples include, among others, the television-series *Altered Carbon* (Netflix, 2018-2020) or the rpg game *Cyberpunk 2077* (CD Projekt RED, 2020).
- [67] See Gatti 2019, pp. 231-236. The 3-D Glasses (also known as 'SegaScope') use a shutter system to close the left and right lens rapidly in order to create a stereoscopic effect within a glass-like headset. It was also paired with a laser gun to 'expand' the experience of first-person shooting outside the screen's domain.
- [68] For a media archeology of the Power Glove see the gaming historian's documentary *The Story of the Power Glove* (2015) available at <https://youtu.be/3g8JiGjRQNE>. I provided a first enactive analysis of the Power Glove in my book *Dispositivo* (Gatti 2016, pp. 231-236).
- [69] See Rubin 2014; Dalpozzo & Negri & Novaga 2018.
- [70] Tjostheim & Waterworth 2022, p. 63. The discussion whether presence arises from 'pretence' (a simulation of reality) or as 'pretending' (making believe the real world is real) nurtured in a genuine suspension of reality judgement provided groundings of the so-called 'simulation hypothesis'. This idea that we are immersed in a computer simulated reality that has put our principle of reality in crisis has gained new momentum in the 2000s with the rise of simulation technologies and the film *The Matrix*. It has also provided grounding for many serial narratives concerning human presence and enhancement. Examples include episodes of *Black Mirror* (2011-present) and *Rick & Morty* (2013-present), and series such as *Neon Genesis Evangelion* (1996-1997), *Humans* (2015-2018), and *Westworld* (2016-present), just to name a few.
- [71] Anderson 2017.
- [72] For an advanced overview in all aspects of haptic technology see the Springer Series on Touch and Haptic Systems (2011-2023) at <https://www.springer.com/series/8786>, in particular see Peer & Giachritsis 2012. For a case study in the field of musical performance see Michailidis & Bullock 2011.
- [73] For more information on the device along with its technical specifics see <https://www.cyborgnest.net/sentero>.
- [74] See Biocca 1997; Waterworth & Waterworth 2014.