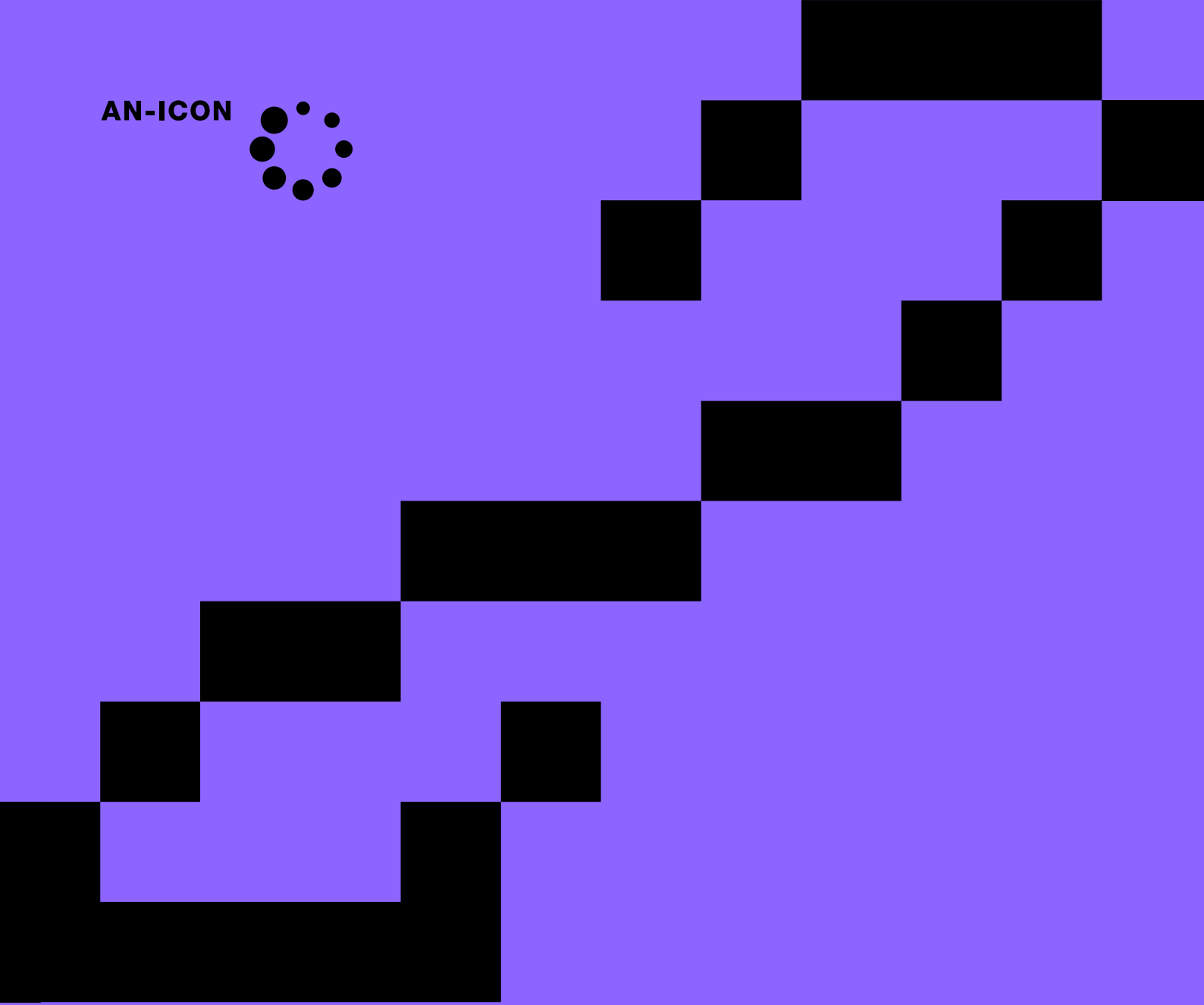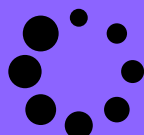# AN-ICON Studies in Environmental Images

→ Just an illusion? Between simulation, emulation, and hyper–realism

Edited by Pietro Conte and Lambert Wiesing

Contents

Introduction

On the razor's edge: the (virtual) image between illusion and deception[1]

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Illusion or delusion?

Were novelists and filmmakers right in fore-shadowing the advent of 3D virtual worlds that would exist parallel to physical reality, where people could interact with each other through the full immersion of all their senses, possibly losing awareness of the artificial nature of those environments? Indeed, what has been imagined in countless science fiction narratives, dystopian movies, and TV series seems to be turning into reality to an increasing

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degree: a pictorially generated environment that is not perceived as such.

A modern incarnation of René Descartes's evil demon thought experiment, the brain-in-a-vat hypothesis famously describes a scenario in which a mad scientist might remove a person's brain from the body, place it in a vat of life-sustaining nutrients, and wire it to a computer that feeds it with electrical stimuli identical to those the brain normally receives. In the words of Hilary Putnam, who in 1981 made the story popular and provoked much heated debate among philosophers of mind, that would cause the individual "to have the illusion that everything is perfectly normal." If, for instance, the person tries to raise her hand, the feedback from the machine will make her immediately "see" and "feel" the hand being raised. The evil scientist can cause the victim "to 'experience' (or hallucinate)" any situation he wishes. He can even erase the memory of the brain operation so that the victim will seem to herself to have been born and always lived in the digital environment.[2]

More recently, the idea of a simulation so powerful that people caught in it would take it for reality in the flesh has resurfaced in notions such as Peter Weibel's "future cinema," according to which the next coming cinematographic apparatuses, thanks to miniature neural implants and interfaces that stimulate the brain directly, will be able to bypass the sensorium, thus acting immediately on the neural networks:

Instead of *trompe l'oeil,* the next step might be *trompe le cerveau* [...]. There would be perception without the senses, seeing without the eyes. [...] Advances in neurophysiology and cognitive science give rise to the hope that future engineers will succeed in implementing these discoveries in neuronal and molecular machines that

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2   H. Putnam, "Brains in a vat," in *Reason, Truth and History* (Cambridge: Cambridge University Press, 1981): 1-21, 6.

transform the technology of simulation to deceive the eye into a technology of stimulation that in turn deceives the brain.[3]

One is certainly free to disbelieve such prophecies and exercise healthy scepticism. And yet, given the unprecedented rapid pace of technological innovation, one cannot help but recall Louis Marin's argument that every representation, in order to present itself "in its function, its functioning, and, indeed, its functionality" as representation, must include a frame that keeps the image-world clearly separated from the real world: "The more 'mimetic' transparency is manifested seductively, [...] the less the mechanisms are noticed, the less they are acknowledged."[4]

The dream, or perhaps nightmare, of a medium achieving absolute transparency and of a user experiencing total immersion has yet to come true, and it will perhaps never do so. However, it is (certainly not only, but nevertheless in a particularly powerful way) the new advancements in the field of simulation, illusion, and immersion that have contributed powerfully to determining the way we think about today's media landscape. The evolution of technological equipment goes hand in hand with the evolution of the techno-cultural – which also means political – *dispositif* that supports and even guides them. One need only consider the way in which virtual reality is nowadays hailed as the last medium, capable of immersing the user in someone else's shoes, teleporting her to some other place, making her feel as if she were really "there."

3   P. Weibel, "The intelligent image: neurocinema or quantum cinema?," in J. Shaw, P. Weibel, eds., *Future Cinema: The Cinematic Imaginary after Film* (Cambridge MA-London: The MIT Press, 2003): 594-601, 599.
4   L. Marin, "The frame of representation and some of its figures" (1988), trans. C. Porter, in *On Representation* (Stanford: Stanford University Press, 2001): 352-372, 353.

Being there: debunking the rhetoric

Such "being there" has become the catch-phrase of virtual technologies, and it often goes along with an over-romanticization of the idea of immersion, according to which immersive environments would grant the experiencer a *perfect* illusion by making the medium disappear. This would differentiate the new forms of illusion from traditional *trompe l'œil*:

The concepts of *trompe l'œil* or illusionism aim to utilize representations that appear faithful to real impressions, the pretense that two-dimensional surfaces are three-dimensional. The decisive factor in *trompe l'œil*, however, is that the deception is always recognizable; in most cases, because the medium is at odds with what is depicted and this is realized by the observer in seconds, or even fractions of seconds. This moment of aesthetic pleasure, of aware and conscious recognition, where perhaps the process of deception is a challenge to the connoisseur, differs from the concept of the virtual and its historic precursors, which are geared to unconscious deception.[5]

The concept of a virtual reality that could replace the realm of physical existence has been criticized for resting upon an idealization of total immersion that would lead to an illegitimate equation of illusion with delusional hallucination. In particular, the assumption of a pictorial environment so hermetically sealed off from anything extraneous to the picture that the observer (or rather the experiencer) feels completely submerged in it is highly problematic. Leading scholars in game studies such as Katie Salen and Eric Zimmerman have labelled this assumption "the immersive fallacy," polemically referring to the idea that

5   O. Grau, *Virtual Art: From Illusion to Immersion* (Cambridge MA-London: The MIT Press, 2003): 15-16.

the ability of a media experience to sensually transport the participant into an illusory reality could reach a point where "the frame falls away so that the player truly believes that he or she is part of an imaginary world."[6] Emblematically expressed in the concept of the holodeck (a fictional technology that made its first appearance in *Star Trek: The Next Generation* and consists in a holographic room where a simulation including sight, sound, touch, smell, and taste is indistinguishable from physical reality), the immersive fallacy encourages people to buy into new forms of magical thinking and overlook that virtual reality is but "a medium of representation that the brain will process in its appropriate cultural context, just as it has learned to process speech, writing, photography, or moving images."[7]

Such warnings against a cyberpunk-flavoured idea of immersion point towards a different interpretation. As is made evident by the etymological presence of *ludus* in the Latin word *inlusio*, "illusion" originally refers to a lusory attitude. Being elicited by the perception of physical representational artefacts, texts, or performances, the *aesthetic* illusion is to be distinguished from both hallucinations and dreams. Moreover, it differs from delusions in that it is neither a conceptual nor a perceptual error, but a complex phenomenon characterized by "an asymmetrical ambivalence"[8] that results from its positioning halfway between the two poles of rational distance (i.e., disinterested "observation" of an artefact in its fictional nature) and immersion (or in Kendall Walton's words, "participation"[9]) in the represented world:

6   K. Salen, E. Zimmerman, *Rules of Play: Game Design Fundamentals* (Cambridge MA-London: The MIT Press, 2004): 451.
7   J. H. Murray, "Virtual/reality: how to tell the difference," *Journal of Visual Culture* 19, no. 1 (2020): 11-27, 20.
8   W. Wolf, "Illusion (aesthetic)," in P. Hühn et al. (eds.), *Handbook of Narratology* (Berlin-New York: de Gruyter, 2009): 144-160, 144.
9   K.L. Walton, *Mimesis as Make-Believe: On the Foundations of the Representational Arts* (Cambridge: Harvard University Press, 1990): 240-289.

When we play a game, we feel engaged and engrossed, and play seems to take on its own "reality." This is all certainly true. But the way that a game achieves these effects does not happen in the manner the immersive fallacy implies. A game player does become engrossed in the game, yes. But it is an engagement that occurs *through play itself.* As we know, play is a process of metacommunication, a double-consciousness in which the player is well aware of the artificiality of the play situation.[10]

Contrary to David Hume's conviction that all illusions should be given up to the flames,[11] the contemporary immersive media and apparatuses make it necessary to disentangle the word "illusion" from its negative connotation as "deception." From this perspective, an illusion is about something that is present but not real: it marks the presence of something while at the same time making it appear as "unreal." The key term for describing this dichotomic phenomenon is *conflict* – a term that in image theory goes back to Hippolyte Taine and Edmund Husserl.[12] Every perception rests upon the awareness of being there and being present, but only image perception implies a self-relativisation of real presence: the perception of every image generates artificial presence. For what is visible in the picture – one may call it, using Husserl's vocabulary, "picture object," or in more analytical tradition "content" or "representation" – is relativised in its character of presence by a conflict (*Widerstreit*). This happens in two different ways: in the case of traditional images through the visibility of the grounding materiality of the image, the visibility of the real environment and, last but not least, through the

10   K. Salen, E. Zimmerman, *Rules of Play*: 51
11   D. Hume, *An Enquiry Concerning Human Understanding* (1748), sect. 12, pt. 3. (Mineola, N.Y.: Dover 2004): 107.
12   On this, see L. Wiesing, *Artificial Presence. Philosophical Studies in Image Theory* (2005), trans. N.F. Schott (Stanford: Stanford University Press, 2010): p. 53.

visible frame. These forms of perceptible conflicts tend to disappear when an image expands into its surroundings, thus becoming an artificial "environment." Yet even in the case of simulations and hyperrealistic worlds, the condition for speaking of images at all is that here, too, there must be an experience of conflict. That is the point: in the case of immersive environments, the conflict is (or, if we are realistic, should be) given through the knowledge of being in a simulation. The knowledge that something experienced is "not real" creates image-generating conflicts, just as traditionally the frame did. This is grasped when it is said: images produce artificial presence.

This calls up numerous questions that the present issue of the *AN-ICON* journal aims to address: how is such a conflict between knowledge and perception to be explained, and is it to be regarded as a new form of aesthetic illusion?[13] On the one hand, it is necessary to distinguish the conflict phenomena of the new forms of immersion formation empirically in their technology from those of traditional images. On the other hand, the various forms of seeing artificial presence must always be categorically differentiated and determined in their respective specificity. Is it a case of an unconscious illusion brought about by a false perception, or is it rather a matter of a lustful, playful attitude adopted in a special kind of illusory relationship? What is the difference between illusion, deception, and hallucination? How does an illusion become a delusion?

As if it were not complicated enough: the description of a virtual environment faces the problem that it is a double form of illusion building. On one side, this is the mostly solely themed illusion that people in simulated and immersive virtual environments have a strong feeling of presence (place illusion) and react to what they perceive

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13   T. Koblížek, ed., *The Aesthetic Illusion in Literature and the Arts* (London: Bloomsbury, 2017).

as if it were real (plausibility illusion).[14] In doing so, however, they are fully aware that they are not "really" there and that events are not "actually" taking place. Yet as relevant as this illusion is, the attention it receives should not induce us to overlook the fact that, on the other hand, there is a second form of illusion formation that is not present in the many precursors of immersive images (such as the stereoscope and the panorama). This illusion of hyperrealism does not just concern what is seen, but also the one who sees. It is the change in the way the viewers experience themselves in relation to the image: virtual reality has the power to make users and beholders feel like they own and control a body (body ownership illusion) that can look very different from their biological one. Here, illusions are created that do not affect what one sees but rather the one who sees something. One might want to think about whether there were not already precursor experiences in this respect in watching films, but it is only in the experience of virtual realities that this phenomenon seems to take on a radicality that brings about new forms of transformation of self-representation and changes in our attitudes to ourselves or to other people, which can be seen, for example, when implicit racial and gender biases are changed – in the best case reduced – in the experience of immersive virtual realities, or health problems and mental disorders are alleviated.[15]

Against this background, the present issue of the *AN-ICON* journal poses equally technological, aesthetic and decidedly moral questions. What are the limits of virtual reality and the possibilities it offers for empathising

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14   M. Hofer et al., "The role of plausibility in the experience of spatial presence in virtual environments," *Frontiers in Virtual Reality* 1, no. 2 (2020), https://doi.org/10.3389/frvir.2020.00002; M. Slater, "Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments," *Philosophical Transactions of the Royal Society B: Biological Sciences* 364, no. 1535 (2009): 3549-3557.
15   T.C. Peck et al., "Putting yourself in the skin of a black avatar reduces implicit racial bias," *Consciousness and Cognition* 22, no. 3 (2013): 779-787, https://doi.org/10.1016/j.concog.2013.04.016; F. Scarpina et al., "The effect of a virtual-reality full-body illusion on body representation in obesity," *Journal of Clinical Medicine* 8, no. 9 (2019), 1330, https://doi.org/10.3390/jcm8091330.

with others and fostering virtuous and socially adaptive processes of imitation? How can we debunk the rhetoric (which has ethical, social, and political significance) behind the celebration of virtual reality as the "ultimate empathy machine?"[16] The field of these questions becomes all the larger and more unmanageable when it is noted that the new forms of digital immersion education, while not necessary, are also usually associated with new forms of interaction education. This raises questions that are often psychological. Is interactivity necessary to create illusion? Does the multisensory quality of the interaction affect the overall effect of illusion? Considering that immersive virtual environments are often inhabited by users' surrogates, do avatars, in their extensive phenomenology, enhance or diminish the degree of illusion? What is the relationship between illusion and the "style" of the image? Is hyperrealism an important element to enhance illusion or, as Gordon Calleja claims,[17] only an element among many others?

The present issue

A first reflection on these topics is offered by Salvatore Tedesco in his essay "Imagination and Körperzustand," which provides a historical overview of how the concept of illusion was understood in the Eighteenth Century by Moses Mendelssohn. Through a critical examination of Johann Georg Sulzer's analysis of the passage from the state of thinking [*Nachdenken*] to that of feeling [*Empfinden*], Mendelssohn elaborated further on the contrast between the state of the body and the faculty of knowledge – a contrast that led the German philosopher to define illusion not merely in terms of common deception, but rather as a

16   C. Milk, "How virtual reality can create the ultimate empathy machine," TED conference, March 2015, https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine.
17   G. Calleja, *In-Game. From Immersion to Incorporation* (Cambridge MA: The MIT Press, 2011).

form of *conscious* illusion. This is made clear in the correspondence with Gotthold Ephraim Lessing on the nature of tragedy, where great emphasis is put on so-called "aesthetic" or "poetic" illusion, considered as the instrument through which the dramatic poet is allowed to induce in the audience – contrary to what Aristotle and his modern followers maintained – even the most violent feelings, on condition that the reader or viewer is under the *aesthetic* effect of the illusion. The latter is characterized by a peculiar mismatch between sensitivity and the higher cognitive faculties: regardless of how deeply immersed one may be in sensory experiences, one still retains awareness of being confronted with a virtual, fictional world. Precisely this contrast harmonization is the hallmark of aesthetic experience as such.

The anthropological relevance of aesthetic illusion can be grasped by describing it in terms of *play*, and more specifically *pretend* play. By referring to both classical and contemporary studies on play and playfulness by scholars from many diverse scientific fields (including among others Sigmund Freud, Jean Piaget, Roger Caillois, Donald Winnicott, Lev Vygotskij, Gregory Bateson, Brian Sutton-Smith and William Corsaro), Anna Bondioli's article offers a reading of illusion as a non-imitative form of play. Far from limiting themselves to reproducing the activities that adults undertake in the surrounding world, children distort reality in a creative way by performing actions that differ from those already seen and known. Children collect elements of the external world and use them in an inter-subjective process of co-construction of meanings in order to open up new possible worlds, without hallucinating: they know for sure that "this is play."[18] From this perspective, the semantic field of illusion shifts from the negative meaning of pretence as lying, mocking, or simulating, to the positive

18   G. Bateson, *The Message "This Is Play"* (Princeton: Josia Macy Jr. Foundation, 1956).

notion of pretending meant as a poietic activity of modelling, building, and giving form. In play, the two cognitive frames – "this is the real world" and "this is the fictional world" – are not to be conceived as completely separate. Players move on the threshold between physical reality and the peculiar (un)reality of fiction. Play isn't real – it is, indeed, "pretend" – but this does not mean it is false. If it were (that is, if it lost the link with the meanings that objects, actions, and events represented during the playful activity denote in the "real" context), it would lose its significance. Yet this is not the case: play (similar in this respect to the poietic use of language in the creation of metaphors) allows the participants to put together things that do not belong to the same category, thereby opening up the possibility to generate new references and meanings that go beyond the logical contrast between the "real" and the "imaginary," between the "true" and the "possible," between "believing" and "not believing."

The ambiguity surrounding the notion of illusion has been made all the more evident by the theoretical reflection on the nature and power of contemporary images. Vilém Flusser's thought, which is the subject of Francesco Restuccia's essay, provides an emblematic example. Illusion is first described as a form of deception, with dangerous and deplorable effects. This is especially true when technical media – starting from photography – are employed in a way that aims to conceal their nature as artefacts. In this sense, the most illusionary images are those that appear transparent and present themselves as objective reality, thus bringing about a new form of "idolatry" or "hallucination:" "Instead of representing [*vorstellen*] the world, they obscure [*verstellen*] it."[19] This dangerous reversal of imagination happens when we do not recognize a medium,

19   V. Flusser, *Towards a Philosophy of Photography* (1983), trans. A. Mathews (London: Reaktion Books, 2000): 10.

especially a visual one, as such. In this sense, technical images are the most deceiving, because their mechanical, automatic production seems to grant a "noninterventionist objectivity"[20] freed from human and cultural interference. But this objectivity is deceptive, because technology is a human product, therefore always culturally biased. In Flusser's work, however, a second interpretation of illusion is given that unveils its possible use as a precious artistic and epistemic tool. In *Filmerzeugung und Filmverbrauch*, the notion is introduced to understand the filmic experience as a modern version of Plato's cave. While sitting in the dark space of the movie theatre, people ignore the world outside the "cave." They do so not because they are deceived by the moving images projected on the screen in front of them. On the contrary, they choose to abandon themselves to the fascination of the medium. They do not want to be freed from the enchantment: their illusion is voluntary, self-imposed, like a specific form of fiction or make-believe play. When illusion is conceived in a positive way as a practice of sense-making, Flusser replaces the German term *täuschen* ("to deceive") with *vortäuschen* (to simulate, to feign). In this sense, simulation is not about producing a copy [*Abbild*], it is about shaping a model [*Vorbild*]. Technical media can allow for a new, "experimental" approach to image making: one inserts a certain input, sees what the outcome is, and then changes the input so as to achieve a different result. According to Flusser, this is the greatest potentiality of virtual simulations: they allow us to experience what until now we were only able to calculate; and vice versa, they allow us to calculate and control experiences that until now we could only vaguely imagine.

       The peculiar experience that contemporary virtual environments grant access to lies at the core of Francesco Zucconi's essay, which follows an anachronistic path

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20   L. Daston, P. Galison, *Objectivity* (New York: Zone Books, 2007).

through art history and theory by taking some of Caravaggio's paintings as an anticipation of the invention of gyroscope technology that made possible the first immersive experience in the history of Western painting. Building on Frank Stella's interpretation of the Italian master's "realistic illusionism"[21] and reformulating Michael Fried's concepts of "absorption" and "theatricality"[22] through the categories of "immersion" and "specularity," Zucconi focuses on the double effect of attraction and distancing as the fundamental structure of the experience of virtual reality cinema. On the one side, as I put on a VR headset, I find myself "teleported" to the simulated environment: I feel "there."[23] On the other side, there is always something that reminds me that I am just inhabiting a digital milieu: a bodily, cognitive, and affective frame brings me back to the "here" of physical reality. Such experience of bilocation[24] is most often conceived of as a negative aspect of even the most sophisticated (and expensive) immersive apparatuses currently on the market – a limitation that, according to many techno-deterministic enthusiasts, will be overcome in some unspecified future, when *total* immersion will be eventually achieved. Arguing against this view, Zucconi maintains that such ambivalent and even paradoxical coexistence of attraction and distancing should be better understood as an intrinsic quality of cinematic virtual reality experiences as such. This medium-specific trait, in turn, can help debunk the bombastic rhetoric that hails virtual reality as the "ultimate empathy machine" capable of making the user not only understand but also directly experience someone's

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21   F. Stella, *Working Space* (Cambridge-London: Harvard University Press, 1986): 11.
22   M. Fried, *Theatricality and Absorption: Painting and Beholder in the Age of Diderot* (Chicago-London: University of Chicago Press, 1983).
23   See among others M. Lombard *et al., Immersed in Media. Telepresence Theory, Measurement & Technology* (Cham: Springer, 2015); M. Lombard, Th. Ditton, "At the heart of it all. The concept of presence," *Journal of Computer-Mediated Communication* 3, no. 2 (1997), https://dx.doi.org/10.1111/j.1083-6101.1997.tb00072.x.
24   A. Pinotti, "Staying here, being there. Bilocation, empathy and self-empathy in virtual reality," *Bollettino Filosofico* 37 (2022): 142-162, https://doi.org/10.6093/1593-7178/9657

other pain and worries. Through reference to Susan Sontag's critical theory of photography, Zucconi challenges the simplistic use of notions such as those of "empathy," "compassion," and "immersion" which accompanies the launch of many virtual reality projects, holding instead that the (alleged) *absolute* transparency of the medium is not only unattainable but not even desirable. From this perspective, the co-presence of illusionistic and counter-illusionistic effects is not to be interpreted as a weakening of the experiential and testimonial value of immersive experiences. On the contrary, it paves the way to a conscious ethical and political approach to virtual reality, according to which the most interesting aspect of such technology is precisely its capacity to produce *both* identification and estrangement, thus making viewers feel at the razor's edge between presence and absence, between "here" and "there," between empathizing with others and being aware that we can never truly walk a mile in someone else's shoes.

If virtual reality as it exists today struggles to make us experience things from the perspective of another human being, can it allow us to feel what it is like to be a non-human creature? Philippe Bédard's article tackles this question by critically examining the fundamental anthropocentrism of virtual reality's dominant mode of experience. Designed as it is around a technological apparatus such as the head-mounted display, which is tuned to the human sensorium, and more in particular, to the subjective qualities of human vision (its binocularity, its "egocentric" perspective, and the individuals' ability to move their point of view through six degrees of freedom of movement along three dimensions), the medium of virtual reality is also intrinsically anthropocentric. This, in turn, seems to rule out from the outset the possibility of bypassing our perceptual habitus by using immersive virtual environments as a tool for

exploring and understanding how non-human (or post-human) beings exist in, and make sense of, a version of the world that is completely different from ours: as Ian Bogost puts it, "when we ask *what it means to be something*, we pose a question that exceeds our own grasp of the being of the world."[25] This does not mean, however, that virtual reality cannot help us *imagine* what the world might look like to a different being. In Bédard's essay, nonnormative, artistic uses of immersive technologies are described that encourage the user to imaginatively explore what the *Umwelt* of a mosquito, dragonfly, or even a tree might appear. Particular attention is paid to the fact that the induction of illusory ownership of, and agency over, a virtual body does not require a fake, hyperrealistic appearance of the avatar; factors like first-person perspective, sensorimotor coherence, multisensory feedback, and the possibility to interact with the virtual environment play a much greater role.[26] This opens the door to artistic experimentation with bodies that do not have human (visual) appearance. The illusory ownership over implausible digital bodies makes it possible for virtual reality artists to produce immersive experiences that facilitate the users' (temporary) engagement in a foray into non-human worlds, notwithstanding the fact that they remain perfectly aware of the impossibility to perceive the environment differently from what our sensorium gives access to.

The idea that analogue and digital immersive devices could be used to expand our sensory knowledge is key for their commercial success. As Marcin Sobieszczanski shows, marketing strategies that pass off virtual reality as the perfect machine to make dreams come true are common. After being applied to cinema, such "oneiric"

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25   I. Bogost, *Alien Phenomenology, Or, What It's Like to be a Thing* (Minneapolis: University of Minnesota Press, 2012): 30.
26   M. Slater *et al.*, "Inducing illusory ownership of a virtual body," *Frontiers in Neuroscience* 3, no. 2 (2009): 214-220, https://doi.org/10.3389/neuro.01.029.2009.

interpretation now tends to assimilate the immersive experience granted by increasingly sophisticated head-mounted displays to hallucinatory phenomena.[27] By sketching out a history of some classical theories that have drawn a comparison between dreams and the "unreal" dimension of the image, Sobieszczanski concentrates on the scientific debate around the nature of illusory phenomena in order to disclose the heuristic potential of the metaphor of virtual reality as hallucination. Highlighting both similarities and dissimilarities between the cognitive mechanisms underlying perception (or perception failure) in hallucinatory states and perception in immersive environments provides an interesting intellectual tool to make a cultural practice evident that is deeply rooted in the human understanding of image-making as the attempt to cross the boundaries that keep the physical world separated from the pictorial world.

One of the biggest challenges this attempt must face is providing, within the virtual environment, multisensory and synaesthetic experiences comparable to those of everyday life. Traditionally, so-called distal senses (vision and hearing) have often been considered more suitable than proximal senses (touch, taste, and smell) to experience images, due to the assumption that genuine aesthetic experience would necessarily imply distance and disinterestedness. Yet the new digital and immersive mediascape calls for going beyond a merely visual or audio-visual way of experiencing the image: when pictures turn into environments, a reorganization of the whole sensory experience is required. Valentina Bartalesi and Anna Calise's contribution deals with this issue by examining the current struggle to include haptic technologies within immersive projects developed by different cultural institutions. Indeed, touch

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27   On this, see G. Grossi, *La notte dei simulacri. Sogno, cinema, realtà virtuale* (Milan: Johan & Levi, 2021).

seems to resist virtualisation: being the sense that, historically and theoretically, has carried the burden of proof on "true reality," it appears a priori unsuited for illusory environments. Proof of this would be that, while haptic technologies are certainly useful to allow users to "touch" – if only virtually – precious artefacts that could not otherwise be touched, they nevertheless present both a qualitative and quantitative deficit compared to the human haptic sensitivity in physical reality: the illusion of touch would be in fact better described as an illusionary touch. However, haptic technologies do not need to be designed to mimic the original functions of touch. Rather than merely attempting to make them replicate the touching experience, programmers and developers can exploit their illusory potential in non-hyperrealistic ways, focussing on the power of haptics to elicit emotions. By reviewing some recent case studies, Bartalesi and Calise show how haptic technologies can enrich our cultural and aesthetic experience of artefacts, offering medium-specific opportunities that neither physical objects nor printed replicas – no matter how accurate they may be – could elicit.

The blurring of the threshold between physical reality and virtual reality is also at the centre of Yizeng Zhang's essay, where the case study of digital fashion is investigated in its function of giving birth to a completely new form of materiality. While creating their clothes, fashion designers have been limited so far by the available fabrics (and their price), the manufacturing technologies at their disposal, and, of course, the laws of physics. The so-called metaverse is in this respect a game changer. Using virtual avatars and models to sell clothing and accessories made of code instead of cotton or wool, designers are free to imagine any type of garment or fabric and to "manufacture" products never seen before. Given that our everyday lives have moved online so much that a new term "phygital" was

coined to indicate the increasing blending of digital experiences with physical ones, it is a safe bet that digital fashion will become a vital category for every brand's business model, being more and more sold as NFTs, showcased on virtual catwalks and in virtual showrooms, or worn by both physical and virtual influencers on social networks. Under the auspices of Gernot Böhme's philosophy, Zhang takes on the notion of atmosphere to reflect on the "stage values" of digital fashion, that is, on its ability to emancipate from the material function of garments and to produce new forms of self-presentation. Digital garments are thus intended as experiences whose value arises from the atmosphere they are able to generate. By tracing such atmospheric production across three sites of its exhibition (the e-commerce website, social media, and the runway show), Zhang shows how digital fashion contributes to the construction of a new kind of affective milieu. If the generation of such atmospheres can be said to be just an illusion or, rather, if the illusion itself can be conceived of as providing access to a new reality, is a question that fits well into the thematic section of this issue of the *AN-ICON* journal.

Imagination and Körperzustand: illusion and play in Moses Mendelssohn's aesthetic reflection

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Abstract

The aesthetic reflection in the eighteenth century is deeply traversed by an experience perceived as capable of disrupting the disciplinary and cognitive system of early modernity: To feel the "own body," that is, to feel its state of well-being or discomfort means to somehow modify from the inside the anthropological project of the Century of Enlightenment and to create the space and the lexicon of a modality of relationship (play, aesthetic illusion) that redefines the relationship with oneself and the context of construction of a future community.

Whereas "Knowledge" and "Will" articulate the same strategy based on the relationship between the spiritual activity of a subject and the semiotic properties of an object, the orientation towards the condition of one's own body defines in the play and in the aesthetic illusion the space of an imaginative reserve which is above all a reserve of time and mode of construction for a future sharing.

Moses Mendelssohn's thought constitutes the exemplary arrival point of an era of theoretical research that we are interested in investigating not only in terms of the solutions it has found for his time, but also in relation to the open problems, which continue to question our time.

The philosophical and aesthetic reflection in the eighteenth century is deeply traversed by an experience perceived as capable of disrupting the disciplinary and cognitive system of early modernity: Feeling the "own body," that is, feeling its "state" of well-being or discomfort – before and in a way different from the cognitive approach of a subject with an object or from the desire that moves towards that object – means to somehow enter the anthropological project of the Century of Enlightenment and to create the space and the lexicon of a modality of relationship (play, aesthetic illusion) that redefines the relationship with oneself and the context of construction of a future community.

In fact, where "Knowledge" and "Will" articulate, albeit in different ways, the same strategy based on the relationship between the spiritual activity of a subject (typically, to formulate it according to the terminology of Moses Mendelssohn: *geistige Bewegung der Seele* and *freie Entschließung des Willens*) and semiotic properties [*Merkmale*] of an object, the orientation towards the condition of one's own body (towards the *Zustand des Körpers*, as we will see, in the sign of Johann Georg Sulzer's work) defines in play and in aesthetic illusion the space of an imaginative reserve which is above all a reserve of time and a mode of construction for a future sharing.

In this dynamic, which for example the aforementioned Sulzer tries to describe starting from the conceptual couple *Empfinden/Erkennen* ("feeling/knowing"), but which in fact would not be conceivable except as a *Bewegung*, that is, certainly, as a "theoretical dynamics," but even before that as a movement of the body and soul, is profoundly inserted another decisive lexical graft, which acquires its most complete theoretical profile in the reflection of Johann Gottfried Herder: I mean the field of *fühlen*, of the tactile feeling, and therefore of its declination as *hinein fühlen* ("internal feeling"); *Gefühl*, which means a thousand things but here I would try to render it as a "tactile feeling;" *Einfühlung*, "empathy;" *Mitgefühl*, "to feel together," "community feeling;" and finally

Familiengefühl, in which this feeling of community undoubtedly reveals a social dimension of identity.

In this sense, decisively rethinking the Leibnizian and Baumgartenian tradition, Moses Mendelssohn speaks of a *vis repraesentativa* which is in and of itself indeterminate, but which through the reference to the state of the soul [*Zustand der Seele*] and of the own body is determined as *Einbildungskraft* facing the past, *Empfindungsvermögen* adhering to the present, *Vorhersehungsvermögen* of the future.

But let's look at the theoretical complex a little more closely at this point. Referring to the two short writings *De anima* and *De DEO*, placed in the appendix to the famous *Philosophiae naturalis Theoria* by Roger Boscovich,[1] Moses Mendelssohn in the fifty-sixth of the *Briefe, die neueste Litteratur betreffend*[2] proposes to take into account, together, the proximity and the difference between the laws of movement [*Gesetze der Bewegung*] of inorganic bodies and those brought about by the union of soul and body in the human organism, which causes

from certain spatial movements [*aus gewissen örtlichen Bewegungen*] in the external limbs to derive certain spiritual movements [*geistige Bewegungen*] in the soul; some in a necessary way, like sensations, others through a free choice, like the determinations of the will.

This is precisely the bipartition and parallelism between *geistige Bewegung der Seele* and *freie Entschließung*

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1   R.J. Boscovich, *Philosophiae Naturalis Theoria* (Vienna: Apud Augustinum Bernardi, 1758): 280-295.
2   M. Mendelssohn, *Gesammelte Schriften* (Leipzig: Brockhaus, 1844): vol. 4, 566. The secondary bibliography on Mendelssohn is very rich, and ranges from historical-critical questions, to aesthetics and the theory of art, to ethics and philosophy of religions, and so on. In these notes - which obviously take into account the overall developments of that critical debate, from the "classic" studies by Fr. Braitmaier, *Geschichte der Poetischen Theorie und Kritik von den Diskursen der Malern bis auf Lessing* (Frauenfeld: Huber, 1888-1889) and L. Goldstein, *Moses Mendelssohn und die deutsche Ästhetik* (Königsberg: Gräfe & Unzer, 1904), up to M. Albrecht, E.J. Engel, N. Hinske, eds., *Moses Mendelssohn und die Kreise seiner Wirksamkeit* (Tübingen: Niemeyer, 1994), and M. Albrecht, E.J. Engel, eds., *Moses Mendelssohn in Spannungsfeld der Aufklärung* (Bad Cannstatt: Frommann-Holzboog, 2000), with particular reference to the large, still decisive monograph by J.P. Meier, *L'Esthétique de Moses Mendelssohn (1729-1786)* (Paris: Atelier Lille III, 1978), and for Italy refer in particular to the excellent work of L. Lattanzi, *Linguaggio e poesia in Moses Mendelssohn* (Pisa: ETS, 2002), and M. Mendelssohn, *Scritti di Estetica*, ed. L. Lattanzi (Palermo: Aesthetica, 2004) - we limit ourselves to refer from time to time to some texts by Mendelssohn himself, of which we will provide a quick theoretical framework for the purposes of our argument.

des Willens mentioned at the beginning, according to a cognitive procedure that is exercised on a "semiotically configured" reality, in which the knowing subject captures certain *Merkmale, notae characteristicae*, in fact we could say semiotic[3] "representative marks" of the object, of the known reality.

In this phase, therefore, Mendelssohn theorizes a perfect parallelism between the sphere of knowledge and the sphere of the will, thus inscribing himself perfectly in that theoretical tradition of the so-called "German rationalism" which can be summarized in the positions of Christian Wolff's *Psychologia empirica* or the psychological sections of Baumgarten's *Metaphysica* – yet, in Mendelssohn's particular thematic declension, the salient term is certainly *Bewegung*, that is the reference to a motility, of the body and of our representative faculty in relation to it, which in fact sets the whole system in motion.

The theoretical framework thus "photographed" by Mendelssohn in 1759 will undergo a rapid evolution, of which we will try to retrace some passages below. At the moment, we limit ourselves to referring to that decisive turning point entrusted by the author to a short private annotation in 1770,[4] which Mendelssohn, critically returning to the path traveled by gnoseology in Germany in the eighteenth century, states that

Pleasure should not have been compared with will. That is an intimate awareness that representation "a" improves our state; the will, on the other hand, is a tendency of the soul to realize this representation.

The Leibnizian *affectus*, Baumgarten's sensitive knowledge "capable of driving force," is now definitely

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3   Obviously I am referring in this way to a very long-term semiotic strategy in the theoretical discourse that interests us here. See, limiting ourselves here of necessity to mentioning the immediate context of reference, the occurrence of the term in the fifty-fifth M. Mendelssohn, *Briefe, die neueste Litteratur betreffend*, in *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie-Verlag, 1929): vol.1, 565.
4   M. Mendelssohn, *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie-Verlag, 1929): vol.1, 225.

characterized as pleasure, with the further clarification that this modality acts on (and therefore it is appropriate to say more precisely to the interior of) our state [*Zustand*] – we would perhaps say modernly on our "psycho-physical balance" – and is therefore to be considered in reference to our intimate awareness of ourselves, rather than continuing to refer to the scope of a cognitive relationship with some *external* object.

It is precisely here that we cross in a more articulated way the theories of Sulzer[5] who, at the end of a long research path that we would define "psycho-physiological," as well as at the start of a new season of German Enlightenment thought, definitively breaks the parallelism and the alliance between knowledge and will by contrasting, in the context of extensively understood "knowledge," *knowledge* in the proper sense (i.e. the semiotic-representative relationship of a knowing subject with a known object) to a *feeling devoid of an object*, through which, in the strict sense, our sensory apparatus experiences itself, its own state of well-being or discomfort.

But let's take a closer look at Sulzer's argument, in which the eye performs the function of a real paradigm of the human soul.[6] Our cognitive faculty, says Sulzer developing considerations that we can trace back to Christian Wolff, is structured in a way that is perfectly analogous to the sense of sight and that, in analogy to it, can be described on the basis of the laws of optics. Objects present themselves to our eye and to our cognitive faculty with a greater or lesser degree of clarity, the focus of our attention progressively focuses on every single element (imaginable as a physical point), leaving the rest of the representation in the twilight.

Therefore the objects are known through a process that allows to obtain a clear knowledge of every single component of the object, so as to finally have a distinct vision of the compound object; for this process to take place,

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5   J.G. Sulzer, "Anmerkungen über den verschiedenen Zustand, worinn sich die Seele bey Ausübung ihrer Hauptvermögen, nämlich des Vermögens, sich etwas vorzustellen, und des Vermögens zu empfinden befindet" (1763), in *Vermischte Philosophische Schriften* (1773) (Hildesheim: Olms 1974): vol.1, 225-243.
6   Ibid.: 226.

however, adequate light is required, which allows the eye to perceive the object.

Conversely, when the light is so dazzling as to injure the eye, there is no longer any perception of the object, but the eye *feels* tactile, that is, in the manner of the darkest sense, itself, its own condition: "The luminous glow touches the ocular nerves in such a way that seeing is transformed into feeling;"[7] this process represents in the best way for Sulzer the passage from the state of thinking [*Nachdenken*] to that of feeling [*Empfinden*]: the representation is no longer a representation of the object, but of my condition of pleasure or displeasure: "We do not feel the object, but ourselves. When it reflects, the intellect takes care of something that it considers to be placed outside of it; when it feels, the soul only takes care of itself."[8]

In this way, however, at the very moment in which a fundamental distinction of levels and functions of the soul is created, a very precise relationship is established between knowing and feeling, in the sense that there is a proportionality between the degree of darkness of our knowledge and the strength of our "sensations" and that the "sensations" are aroused, so as to give rise to the transition from the state of thinking to that of feeling, when a certain idea arouses a crowd of other obscure representations.

The characteristic fact of Sulzer's anthropological vision is that this obscurity of feeling is, in itself, an insurmountable *datum*: "We feel desire or aversion without knowing why: We are moved by forces we do not know."[9] Precisely from this state of affairs – we observe here in passing – the arts derive their origin and at the same time their function, destined to enter into a relationship with the darkest part of feeling and to turn it to the advantage of humanity.

The caesura between knowing and feeling theorized by Sulzer – it would be rather simple to argue – more than corresponding to a deepening of the eighteenth-century physiological discourse, more than opening a philosophical

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7   Ibid.: 231.
8   Ibid.: 229-230.
9   Ibid.: 241.

question destined to be very influential, is in a certain way the symptom, the surface effect, so to speak, of a deep landslide destined to cross the whole thinking of the second half of the eighteenth century, that of the so-called *Popularphilosophie*.

In light of what has been seen in Mendelssohn's *Briefe*, that is, in light of the attempt to describe the "motions of the soul" along the lines of the laws of physical movement, it is striking that the distinction made by Sulzer undoubtedly places at the center of the analysis the *opacity*, the resistance of the body to the gnoseological strategies by which the body itself is crossed throughout the Leibnizian-Wolffian season, but the fact that this happens (and this precisely affects, and perhaps explains the intimate distrust towards Sulzer himself of many of the major protagonists of the *Aufklärung*), creating a static contrast between the state [*Zustand*] of the body and the faculty of knowledge.

Conversely, it is precisely the relational *dynamics* that remain at the center of Moses Mendelssohn's interests, as already exemplarily shown in his reference to Boscovich's theses on motor skills in the investigation of the physical body and the living organism. And it is precisely here that the space for reflection opens up for the concept of *illusion*, destined to become central in Mendelssohn's aesthetic reflection.

Mendelssohn's aesthetic thought, as it is actually quite well known, is very troubled and passes through different and sometimes quite intricate theoretical phases; all the more noteworthy is the fact that from the first theorizations to the definitive results, the link between an attempt at a rational description, even a *mathematization* of the relationship between physical movements and "motions of the soul," and the enucleation of the way to function of the aesthetic illusion.

It is in fact in the correspondence on the tragic with Lessing, and therefore already in the years 1756-1757, that Mendelssohn starts his reflection on the "*ästhetische*" or even "*poetische*" *Illusion*, which is considered the instrument through which the dramatic poet can give space - against Aristotle and his modern followers – even to the most violent

feelings, such as hatred or repugnance [*Abscheu*], on the condition that the reader and viewer are under the *aesthetic* effect of the illusion.[10]

Faced with the hesitations manifested by Lessing in the correspondence, Mendelssohn tries to organize the theme in a more extended form by articulating a short essay *Von der Herrschaft über die Neigungen* (*About the dominion over inclinations*),[11] which starts from an attempt to mathematize the dynamics of motions of the soul, theorizing a direct proportionality between the kinetic force of motivation and the expected good, as well as between the kinetic force itself and the clarity of the representation that one possesses of it, while this force would be expressed according to an inverse proportionality in relation to the time necessary for the representation itself to take shape: "Quantity of motivation = good × clarity ÷ time."[12]

On this Platonic theoretical basis Mendelssohn also explains the effect of illusion, saying that:

When an imitation bears so much resemblance to the original that our senses can be persuaded at least for a moment to see the original itself, I call this deception an aesthetic illusion. The poet must speak in a perfectly sensitive way; for this reason all his speeches must deceive us in an aesthetic way. For an imitation to be beautiful, he must deceive us aesthetically; at the same time the higher cognitive faculties must be aware that it is an imitation, and not nature itself.[13]

Mendelssohn therefore bases the anthropological effect of the aesthetic illusion on the *discrepancy* between sensitivity and intellect. The illusion is *aesthetic* and it is not a common deception when it is addressed *directly* to the sensitivity by involving the higher faculties only *indirectly*.

This discrepancy is first of all a temporal hiatus in the effect of the aesthetic representation:

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10   See K.W. Segreff, *M. Mendelssohn und die Aufklärungsästhetik im 18. Jahrhundert* (Bonn: Grundmann, 1984): 94.
11   M. Mendelssohn, "Von der Herrschaft über die Neigungen," in *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie Verlag, 1931): vol. 2, 149-155.
12   Ibid.: 149.
13   Ibid.: 154.

It is easy to see that that judgment [that is, the aesthetic judgment] must precede, and that therefore the conviction about the similarity must be intuitive, that is, take place through illusion, while on the other hand, the conviction that it is not the original itself may come a little late, and therefore be dependent on symbolic knowledge.[14]

The argument itself is not fundamentally new, and to give a single example relating to a possible source, it is enough to recall Bernard de Fontenelle, who in the *Réflexions sur la poétique* of 1742 declares that our pleasure in following the painful events of a hero that we love, crying and consoling ourselves alternately for what we see, depends on our awareness that it is a fiction.[15]

What is new in Mendelssohn is the temporal scheme, and the theoretical framework in which it is inscribed, which is evidently influenced by the thought of Baumgarten, of which Mendelssohn becomes a continuer: While, so to speak, the awareness of the fictional character holds true in Fontenelle as an undoubtedly *presupposed* guarantee of "poetic" enjoyment, Mendelssohn is instead interested in the path that leads from the *touched* soul of the user to the aesthetic object, and in this path he discovers a double semiotic-cognitive modality, and precisely two different temporalities, which, however, are valid as the two necessarily coexisting stages for the realization of aesthetic pleasure.

Sensitive knowledge *intuitively* grasps an *identity* between original and copy where only the greater slowness of intellectual knowledge, due to its *symbolic* character, will be able to reformulate the relationship as a *similarity* of elements (intellectually) recognized as distinct.

Only in the temporal interplay between the two cognitive stages is aesthetic pleasure realized for Mendelssohn, which takes the form of the subsequent recognition of the *similar* in the imitative representation as *identical and different*. Identical for sensitivity and – with a short hiatus – different for the intellect. Aesthetic pleasure therefore allows

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14   Ibid.
15   B.L.B. de Fontenelle, *Réflexions sur la Poétique* (Paris: M. Brunet, 1742): XXXVI.

us to penetrate into the human soul, indeed to say more precisely *within the motivational dynamic that governs the movements of the soul*, so as to relate sensitivity and intellect not for the purpose of a progressive "unveiling" of reality that destroys illusion and error, but on the contrary for the purpose of an enjoyment that finds its root in *imitation*, capable of emerging with particular evidence right in the case of the imitation of passions that are violent and painful,[16] which would not only turn out to be such if they were experienced in reality, but which would be no less painful if we were simply faced with an "interpretative error" of our sensitivity destined to be rationally overcome.

In the same year 1757, one of the decisive writings of Mendelssohnian aesthetics, the *Betrachtungen über die Quellen und die Verbindungen der schönen Künste und Wissenschaften* (*Reflections on the Sources and Connections of the Fine Arts and Sciences*),[17] added a further decisive element to this descriptive framework, clarifying that, from the semiotic point of view, intuitive knowledge concerns both the case in which the object is immediately present to our senses, and the case in which it is represented through signs [*Zeichen*] through which the ideas of the designated [*Ideen des Bezeichneten*] can be seen more distinctly than those of the sign.

The beauty of the aesthetic relationship (but by now Mendelssohn's discourse – precisely through the reference to the designation process – strongly gravitates towards *artistic* beauty) therefore offers the example of a peculiar *transparency of the medium*, and it is right through the transparency of the sign that the object appears with an evidence that captures and sets in motion the faculties of our soul.

In the same years, in controversy with Reimarus, Mendelssohn will also return to the nature of the imagination and to the overall relationship of the faculties of the

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16 M. Mendelssohn, *Von der Herrschaft über die Neigungen*: 155.
17 M. Mendelssohn, "Betrachtungen über die Quellen und die Verbindungen der schönen Künste und Wissenschaften," in *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie-Verlag, 1929): vol. I, 169.

soul, saying that – far from being considered a faculty in its own right – the imagination is rather a *modification* of the unique, original and in principle completely indeterminate representative capacity of the soul which however "through the state of one's own and of one's body [*durch ihren und ihres Körpers Zustand*],"[18] is addressed and configured in specific ways, articulating itself precisely as *Einbildungskraft* facing the past, *Empfindungsvermögen* adhering to the present, *Vorhersehungsvermögen* of the future.

The famous statement of Baumgarten – according to which the individual soul represents the universe pro positu corporis –[19] is therefore changed in a decisive way by redefining the *position* of the body as *Zustand*, a *state* or more precisely a *condition* of well-being or malaise.

Let us pause for a moment to consider Mendelssohn's path so far: The "aesthetic illusion" is clearly distinguished from mere "cognitive deception," at the very moment in which the attention thus shifts one way in the direction of *internal* dynamics to our soul, that is towards the *play*, the balance of the faculties, present in our soul and set in motion by the aesthetic representations, and on the other hand it traces the dynamics of the relational movement between our soul and the aesthetic object, now more and more clearly distinguished from the cognitive one.

The brief note of 1770 to which attention has already been drawn testifies to a deepening of the first question – that relating to the internal dynamics of our soul – which would not be imaginable and would probably not have assumed that configuration without the openings on one's own body and on his condition made possible by the almost contemporary theories of Sulzer.

Mendelssohn therefore writes:

Pleasure should not have been compared with will. That is an intimate awareness that representation "a" improves our state [*Zustand*];

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18   M. Mendelssohn, "Rezensionsartikel," in *Briefe, die neueste Litteratur betreffend* (1759-1765), 20 nov. 1760: 300 in *Gesammelte Schriften, Jubiläumsausgabe* (Stuttgart: Frommann-Holzboog,1991): no. 5,1.
19   A.G. Baumgarten, *Metaphysica* (1779) (Halle: Hemmerde, 1939): § 512.

the will, on the other hand, is a tendency of the soul to realize this representation. Pleasure is, so to speak, a favorable judgment of the soul on her real state; the will, on the other hand, is a tendency of the soul to achieve this state.[20]

In this way, undoubtedly, Mendelssohn moves towards an overall redefinition of the "system of faculties" that distances him from the Wolffian tradition as well as from Baumgarten, his model, approaching that tripartite division between the cognitive sphere, the sphere of will and aesthetic pleasure that characterizes the second eighteenth century from the so-called *Popularphilosophie* to Kant. No less significant is that this occurs through a specific attention to *one's own body*, and to the way in which the representative processes do not so much modify our relationship with reality on the objective side, as they redefine its internal resonance.

However, whereas precisely on this point Sulzer chose an "extremist" reading, speaking of a "feeling *devoid of an object*," through which our body senses itself and not the object, and therefore sacrificed the understanding of the dynamic relationship to highlight the question of the *Zustand*, of the state/condition of the organ (remember what Sulzer says about the eye and sight), of one's own body, of the soul vitalistically considered coextensive with the body, Mendelssohn never loses sight of the relationality, the dynamism of the framework of faculty.

It is perhaps also for this reason that his is the most significant figure in the entire German debate from Baumgarten to Kant.

Another short essay is dedicated to what has just been defined as the dynamics of the relational movement between our soul and the object, dating back to June 1776, in which, similarly to what we have just seen, Mendelssohn moves, so to speak, from "systematic reasons," openly declared already from the title of the fragment: [*Über*

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20   M. Mendelssohn, *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie-Verlag, 1929): vol. 1, 225.

*das Erkenntnis-, das Empfindungs- und das Begehrungsver-
mögen*] *On the faculty of knowing, of feeling and of appetite*.
What six years earlier had been entrusted to an almost incidental note here instead – even if the writing is destined not to leave the private workshop of Mendelssohn's thought – acquires the characteristics of a system program:

Between the faculty of knowing and the faculty to appetite there is the faculty of feeling [*Empfindungsvermögen*], by means of which we feel pleasure or displeasure about something, we appreciate it, approve it, find it pleasant, or we despise it, blame it and find it un–pleasant [...]. The end of the faculty of knowing is the *truth*; that is, as we possess a faculty of knowing, we strive to make the concepts in our soul accord with the qualities of their objects. The end of the faculty of hearing is the *good*; that is, insofar as we possess a faculty of feeling, we strive to make the objective qualities accord with our concepts of goodness, order and beauty.[21]

The truly innovative moment of this position lies in the clear distinction of areas between will and pleasure: The pleasure for a representation does not necessarily imply the desire for the object that underlies it.

Mendelssohn is above all interested in distinguishing two modalities of relationship with the object: In the cognitive relationship we modify our representations to adapt them to the truth of the object, in the case of the faculty of feeling we aim instead to harmonize the properties of the object with our own concepts of good, order, beauty, and the tool for this to happen is clearly identified in the aesthetic illusion. The peculiarity of the statute of aesthetic illusion is then the true core of Mendelssohn's discourse, when it is distinguished both from cognitive truth and also from the concrete modification of reality which the will aims at.

But there is more; Mendelssohn distinguishes two fundamental human attitudes, the first tending to truth, the second to *poetic invention* [*Erdichtung*]. If the first corresponds to the work of the faculty of knowing, the poetic

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21   Ibid.: vol. 3, 1, 276.

invention will instead follow the intent of *keeping in exercise* [*in Übung zu erhalten*][22] the faculty of feeling. In the same days, another brief note[23] completes the Mendelssohnian description, noting that this "faculty to entertain oneself" [*Unterhaltungsfähigkeit*] (it is interesting how Mendelssohn tries to set the theoretical framework in motion even in proposing new names for a system of faculties perceived as in active transformation with respect to the Wolffian model) has an objective side (simplifying I would say the quantity and order of semiotic markers capable of "giving something to think about") and a subjective side (the faculty itself and the ordering criteria it is able to set). The *beauty* will therefore reside in the harmony between the objective and subjective aspects of the new faculty, capable of arousing in us "in the contemplation of the object, the awareness of our strengths rather than our limits, and movement is pleasant."[24]

Conversely, that disharmony that comes from the excess of the object over our faculties will cause *dizziness*, and on a conceptual level it will give life to the *sublime*.

The conclusive synthesis of the *Morgenstunden*, in 1785, will insert the considerations that we have followed up to now into a much broader theoretical framework, without however further introducing profound changes; confirming and reformulating again the tripartition between the faculty of knowing, that of desiring and the "aesthetic faculty," now redefined as the capacity of appreciation [*Billigungsvermögen*], Mendelssohn now distinguishes between two fundamental aspects of human knowledge, depending on whether one considers its *material* relevance or the *formal* configuration.

From the material point of view, that is, a given notion can be true or false; considered from this point of view, knowledge knows no degrees, truth is an "indivisible unity."[25] It is quite another thing to consider knowledge as capable of arousing pleasure or displeasure, that is, as an object of

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22   Ibid.
23   M. Mendelssohn, "Über objektive und subjektive Unterhaltungsfähigkeit," in *Gesammelte Schriften, Jubiläumsausgabe* (Berlin: Akademie-Verlag, 1929): vol. 3, 1, 275.
24   Ibid.
25   M. Mendelssohn, "Morgenstunden," in *Gesammelte Schriften, Jubiläumsausgabe* (Stuttgart: Frommann-Holzboog; 1974): vol. 3, 2, 62.

the faculty of appreciation: precisely this can be defined as the formal aspect. And vice versa, this consists exclusively in evaluating, in comparison, in gradation, in plus and minus; moreover, every conceivable degree of this scale of values can be thought of "with the same truth,"[26] which is evidently a truth of the formal aspect of knowledge, a peculiar truth of aesthetic illusion.

Moses Mendelssohn's thought, in its different phases and declinations, through the collaboration with Lessing and up to the final results of the *Morgenstunden*, constitutes the exemplary arrival point of an era of theoretical research that we are interested in investigating not only in terms of the solutions that he found for his time, but also in relation to open problems, which continue to question our time.

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26   Ibid.: 63.

Pretend play: a productive illusion

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Abstract

The contribution focuses on pretend play, a kind of play that is found in children of all cultures and is easily recognizable by adults. The expression with which this type of play is labelled presents, in the common sense, a semantic aura that refers to a series of terms with a negative meaning such as falsehood, deception, error, illusion. Starting from the assumption that the understanding of the meaning of pretend play must be based on a distancing from the idea of truth as a reflection of reality, I'll present and discuss some play theories which show, on the contrary, the necessity and the productivity of the "as if." In line with this perspective, infantile pretend play will be considered as the prototype of an essential human experience to which particular attention should be paid, to be promoted with sensitivity and delicacy, and not to be used improperly as an instructional tool.

The phenomenon play

The basis from which I will elaborate my reflections on the theme is constituted by the traits which, according to Caillois,[1] distinguish play. These consist in a series of peculiar characteristics, connected, more than to the activity itself, to the attitude of the player while playing: freedom (controlled play is no longer play and loses its nature of attractive and joyful fun); separateness (from ordinary life, from what we call "real" or serious, circumscribed within spatially-temporally defined boundaries: the chessboard, the football field, etc.); uncertainty (the development is not predetermined and the outcome is not obvious, so there is an element of risk always present in play which makes it attractive); unproductivity (play is an unfinalized activity: it is played only for the pleasure of playing, not for purposes external to it); regulation (play is not an anarchic activity; it creates a universe in which rules different from those in force in the ordinary world are established); fictitious statute (accompanied by the specific awareness of a different reality or of total unreality with respect to normal life).

It would be these properties that make play attractive, engaging and enjoyable – "an oasis of happiness," as Fink defined it[2] in which the fullness of existence is realized. At the same time, alongside the affective colouring of playful activity, the aforementioned properties make it the place of *sui generis* thought, of experimentation without consequences, where everything is possible.

However, such an enhancement should not be taken for granted. An aura of negativity has historically characterized discussion of play as a waste of time, lack of seriousness, infantilism, unproductiveness, dissipation, with a particular emphasis starting from the Protestant work ethic.

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1 R. Caillois, *Les jeux et les hommes* (Paris: Gallimard, 1967).
2 E. Fink, *Oase des Glücks. Gedanken zu einer Ontologie des Spiels* (Freiberg-München: K. Alber, 1957).

But even when play is positively evaluated – and this is the case in current pedagogical debate on childhood – there is a risk that its educational effectiveness is considered more in terms of an "exploitation" for extrinsic purposes (of learning, of moral education, etc.) than the recognition of its peculiar properties, the primary of which is de-finalization. This is because the way in which play is viewed seems to take shape from conceptual contrasts that relegate it to a position of subordination: falsity vs truth; fantasy vs reality; gratuity vs productivity; frivolity vs seriousness.

The particular case of pretend play

Then there is a particular type of play with respect to which these contrasts are even more evident, giving rise, in pedagogical discussion, to proclamations of enthusiasm, on the one hand, as if it were the panacea of education, or of strong perplexity on the other, as a harbinger of possible evil consequences. This is pretend play,[3] a type of play that is found in children of all cultures, the first manifestations of which occur at around a year and a half and become increasingly articulated and complex in the following years.

What are the characteristics of this type of play according to psycho-pedagogical research? Greta Fein, an American scholar who has carried out numerous observational studies of children engaged in "pretending," and has discussed them in the light of the most significant theoretical reflections, identifies five aspects that characterize this type of play.[4] The first – referential freedom – refers to the divergent relationship that the child has with the surrounding environment, producing playful transformations,

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3 In psycho-pedagogical literature on childhood, the terms pretend play, make-believe play, symbolic play, imaginative play, "as if" play are used interchangeably.
4 G. Fein, "Pretend play: creativity and consciousness," in D. Gorlitz, J.F. Wohlwill, eds., *Curiosity, Imagination and Play* (Hillsdale - New Jersey - London: Erlbaum, 1987): 281-304.

for example the arm of an armchair becomes the saddle of a motorbike. The second – denotative license – concerns the divergent position adopted by the child towards real experience as a result of which the events represented are more inventions than reports of facts that occurred in reality. The third – affective relations – indicates that what is represented in fictional play are emotions, affections, experiences, relationships: the actions performed during play take on meaning if they are considered in this perspective. The fourth – sequential uncertainty – informs us that in fiction the plots have a recursive and non-linear quality: in play new themes emerge, old themes are taken up again; the succession is not predictable. Finally, the fifth – self-mirroring – has two different aspects: it indicates on the one hand that the child is aware of "pretending" and, on the other hand, that in play he expresses himself, his particular point of view on the world. It is because of these characteristics that in pretend play one object is used as if it were another, a person behaves as if he were another; the present time and place (the here and the now) become a different time and an elsewhere; you can talk to imaginary figures and people (pretend to be chased by the big bad wolf or to be talking on the phone with grandmother) and materialize non-existent objects (such as when you sip coffee from an empty cup or light an imaginary fire on the toy stove).

Play and mimesis: against an epistemology of the copy

The detection of these characteristics denies the idea of common sense, rather widespread, according to which "pretending" is an imitative form of play. (By playing pretend, the children would reproduce, for example, the behaviour of the mother who looks after her children

or the doctor who visited them or the plumber who came to the house to repair the washing machine.) What should instead be highlighted is that, while taking a cue from what surrounds them and using concrete objects, children distort reality and perform actions that differ from those seen and known.

This aspect is particularly highlighted by the sociologist of education William Corsaro, who, considering pretend play as a significant aspect of what he calls "peer culture" or "children's culture," speaks of "interpretive reproduction"[5] according to which children do not limit themselves to imitating and internalizing the surrounding reality but strive to interpret and make sense of their culture and to participate in it. Children critically reproduce ideas that come from the world of adults and they appropriate them creatively and collectively until they become characteristic aspects of their culture. Peer culture is an inter-subjective process of co-construction of meanings.

Freud, in the essay *The Relation of the poet to day-dreaming* (1908),[6] in which child's play is compared to the artistic activity of a novelist, affirms that when he plays, the child suspends his relationship with reality and gives a new order to the things of his world. In play, children collect elements of the external world and use them to serve some element that derives from internal reality, without hallucinating: children know that it is play.

In this regard, it is interesting to mention the critical exchange between two important scholars of play, Jean Piaget and Brian Sutton-Smith.[7] According to Piaget, intellectual development proceeds through two processes,

5 W.A. Corsaro, "Interpretive reproduction in children's peer cultures," *Social Psychology Quarters* 55, no. 2 (1992): 160-177, https://doi.org/10.2307/2786944.
6 S. Freud, "The relation of the poet to daydreaming" (1908), trans. J. Riviere, in *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, vol. IX (New York: W.W. Norton & Co, 1976): 173-183.
7 B. Sutton-Smith, "Piaget on play: a critique" (1966), in E.R. Herron, B. Sutton-Smith, eds., *Child's Play* (Malabar, Florida: R.E. Krieger Publishing Company, 1971): 104-110.

that of "assimilation" and that of "accommodation." There is assimilation when an individual uses something of his environment (eg. an object) for an activity that is already part of his repertoire and that is not modified: an already existing scheme is used when dealing with a new object or new situation (for example, if a young child has mastered the action of grasping and throwing he will apply these actions to new objects he comes across). It is therefore something known/acquired that is simply applied. On the contrary, accommodation occurs when the old responses (what has been acquired) are not effective to deal with the environment and need to be modified (e.g. the child realizes that he has difficulty in throwing an object heavier than usual and modifies his grip and hand-eye coordination so as to launch it effectively). With assimilation, something already possessed is simply exercised; accommodation, on the other hand, involves the recognition of something new. According to Piaget, only the latter – accommodation – can be recognized as learning while play would be assimilation in its purest form, an expression of subjectivity without value for the knowledge of reality. Hence Sutton-Smith's critical observation that the conception of knowledge underlying Piaget's theory of development is a "copyist epistemology," a naive epistemology according to which accommodation is a sort of photographic negative of external reality.[8] In confirmation of this, Sutton-Smith notes in Piaget's conception an asymmetry in the functions performed, in the development of thought, by imitation and play, in favour of the former. An asymmetry confirmed by the fact that Piaget believes that play, especially symbolic play, disappears with the progressive conquest of logical and rational forms of thought: the more play loses its character of "distortion of reality" the more it transforms into objective imitation. But

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8 J. Piaget, *La formation du Symbole chez l'Enfant* (Neuchâtel: Editions Delachaux & Niestle, 1945).

the most stringent criticism concerns the focus of Piaget's theory of development on cognitive operations of a rational and convergent type to the detriment of imaginative and divergent ones. It would be precisely this centering that would make Piaget consider the symbolic thought typical of play as a strictly infantile mode of little use for the adult mind.

Possible worlds

The remarks made by Sutton-Smith are based on references other than those that form the background to Piaget's theory of development; they are based on the criticism of the idea of knowledge as a copy which from Plato onward, passing through Aristotle, has long permeated Western culture, on the recognition of divergent thought as an important intellectual tool and on the enhancement of the imagination as a typically human way of relating to the world. In play there is a gap, a divergence from what we consider real as objective; however, the reality to which play gives rise is not pure illusion, lie, the expression of a self-centred subjectivity but the result of the creation of possible worlds. This creation presents two sides at the same time, one relating to the form of thought to which play, and in particular pretend play, gives rise; the other relates to the emotional-affective dimension which the power to modify and create urges.

Taking up the Aristotelian distinction between *episteme* and *techne*, Silvana Borutti, in her *Filosofia delle scienze umane*, writes:

True knowledge for Aristotle has to do with what cannot be other than what it is (*episteme*). *Techne* (art) has to do with what can be differently, with the modality of being that is typical [...] of the poietic world (poieo: fabricate, build, work) of creation: it has to do

therefore with the future and with the possible, whose principle is in those who create.[9]

With the latter, therefore, we go "beyond the datum" and push ourselves towards the possible. It is in this perspective that fiction takes on a particular meaning.

Fiction [...] should not refer so much to the semantic element of 'pretending' in the sense of 'simulating', and therefore to the dimension of a lie, of the illusion of truth, of the true-like, but rather to the semantic field of 'pretending' like modelling, forming, building.[10]

Fiction, in the sense in which we intend it here, "loses all mimetic status, and rather has the status that we have called 'poietic': productive of reference worlds."[11]
This configurative tendency producing possible worlds is found in an embryonic form, as mentioned at the beginning, in pretend play, in which real and lived experience is represented in non-mimetic ways. Children:

When they 'pretend', they interpret, comment, exaggerate, highlight rather than imitate. Reality and experience can be represented, staged, and, above all, modified. [...] Thus the child can represent not so much what has happened to him but the sense of what has happened to him.[12]

Two sisters "play sisters"

This aspect of the extraction of meaning, which is typical of symbolic play, emerges with particular force

9 S. Borutti, *Filosofia delle scienze umane* (Milano: Bruno Mondadori, 1999): 100. This and other excerpts cited from texts published in Italy have been translated into English by the author of this essay.
10 Ibid.: 107.
11 Ibid.: 112.
12 A. Bondioli, D. Savio, *Osservare il gioco di finzione. Una scala di valutazione delle abilità ludico-simboliche infantili* (SVALSI) (Bergamo: Edizioni Junior, 1994): 11.

from the essay "Play and its role in the mental development of the child", in which Vygotsky reports an example of play that is only apparently mimetic, that of two sisters "playing sisters."[13] Why should two sisters reproduce in play what they do every day? According to Vygotsky, the two sisters are exploring what it means to "be sisters," they are trying to discover the meaning of sisterhood through a non-mimetic but modelling activity, which allows, in the execution, a multiplicity of variations (the sisters in the park games, sisters at breakfast, sisters at a party, sisters in the dark at night, etc.).

The paradox of play: the word cat doesn't scratch

In a nursery school class we have witnessed this dialogue:

Claudia (41 months) starts playing by asking: "Where is dad? Where is dad?"
Laura (38 months), pointing to Emanuele (32 months): "Dad is here, look!"
Claudia: "No! … daddy … the pretend one."
Laura: "He is the pretend one" and puts Emanuele in front of her.
Claudia to Emanuele: "Are you pretend?"
Emanuele nods his head.

To try to understand the meaning of this playful conversation, we can refer to the thinking of Bateson, who considers play a form of meta-communication about the world. For Bateson,[14] play has a metaphorical meaning but

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13 L.S. Vygotsky, "Play and its role in the mental development of the child" (1966), trans. N. Varesov, M. Barrs, in J.S. Bruner, A. Jolly, K. Sylva, eds., *Play. Its Role in Development and Evolution* (Harmondsworth: Penguin Books): 537-554.
14 G. Bateson, "A theory of play and fantasy" (1954), in *Steps to an Ecology of Mind* (Northvale: Jason Aronson, 1954): 216-235.

with a particular emphasis. In play we operate a shift: objects, actions and events are transferred from the context that has as its frame "this is the real world" to the context that has as its frame "this is play," but the two contexts are not completely separate. The players are "on the border" between the real world and the play world. Play isn't real – it's "pretend" – but it's not false. If it were, that is, if it completely lost the link with the meanings that objects, actions and events represented in play denote in the "real" context, it would lose its meaning. He also says that, precisely for this reason, play allows us to put together things that do not belong to the same category, opening up to "logically" improper references that undermine the usual way of considering things. "The sun is a ball of fire," says a child watching a sunset; in a game observed in a nursery school, a cardboard box on which the eyes of a group of children are focused is the computer of a police operations centre. "Play is a disassembly: we can only play when we manage to 'do violence' to our categories,"[15] which makes change and new arrangements possible.

The metaphor is a good example of the confusion of logical types that allows us to experience change.

The metaphor as a re-description of the world

In playful fiction there is always an aspect of "non-literality" and variation that makes it related to the metaphor, seen not as a lexical substitution, based on the similarity between things or ideas (substitutive and comparative conception), but as an interactive structure:

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15 R. Rovatti, "Il gioco in questione," in M. Noziglia, ed., *Giocare e pensare* (Milano: Guerini, 1995): 95-106. See also D. Zoletto, "Giocare per disimparare," *Multiverso*, no. 2, http://www.multiversoweb.it/rivista/n-02-flessibilita/giocare-per-disimparare-209/, accessed December 9, 2021.

in a metaphor meet and conflict […] heterogeneous paths of mean-
ing, which determine each other, reorganizing our way of seeing.[16]

This is the function that Wittgenstein attributes to the metaphor as "seeing as."[17] If we then consider pretend play as a metaphorical device, a non-literal transcription-translation of situations, experiences, behaviours, its enlightenment function clearly emerges. Again quoting Borutti, metaphorical thought produces a semantic increase,

that is, it says something that can only be said through the meta-
phorical turn (it is not related to a literal level) but is a re-description
of objects, their reconfiguration.[18]

Narrative thinking, with all its various implications, is the medium and the fruit of the metaphorical reconfiguration of experience.

Illusion and creative experience

Winnicott some time ago affirmed that when playing, our judgment of reality is suspended, that in play the distinction between what is produced by me (subjectivity) and what comes from outside (the not-me) falls away.[19] Play brings to life external reality – the transitional objects: the flap of the blanket, the teddy bear, the doll are not lifeless objects but are alive – and makes these new objects open to sharing only if one believes in the power of illusion.
Here is a counterexample, taken from Tolstoy's *Childhood*, which helps us to understand what it means to play with a spoilsport who does not agree to place himself in the intermediate zone between subjective and objective:

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16 S. Borutti, *Filosofia delle scienze umane*: 117.
17 L. Wittgenstein, *Philosophical Investigations* (Oxford: Blackwell, 1953): 278.
18 S. Borutti, *Filosofia delle scienze umane*: 120.
19 D. Winnicott, *Play and Reality* (London: Routledge, 1971).

Woloda's condescension did not please us much. On the contrary, his lazy, tired expression took away all the fun of play. When we sat on the ground and imagined that we were sitting in a boat and either fishing or rowing with all our might, Woloda persisted in sitting with folded hands or in anything but a fisherman's posture. I made a remark about it, but he replied that, whether we moved our hands or not, we should neither gain nor lose ground — certainly not advance at all, and I was forced to agree with him. Again, when I pretended to go out hunting, and, with a stick over my shoulder, set off into the wood, Woloda only lay down on his back with his hands under his head, and said that he supposed it was all the same whether he went or not. Such behaviour and speeches cooled our ardour for the game and were very disagreeable — the more so since it was impossible not to confess to oneself that Woloda was right, I myself knew that it was not only impossible to kill birds with a stick, but to shoot at all with such a weapon. Still, it was play, and if we were once to begin reasoning thus, it would become equally impossible for us to go for drives on chairs. I think that even Woloda himself cannot at that moment have forgotten how, in the long winter evenings, we had been used to cover an arm-chair with a shawl and make a carriage of it — one of us being the coachman, another one the footman, the two girls the passengers, and three other chairs the trio of horses abreast. With what ceremony we used to set out, and with what adventures we used to meet on the way! How gaily and quickly those long winter evenings used to pass! If we were always to judge from reality, play would be nonsense; but if play was nonsense, what else would there be left to do?[20]

The involvement of each player lies in participating in the illusion that comes from keeping uncertainty alive (is it my creation or is it a "not me?" Is this a world only I see or do others too?). It is interesting to note how

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20 L. Tolstoy, *Childhood* (1852), trans. C.J. Hogarth, chapter 8, https://www.gutenberg.org/files/2142/2142-h/2142-h.htm#link2H_4_0008, accessed January 12, 2023.

Winnicott, grafts, on this idea of play as an intermediate area of experience, the theme of culture as the fruition/production of shared play, as an inter-subjective dialogue that can only take place in that third dimension of experience where subjective and objective meet. Culture is not seen here as a set of meanings crystallized and codified to be transmitted or acquired, but as an experiential practice of meaning-making, of creation, re-combination, reinterpretation of meanings.

Fiction as conjecture

In line with these considerations Susan Isaacs, English psychoanalyst and educationalist, follower of Dewey, in one of her most significant works, *Intellectual growth in young children*, considers that "imaginative play, in its most intense expression may be looked upon as the prototype of the 'thought experiment',"[21] a close relative of hypothetical reasoning. "As if" play offers the possibility of emancipating oneself from the present state of things, creating an imaginary world governed by the formula of "if ... then." As recounted in the documents reported in this work, one cannot get off the imaginary ship because one would drown; castles cannot be built "up to the sky" because planes would knock them down.

Pretending, therefore, is an aid to non-reproductive but modelling thought which is at the basis of the abductive capacity of elaborating theories starting from experience; furthermore, it would approach that aspect of scientific elaboration relating to the production of hypotheses to be verified.

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21 S. Isaacs, *The Intellectual Growth of Young Children* (London: Routledge, 1930): 104.

Believe in illusion

There is a strong emotional-affective component in pretend play that should not be forgotten.

Michael and Enid Balint, Hungarian psychoanalysts and a married couple, describe the emotions felt in the game of catch: the fear of being caught and the hope of escaping capture; the possibility of always starting over.[22] The liminal condition of play, the fact of its being on the border between reality and illusion, produces real emotions in fictitious contexts, which makes play attractive, engaging and safe. Just think of the spool game of little Ernst, Freud's nephew,[23] who, in his throwing away a reel-and-thread, represents the painful removal of his mother and, at the same time, revenge against her; bringing it closer, the consolation of the reunion with her. But also another game commonly played between mother and child – peek-a-boo – has a similar emotional meaning: the negative emotions aroused by the disappearance, albeit momentary, of the protective and loved figure, find their positive reversal and reassurance in the reappearance of the maternal face. This is what happens in fairy tales: the happy ending after the hero's vicissitudes and risky adventures offers satisfaction.

To conclude: some educational considerations

The first. Play may/should in no way be manipulated. It must not be bent to serve extrinsic purposes (e.g. learning by playing), nor be sanctioned/punished in its manifestations as long as it remains within the realm of fiction (for example cooking a doll); it must not be devalued as unrealistic

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22 M. Balint, E. Balint, *Thrills and Regression* (Madison: International Universities Press, 1959).
23 S. Freud, "Beyond the pleasure principle" (1920), trans., J. Strachey, in *The Standard Edition of the Complete Psychological Works of Sigmund Freud, vol. XVIII* (New York: W W Norton & Co, 1976): 1-64.

and unproductive (Stop playing, do your homework!); it should not be interrupted (so it's just play/just a game).

"As if" play manifests the value of childhood in its fullness and shows that it unfolds all its power only if it is kept on the razor's edge between "believing" and "not believing," between the "true" and the "possible," between the "real" and the "imaginary."

The second consideration is closely related to the first. Play can be shared between children and between adults and children only if, together, you cross the uncertain boundary between reality and illusion and, together, you enjoy the adventures of the imagination, if you are able to match/overlap your own intermediate areas of experience such as when, in a cloud, the same subject is glimpsed (a horse, a dolphin, a car). Sharing play involves getting in tune with one another within this dimension as adventurous as it is rewarding.

Finally, the interpretation that has been given up to now of pretend play places this childlike conduct, of creating possible worlds, at the root of both art and science, united by being both reconfiguring activities. Children are neither artists nor scientists but it is possible – and necessary – to support and foster their predisposition to play as well as to focus on expressive forms of value and significant aesthetic fruition, both to support a hypothetical thought that allows forms of reflective investigation.[24] It is in this sense that we can speak of play, and, in particular, of pretend play as a productive illusion to be nurtured with delicacy and respect. The imagination must be educated, as Frey states,[25] but not domesticated.

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24 A. Bondioli, "Impulso epistemofilico e gioco: alle radici di scienza e arte," in E. Mignosi, G. Nuti, eds., *Un'infanzia fatta di scienza e di arte* (Milano: FrancoAngeli, 2020): 15-36.
25 N. Frey, *The Educated Imagination* (Bloomington/Indiana: Indiana University Press, 1964): xx.

The polysemy of Vilém Flusser's concept of illusion

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Abstract

Vilém Flusser uses the concept of illusion in a non-systematic way, resulting in two ostensible contradictions. First of all, he often uses the term illusion, while criticizing the metaphysic assumptions that it implies; secondly, he seems to both dispraise and value the illusionary nature of technical images. This article aims at clarifying Flusser's thoughts on illusion in the belief that they are not as conflicting as they might seem at first.

In fact, when Flusser deplores the risk of deception associated with technical images, he refers to the illusion of transparency. He does not oppose the concept of illusion to a supposed objective truth, on the contrary, he opposes the illusion of the objective nature of images to the awareness of their constructed and mediated character.

However, a rational demystification of illusions is not a viable option, since, according to Flusser, they are the result of a voluntary self-deception: we suppress our critical thinking because we cannot bear its complexity, we want images to "release us from the necessity for conceptual, explanatory thought." This is why Flusser thinks that aware illusion – in other words: fiction – can help us overcome our "inertia of happiness" and develop a critical imagination.

Keywords

Flusser   Illusion   Fiction   Fontcuberta

Idolatry   Self-deception

To quote this essay: F. Restuccia, "The polysemy of Vilém Flusser's concept of illusion," *AN-ICON. Studies in Environmental Images* [ISSN 2785-7433] 2 (2022): 52-66, https://doi.org/10.54103/ai/17655

Leafing through the pages of *Herbarium* (1982-1985) by Joan Fontcuberta one is immediately seduced by the beauty of these black and white analog photographs of exotic plants, whose geometric details remind one of Karl Blossfeldt's work. The whole series is presented as scientific documentation, including the botanical nomenclature of these newly discovered species. Only at a second glance one might notice that something is wrong: some details in the image, the strange pseudo-Latin names. What *appeared* to be plants *are actually* small assemblages of pieces of plastic, fragments and parts of animals found by the artist in the industrial outskirts of Barcelona. We have been victims of an illusion. These images, both hyper-realistic and extremely unlikely, aim to deceive us and at the same time to reveal the deception. Without any digital manipulation, Fontcuberta's work on the one hand invites us to reflect upon the supposed immediate and documentary character of photography, on the other hand it allows us to experience unprecedented and surprising configurations.

Fontcuberta had an important intellectual collaboration with a philosopher and media theorist who dedicated many of his writings to discussing the illusionary character of technical images: Vilém Flusser.[1] Although the term "illusion" appears only rarely in his writings and in a non-systematic way, Flusser was definitely fascinated by the ambiguity of this concept, which, as it emerges in *Herbarium*, can be conceived both as a form of deception, with dangerous and deplorable effects, and as a precious artistic and epistemic tool.[2] Often Flusser refers to illusive phenomena in a pejorative way; sometimes he tends to reject the metaphysical assumption – implied by the concept of illusion – that an objective truth can be found beyond

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1 Flusser also wrote the introduction to the German edition of Herbarium: V. Flusser, "Einführung '*Herbarium*' von Joan Fontcuberta," in *Standpunkte: Texte zur Fotografie* (Göttingen: European Photography, 1998): 113-116.

2　As Carrillo Canán wrote, "Flusser has no explicit *theory on deception* but as with many critical thinkers, his theory is to a great extent a theory of deception." A.J.L. Carrillo Canán, "Deception and the 'magic' of 'technical images' according to Flusser," *Flusser Studies*, no. 4 (2008): 1-12, 1. Significantly, neither "illusion," "deception," nor "fiction" was chosen as one of the 235 entries that make up the glossary of *Flusseriana*. S. Zielinski, P. Weibel, D. Irrgang, eds., *Flusseriana: An Intellectual Toolbox* (Minneapolis: Univocal, 2015).

appearance; on other occasions he seems convinced that the art of illusion is the best tool for the creative training of our imagination. Therefore, it could be useful to try to put an order, as far as this is possible, to Flusser's thoughts on illusion, in the belief that they are not as conflicting as they might initially seem. First we will analyze the contexts where he deplores the risk of deception associated with any mediation, and with new media and technical images in particular; then we will consider his critiques of the concepts of illusion and especially of disillusion, focusing on his theory of a voluntary self-deception; finally we will see how Flusser approves of illusion when it is understood as a form of fiction.

Illusion as deception

The German word that Flusser uses the most when referring to the negative sense of illusion is "*Täuschung*," which could be translated as "deception." The verb "*täuschen*" literally means to exchange, to swap: by exchanging two different things, one mistakes one for another one. Being deceived is, first of all, taking something for something else, or conferring to one thing the value that we should only confer to something else. What are the two things that, according to Flusser, might dangerously be confused? The model and its copy, the signified and the signifier, the thing and the image. Deception is "a reversal [*Umkehrung*] of the vectors of significance,"[3] or a "reversal of the function of the image:"[4] images should represent the world and help us "to orientate" ourselves within it, but we end up forgetting about the world and living in function of the images we have created.[5] Images "are supposed to be

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3   V. Flusser, *Towards a Philosophy of Photography* (1983), trans. A. Mathews (London: Reaktion Books, 2000): 37, 68.
4   Ibid.: 10.
5   On the concept of reversal as the key to understanding Flusser's conception of technical images see D. Irrgang, *Vom Umkehren der Bedeutungsvektoren: Prototypen des Technischen Bildes bei Vilém Flusser* (Cologne: Verlag der Buchhandlung Walther König, 2017).

maps but they turn into screens: Instead of representing [*vorstellen*] the world, they obscure [*verstellen*] it."[6]

Flusser is not concerned by the deceptions that occur when we take an image of A for an image of B. As long as we truly know that something is an image, we also know that it is a human construction, that it needs to be interpreted and that this interpretation might be wrong. The real problem arises when images conceal their own nature.

Flusser's main models for his (implicit) theory of deception are Plato's concept of *eidolon* and the Jewish and early Christian conception of idolatry.[7] In his interpretation, both Plato's *eidola* and religious idols are images that should mediate and represent something else (ideas for Plato, God in the Jewish and Christian tradition), but instead of presenting themselves as such, they end up being taken for what they should refer to. Flusser rethinks the concept of idolatry in a secular way, conceiving it as that particular form of deception which occurs when we do not recognize the symbolic and cultural nature of an image. In *Towards a Philosophy of Photography* idolatry is defined as "the inability to read off ideas from the elements of the image, despite the ability to read these elements themselves; hence: worship of images."[8] It is important to notice that idolatry is not only a perceptual deception, but has effects on human behavior: Flusser writes, metaphorically, that images are "worshiped" when they "have a hold over people as objects."[9]

Sometimes, in order to identify this particular form of deception Flusser uses, instead of "idolatry," the term "*hallucination*."

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6   V. Flusser, *Towards a Philosophy of Photography*: 10.
7   Ibid.: 11; V. Flusser, "The codified world" (1978), in *Writings*, trans. E. Eisel (Minneapolis-London: University of Minnesota Press, 2002): 35-41, 39. See also F. Restuccia, "Flusser against idolatry," Flusser Studies, no. 26 (2018): 1-15 and F. Restuccia, *Il contrattacco delle immagini. Tecnica, media e idolatria a partire da Vilém Flusser* (Milan: Meltemi, 2021).
8   V. Flusser, *Towards a Philosophy of Photography*: 83. A similar "semiotic" definition of idolatry was proposed by Augustine: "Now, he is in bondage to a sign who uses, or pays homage to, any significant object without knowing what it signifies," S. Augustine, *On Christian Doctrine*, trans. D.W. Robertson jr. (London: Pearson, 1958): III, IX, 13.
9   V. Flusser, "Design: obstacle for/to the removal of obstacles" (1993), in *The Shape of Things. A Philosophy of Design* (London: Reaktion Books, 1999): 58-61, 60.

Imagination can dialectically reverse and become hallucination. Images resulting from this reversed imagination stop working as mediation and become opaque surfaces hiding the world. The semantic vectors invert and point towards their producer instead of pointing towards the world.[10]

It is important to notice that this sort of reversal can happen with any kind of mediation and not only with images. When we stop using texts and conceptual thinking to help us understand the world, and we start using the world in order to understand our texts, or forcing data to fit into our conceptual grid, then we are victims of another form of deception. In this case Flusser talks about *textolatry*, as opposed to idolatry, or *paranoia*, as opposed to hallucination.[11]

This dangerous reversal of imagination happens when we do not recognize a medium, especially a visual one, as such. Therefore, the most illusionary images are those that appear transparent, concealing their status of images and presenting themselves as objective reality. According to Flusser, technical images – all images produced by apparatuses, starting with photography – are the most deceiving, in this sense, because their mechanical production seems to grant an automatic and almost natural process that avoids any human and cultural interference.[12] "But this 'objectivity' of the photograph is deceptive [*täuschend*],"[13] because technology is a human product and is also culturally biased. The program that apparatuses use to code images was written by human beings and is an externalization of the visual schemata that they would use if they were drawing an image themselves. When we see

10   V. Flusser, "Iconoclastia," *Cavalo azul*, no. 8 (1979): 78-84, 79, my translation; see also V. Flusser *Towards a Philosophy of Photography*: 10.
11   The choice of the last couple of words is due to their etymology: "hallucination," which might be related to the Latin word *lux* (light), refers to visual thinking, whereas "paranoia," which comes from the Greek word *nous* (intellect), refers to conceptual thinking. See V. Flusser, "Iconoclastia:" 79, and V. Flusser, *Towards a Philosophy of Photography*: 10.
12   H. Fox Talbot, *The Pencil of Nature* (London: Longman, Brown, Green and Longmans, 1844) was one of the first to assert such a natural character of photography. See K. Walton, "Transparent pictures: on the nature of photographic realism," *Critical Inquiry*, no. 11 (1984): 246-277, https://www.doi.org/10.1086/448287.
13   V. Flusser, *Towards a Philosophy of Photography*: 51.

a drawing or any other traditional image, though, we are aware that what we are looking at is someone's interpretation of the world, and not the world itself; but when we see a photograph, or a video, we assume that what we are looking at is a direct emanation of reality. "This lack of criticism of technical images is potentially dangerous […] for the reason that the 'objectivity' of technical images is an illusion [*Täuschung*]."[14] The elements of a photograph appear to be "symptoms" of the world, instead of "symbols" that need to be "decoded."[15] The only way to avoid idolatry, hallucination and deception is to recognize the symbols contained in an image and decode them, discovering the "programmed concepts" they represent, "so as to identify the true significance of the photograph."[16]

Based on what has been discussed so far, Flusser seems to maintain a sort of platonic dualism: images are just symbols and should not be confused with the real world. However, Flusser refuses this approach as "'metaphysical' […] in the worst sense of the word."[17] The reason why he deplores the illusion of transparency of technical images is because, according to him, no such thing as an immediate reality can be found, not even beyond images. Even "the amorphous stew of phenomena ('the material world') is an illusion [*Täuschung*],"[18] since it is only accessible through our nervous system and is therefore also a construction. In an interview with Florian Rötzer he declared:

The concept of simulation disturbs me. When something is simulated, that is, when it looks like something else, there must be something being simulated. In the term simulation or simulacrum lies a deep metaphysical belief that something can be simulated. I do not share

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14 Ibid.: 15.
15 Ibid.; V. Flusser, "Für eine Theorie der Techno-Imagination, 1980 in *Standpunkte: Texte zur Fotografie*: 8-16, 8.
16 V. Flusser, *Towards a Philosophy of Photography*: 44.
17 Ibid.: 62.
18 V. Flusser, "Form and material," in *Shape of Things: A Philosophy of Design*: 22-29, 22.

this belief [...]. In my opinion in the word simulation hides what is left of a belief in the absolute.[19]

Flusser is not afraid that the real world could be replaced with a simulation: on the one hand because our technologies do not allow us to build virtual worlds as defined as the experience of the world built by our nervous system, on the other hand because if this ever happened, then it would not make sense to distinguish these experiences as belonging to different levels of reality.[20] Moreover our lifeworld and our simulations are already intertwined, since the experiences we have in the former affect those we have in the latter and vice versa. The real illusion is the possibility of accessing a pure, immediate reality.

If all is construction, then why is Flusser concerned? Because if we assumed that images – and generally our whole experience of the world – are immediate and pure, then we would accept them acritically. We would start unconsciously absorbing interpretations of reality without questioning them, and our imagination would slowly become lethargic.

We should then try to avoid surrendering to the illusion of transparency, train our imagination and learn to decode the images we are surrounded by. But how can we do this? Is a rationalistic debunking the only way out of deception?

Illusion as self-deception

In the essay *Filmerzeugung und Filmverbrauch* Flusser rethinks the movie theater as a modern version of[21] Plato's cave. People sit in a dark space looking at images

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19   V. Flusser, *Zwiegespräche* (Göttingen: European Photography, 1996): 230-231, my translation. See J. Baudrillard, *Simulacra and Simulation* (1981), trans. S. Glaser (Ann Arbor: University of Michigan Press, 1995). Flusser considered Baudrillard a friend and often quotes him in his final years, although mostly polemically.
20   V. Flusser, "Vom Virtuellen," in F. Rötzer, P. Weibel, eds., *Cyberspace. Zum medialen Gesamtkunstwerk* (München: Boer, 2002): 65-71; V. Flusser, *Kommunikologie weiter denken* (Frankfurt am Main: Fischer, 2008): 75-77.
21   V. Flusser, "Filmerzeugung und Filmverbrauch," in *Lob der Oberflächigkeit. Für eine Phänomenologie der Medien* (Bensheim-Düsseldorf: Bollman Verlag, 1993): 153-166.

projected on the wall in front of them, ignoring the world outside the "cave." What does Flusser's interpretation of the myth teach us? That people *want* to stay in the cave, they are not chained, they do not desire to be freed. Their illusion is voluntary.

According to Flusser commercial cinema still has some degree of idolatry: people contemplate those images acritically, as pure entertainment, without questioning the message that is being passed. Therefore they are "programmed" by the technical images to think and act in a certain way: the same people who leave the movie theater, writes Flusser, will form a line to enter the supermarket. They are victims of a double illusion: on the one hand they see the lights projected on the screen as a world taking shape in front of their eyes, on the other hand they end up believing that the people, the feelings, the values they perceived somehow exist and have a life of their own, that they are not the creation of a team of artists and technicians. However, neither of the two forms of illusion is a complete deception. Any film spectator knows how a film is made: they know the impression of movement is produced by the rapid sequence of the frames, they know the events portrayed have been written, designed and reproduced, but they choose to believe in them. "Moviegoers are believers not in good faith, but in bad faith [*böse Glaubens*]: they know better, but don't want to know. This is not magic, but something new."[22]

In *Towards a Philosophy of Photography*, written around three years later, Flusser further develops his conception of a voluntary illusion, or belief in bad faith. Even though people nowadays act as if they were under the magic spell of technical images – they see a commercial and buy the product, they watch a video and change their political opinion – yet they do not believe in those images in the same way as people belonging to traditional magic cultures believed in their images. While the latter did not develop their critical consciousness (their conceptual

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22   Ibid.: 163, my translation.

thinking), which can only be trained through literacy,[23] the former do have it, but end up suppressing it.

Both Native Americans and functionaries believe in the reality of images, but functionaries do this out of bad faith. After all, they have learned to write at school and consequently should know better. Functionaries have a historical consciousness and critical awareness but they suppress these. They know that the war in Lebanon is not a clash between good and evil but that specific causes have specific consequences there. They know that the toothbrush is not a sacred object but a product of Western history. But they have to suppress their superior knowledge of this.[24]

The main sources for Flusser's conception of a belief in bad faith might be Johan Huizinga and Marcel Mauss.[25] However, these authors developed the idea of a voluntary belief, or a partially aware illusion, in order to describe traditional magical thinking and not only the contemporary experience of technical images.[26] By trying to prove that any magic ritual has a playful dimension, just as any game has a ritual dimension, Huizinga affirms that no illusion is ever a complete deception: it is always combined with some degree of simulation.

As far as I know, ethnologists and anthropologists concur in the opinion that the mental attitude in which the great religious feasts of savages are celebrated and witnessed is not one of complete illusion. There is an underlying consciousness of things "not being real." [...] A certain element of "makebelieve" is operative in all

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23   V. Flusser, "Line and surface" (1973), in *Writings*: 21-34; V. Flusser, *Die Schrift. Hat Schreiben Zukunft?* (Göttingen: Immatrix, 1987).
24   V. Flusser, *Towards a Philosophy of Photography*: 63.
25   V. Flusser, *Post-History* (1983), trans. R. Maltez Novaes (Minneapolis: Univocal, 2013): 99-106; V. Flusser, *Towards a Philosophy of Photography*: 27; *Kommunikologie weiter denken*: 245.
26   The notion of *"voluntary illusion"* [*illusion volontaire*] can already be found in Paul Souriau, *L'imagination de l'artiste* (Paris: Librairie Hachette et cie, 1901), while the concept of *aware illusion* [*bewußte Selbsttäuschung*] was first developed by Konrad Lange, *Die Bewußte Selbsttäuschung als Kern des künstlerischen Genusses* (Leipzig: Verlag von Veit & Comp., 1895).

primitive religions. Whether one is sorcerer or sorcerized one is al-
ways knower and dupe at once. But one chooses to be the dupe.[27]

In a similar way, a few years before, Mauss wrote that any magical performance reveals the collective will to believe in it, both on the part of the spectators and the magician:

We are in no doubt that magical facts need constant encourage-
ment and that even the sincerest delusions of the magician have always been self-imposed to some degree.[28]

Yet, one should be able to distinguish between this sort of sincere self-delusion that we can find in the experience of traditional magic, from the "belief in bad faith" that Flusser identifies in the experience of technical images. On the one hand the "underlying consciousness of things 'not being real'" is still a blurry intuition, on the other hand the critical consciousness reached by educated people is fully developed and can only coexist with illusion if it is partially suppressed.

Why do we systematically suppress our critical and conceptual thinking and choose to be deluded? Flusser thinks that this human behavior is not only a result of our tendency to conform. The reason why we need to partially suppress our critical consciousness in order to function within society is that, at this level of complexity, conceptual thinking is no longer efficient. The point is not that people do not understand rational explanations; it is that they do not want to hear them. Commenting on how, during the 1982 Lebanon War, people formed their opinions based on videos and photos, rather than on theoretical analyses, Flusser writes:

27   J. Huizinga, Homo Ludens: *A Study of the Play-Element in Culture* (1938), trans. R.F.C. Hull (London-Boston-Henley: Routledge & Kegan Paul, 1949): 22-23.
28   M. Mauss, *General Theory of Magic* (1902), trans. R. Brain (London-New York: Routledge, 2001): 118.

We are by now sick and tired of explanations and prefer to stick to the photograph that releases us from the necessity for conceptual, explanatory thought and absolves us from the bother of going into the causes and consequences of the war in Lebanon: In the image we see with our own eyes what the war looks like. The text simply consists of instructions as to how we are to see.[29]

We suppress our conceptual thinking because of the cognitive comfort provided by technical apparatuses that calculate and build images for us. Flusser calls the state of numbness generated by this comfort the *inertia of happiness*: "It is this inertia of happiness that stands in the way of a changeover."[30]

This theory forces us to reconsider the rationalistic approach that one could at first read into Flusser's critique of deception. If our illusion is somehow self-imposed and the suppression of our critical consciousness is a reaction to the heaviness, the complexity and the abstractness of conceptual thinking, which expresses the need to expand the visual, sensory and emotional dimension of existence, we cannot simply debunk our self-delusion by rational means. The only way to overcome the negative aspects of deception is within the image world, therefore through a creative use of illusion.

Illusion as fiction

When the term "illusion" is used by Flusser with a positive connotation it has the meaning of construction or fiction. In the posthumous book *The Surprising Phenomenon of Human Communication*, where he defines the structure of communication as the infrastructure of human reality, Flusser writes that the act of communicating produces the illusion of immortality. We know, due to the suffering of our bodies, that it is an illusion: "Despite our individual and collective memories, we remain mortals. Nevertheless,

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29   V. Flusser, *Towards a Philosophy of Photography*: 62.
30   V. Flusser, *Kommunikologie weiter denken*: 210. "Es ist diese Trägheit des Glücks, die einer Umschaltung entgegensteht."

this illusion is, still, our own reality, our ontological dignity."[31] In this case illusion is a different name for sense-making, the attribution of meaning, which according to Flusser is what makes us humans.

When illusion is conceived in this constructive way, Flusser replaces the term "*täuschen*" (deceive) with the term "*vortäuschen*," which could be translated as "simulate," "feign."[32] In *Shape of Things* he defines the verb "to design" as "to concoct something, to simulate [*vortäuschen*], to draft, to sketch, to fashion, to have designs on something."[33] A simulation – this constructive form of illusion – is not about producing a copy [*Abbild*], it is about shaping a model [*Vorbild*].[34]

In "Filmerzeugung und Filmverbrauch" Flusser affirms that not only does the sequence of frames produce the illusion of movement, but the very frames are illusions, as they recreate the impression of three dimensional spaces through the two-dimensional disposition of colors. In this context "illusion" is not meant in a negative sense: Flusser is fascinated by the capacity of technical images to evoke meaningful and visual experiences from non-meaningful and often non-visual elements, such as the bits of information for digital photography.[35] Technical images have an illusionistic effect in that they evoke an impression by means of calculation.

The point-projection perspective designed by renaissance painters, the *trompe-l'œil* designed by baroque architects, the tricks designed by stage magicians produce emotional effects using rational techniques. Experimental photographers and programmers work in the same way, but

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31   V. Flusser, *The Surprising Phenomenon of Human Communication* (1975), trans. R. Maltez Novaes, D. Naves (Metaflux, 2016): 154.

32   V. Flusser, "Gärten," in *Dinge und Undinge. Phänomenologische Skizzen* (München-Wien: Carl Hanser, 1993): 46-52, 51.

33   V. Flusser, "About the word design," in *Shape of Things: A Philosophy of Design*: 17.

34   V. Flusser, "Abbild – Vorbild oder: was heißt darstellen?," in *Lob der Oberflächlichkeit* (Düsseldorf: Bollmann, 1993): 293-317.

35   Even in the case of analog photography, according to Flusser, the image could be reduced to computable elements, such as the exposure time, the focal aperture, and the ISO setting.

with more efficient tools: they can program an apparatus that will translate an alphanumeric input into a visual output.

According to Flusser, this allows for the first time for an experimental approach to image making and therefore an element of control over the visual world: a synthesis between conceptual-critical thinking and visual-emotional thinking. The word "experimental" is used in a literal sense: technical images can be used for experiments. One can insert a certain input, see what the outcome is, and consequently change the input in order to achieve a different result.

If one writes the equation of a Mandelbrot fractal in a computer in order to visualize it on the screen, one may be surprised by the outcome and therefore learn from it. The complexity of that geometrical figure where the totality is infinitely repeated in the parts could not be perfectly foreseen.

One sits in front of a keyboard, taking one dot element after another out of the memory, to fit it into an image on the screen, to compute it. This step-by-step process of extraction can be automated so that it can proceed very quickly. The images appear on the screen one after another in breathtaking speed. One can follow this sequence of images, just as if the imagination had become self-sufficient; or as if it had traveled from inside (let's say from the cranium) to outside (into the computer); or as if one could observe one's own dreams from the outside. In fact, some of the appearing images can be surprising: they are unexpected images.[36]

The idea of an experimental character of technical images could be better understood by taking into consideration Flusser's notion of *science fiction*, where he further develops the relationship between conceptual and emotional thinking. With this expression Flusser not only refers to the literary genre, to which, moreover, he

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36   V. Flusser, "A new imagination," in *Writings*: 110-116, 114. For a closer analysis of this essay and for a discussion about the idea of surprising images and the externalization of imagination, see L. Wiesing, *Artificial Presence* (2005), trans. N.F. Schott (Stanford: Stanford University Press, 2010): 98-101. See also V. Flusser, "Ein neuer Platonismus?," *kulturRRevolution*, no. 19 (1988): 6.

contributed with many charming short stories,[37] but also reflects about the deep inner connection between science as fiction and fiction as science: something that has been called a "speculative fiction."[38] Any scientific knowledge is based on the development of models and simulations that are, strictly speaking, illusions. When fiction is enhanced with the experimental exactness provided by technical images, it becomes a powerful tool to create surprising models that will allow us to think of what we are not yet able to conceive.

This is, according to Flusser, the greatest potentiality of virtual simulations: they allow us to experience – emotionally, visually, haptically – what until now we were only able to calculate; and at the same time they allow us to calculate and control experiences that until now we could only vaguely imagine. Flusser believes that virtual environments, and in general all technical images, should not be used to reproduce what already exists for recreational purposes,[39] but should "bring to virtuality" alternative worlds. Thanks to simulated environments, for example, we could be able to experience a world where all living creatures are sulfur-based instead of carbon-based – a world that,

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37   Most of Flusser's philosophical science fiction short stories can be found in the following publications: V. Flusser, *Ficções Filosóficas* (São Paulo: Edusp, 1998); V. Flusser, *Angenommen: Eine Szenenfolge* (Göttingen: European Photography, 2000); V. Flusser, L. Bec, *Vampyroteuthis Infernalis: A treatise with a Report by the Institut Scientifique de Recherche Paranaturaliste* (1987), trans. V.A. Pakis (Minneapolis: University of Minnesota Press, 2012). See also Flusser's essays on fiction: V. Flusser, "Da ficção," *O diário* (August 26, 1966); V. Flusser, "Science fiction" (1988), trans. W. Hanff, *Flusser Studies*, no. 20 (2015): 1-3, where Flusser writes about a *fantasia essata* (exacting fantasy), which he attributes to Leonardo da Vinci.

38   J. Torres, "Homo Fictor: em busca de uma ficção filosófica," *Santa Barbara Portuguese Studies* 2, no. 4 (2020): 1-12, 7. Much has been published on Flusser's theory of fiction, and science fiction in particular. See G. Salvi Philipson, "Flusser para além do ensaio: de outros modos possíveis de habitar a intersecção entre ficção e filosofia," *Flusser Studies*, no. 25 (2018): 1-17; the sixth chapter of A. Finger, R. Guldin, G. Bernardo Krause, *Vilém Flusser. An Introduction* (Minneapolis: Minnesota University Press, 2011): 109-129; P. Bozzi, "Rhapsody in blue: Vilém Flusser und der vampyroteuthis infernalis," *Flusser Studies*, no. 1 (2005): 1-20; G. Bernardo Krause, "On philosophical fiction," in R. Guldin, ed., *Das Spiel mit der Übersetzung. Figuren der Mehrsprachigkeit im Werk Vilém Flussers* (Tübingen-Basel: Francke, 2004): 119-128.

39   Flusser is extremely skeptical about the documentary function of technical images, not only because of their illusionary character (technical images can be easily manipulated), but because he questions the neutrality of any sort of documentation. Any document presents a point of view, with a system of ethical and political implications, as it were objective. See F. Restuccia, "La realtà sta nella fotografia. Autenticazioni delle immagini della guerra del Libano," *Carte semiotiche*, no. 4 (2016): 160-170.

without any technical help, we can anticipate, but not fully conceive.[40]

       Rethinking illusion as an aware and voluntary simulation allows Flusser to avoid the rationalistic approach to debunking. He realizes that visual interfaces (and even more, haptic and immersive ones) allow for experiencers to overcome their *inertia of happiness* and take part in the model making process. However, this is only possible if technical images and virtual environments are open to a strong interactive participation.[41] This way, by turning the coding process into a playful interaction, it will be possible to bridge the gap between critical and visual thinking, between the elite of programmers and the mass of consumers.

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40   V. Flusser, "Vom Virtuellen:" 70-71; V. Flusser, *Kommunikologie weiter denken*: 78. Recently Andrea Pinotti identified this approach as part of a post-human trend in VR (try to experience the world beyond the limits of the human body and mind, for example by flying as an eagle) as opposed to a humanitarian trend (VR as an empathy machine meant to move the experiencer about social issues). The main limit of the post-human approach is that it will only allow perceiving a non-human world as a human being would perceive it. A. Pinotti, *Alla soglia dell'immagine* (Torino: Einaudi, 2021): 201; see also A. Pinotti, "What is it like to be a hawk? Inter-specific empathy in the age of immersive virtual environments," in Y. Hadjinicolaou, ed., *Visual Engagements. Image Practices and Falconry* (Berlin-Boston: De Gruyter, 2020): 30-47. The best example of this post-human approach in Flusser is definitely his *Vampyrotheutis infernalis*.
41   On the (post-)political implications of Flusser's theory of participation, see M. Menon, *Vilém Flusser e la "Rivoluzione dell'Informazione": Comunicazione, Etica, Politica* (Pisa: Edizioni ETS, 2022): 172-178.

Caravaggio's gyroscope: on the two "moments" of the virtual experience

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Abstract
In the first of the Charles Eliot Norton Lectures that he gave at Harvard in 1984, Frank Stella focused on "The necessity of creating pictorial space that is capable of dissolving its own perimeter and surface plane," and claimed that "No one helped lighten this burden more than Caravaggio." At a certain point in his talk, the American artist went so far as to say that Caravaggio anticipated the invention of the gyroscope, the technological device which makes the virtual experience possible. Stella's lecture is the starting point for developing an anachronistic path through pictorial and digital media, in light of their ability to produce illusionistic effects on viewers. In particular, building on Michael Fried's theory of art and image, this paper investigates virtual experience with reference to two different moments: the "immersive" moment, in which one has the impression of stepping into the frame, and the "specular" one, where the illusionistic effects are revealed; the attraction, when sinking into an image that has become an environment, and the distancing, when the image itself beckons to us and we are invited to reflect on our position as viewers.

Keywords   Caravaggio   Frank Stella   Michael Fried

Immersion and Specularity   Virtual Reality Cinema

Introduction

I put on the headset and immerse myself in another world – in a theme park or in a refugee camp, in a disaster-stricken village or perhaps in the city of Hiroshima immediately after the launch of the atomic bomb.[1] In some cases I am a mere sightseer, while in other cases I am the "witness" to significant events. I have to enter into an empathetic relationship with those who dwell very far from me, I am expected to "put myself in their shoes" and to experience their condition "directly."[2] Yet I cannot help but realize, sooner or later, that I find myself physically in the safe spaces of a museum or a gallery, in the section dedicated to VR cinema at the Venice International Film Festival, or perhaps in the pavilion of an NGO that uses virtual reality as a form for raising public awareness on sensitive topics. No matter how effectively illusionistic this virtual environment is. Always, in the media experiences of VR cinema, something pushes me inward, draws me into the virtual environment, while, at the same time, something else pushes me out, reminding me that I am just facing an image, and bringing me back to the spatial and temporal coordinates of our physical world.[3]

This article does not intend to analyse immersive videos by trying to deconstruct the nonchalant use of the notion of "empathy" and the ideology of "transparency" that has characterized their promotion, which has already

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1 As an example of a virtual theme park experience, see "Disneyland Paris - 360 VR - Main Street," Disneyland Paris, YouTube video, 1.19, 2020, https://www.youtube.com/watch?v=RNly6mSF0-o, accessed January 10, 2023. Regarding the applications of such technology to the field of humanitarian communication, see http://unvr.sdgactioncampaign.org, accessed January 10, 2023. As for the fourth example, please refer to the official web page of the project https://www.smithsonianmag.com/innovation/new-virtual-reality-experience-drops-you-hiroshima-right-after-its-been-bombed-180968903, accessed January 10, 2023.
2 As an emblematic example of the promotional use of a term such as "empathy" and on the idea of putting oneself in another's place through VR cinema, see https://youtu.be/vAEjX9S8o2k.
3 These issues can be conceived with reference to Edmund Husserl's phenomenological lesson and the relationship among the notions of *Bildding* (the physical thing), *Bildobjekt* (image-object) and *Bildsujet* (image-subject). See E. Husserl, "Phantasy and Image Consciousness," in *Phantasy, Image Consciousness, and Memory (1898-1925). Edmund Husserl Collected Works*, vol 11 (Dordrecht: Springer, 2005). On the illusionistic forms of virtual reality, examined through a rereading of Husserl, see P. Conte, *Unframing Aesthetics* (Milan: Mimesis International, 2020): 46-52.

been the subject of several studies.[4] Rather, I would like to take up and further develop some issues present in my previous works, with the aim of opening a space for reflection on immersive technology following an anachronistic path through pictorial and digital media by referring to some concepts of art history and theory.[5]

The main objective is to focus, in analytical and theoretical terms, on the double effect of attraction and distancing described above, as structuring the experience of VR cinema. While the impossibility of fully capturing and keeping the viewers within the virtual environment has mostly been conceived as a negative limitation of such technology, in this paper I try to argue otherwise. Through the reference to a repertoire of images from the past, the aim is to describe the paradoxical character of an experience that is made up as much of attraction as of distancing. But before this can be sustained there are some intermediate steps.

After this introduction, in the second section, taking up a hypothesis advanced by Frank Stella, I explain the idea that gives the title to this paper: that Caravaggio, anticipated the invention of gyroscope technology and therefore made possible the first immersive experience in the history of Western painting. In the third, fourth and fifth sections, building on Michael Fried, I try to emphasize the two moments that characterize Caravaggio's paintings: *immersion*, the formal device that attracts within the image, and *specularity*, understood as the set of figurative and compositional elements that produce an effect of awareness on the viewer.[6] In the conclusion, I reconsider Fried's analysis and the concepts that characterize his theoretical

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4 The literature on the notion of empathy is vast and constantly evolving with reference to new technological and expressive forms. For an early critical reflection on the facile use of this concept in relation to VR cinema, see W. Uricchio, S. Ding, S. Wolozin, and B. Boyacioglu, *Virtually There: Documentary Meets Virtual Reality Conference Report* (The MIT Open Documentary Laboratory, 2016): 17-18, http://opendoclab.mit.edu/wp/wp-content/uploads/2016/11/MIT_OpenDocLab_VirtuallyThereConference.pdf, accessed January 10, 2023.
5 I refer to F. Zucconi, *Displacing Caravaggio: Art, Media, and Humanitarian Visual Culture* (Cham: Palgrave Macmillan, 2018).
6 On these two notions, which will also be referred to in the following pages, see M. Fried, *The Moment of Caravaggio* (Princeton and Oxford: Princeton University Press, 2010).

work in relation to contemporary media. What emerges is an opportunity for developing an ethic of VR: to what extent, can immersive technology facilitate the assumption of a testimonial gaze? Under what conditions can the gesture of wearing a virtual reality headset assume a critical value?

Frank Stella's hypothesis

The American artist Frank Stella is, without a doubt, someone who understands visual surfaces and media frames, their ability to offer illusionistic effects. One only has to think of his works in the 1960s, where a series of frames relentlessly squeeze against each other, leaving a small coloured square in the centre. Taking inspiration from Louis Marin's analysis of *Gran Cairo* (1962), it is fair to ask whether these squares-frames are a well or a pyramid (Fig. 1). As the French historian and theorist notes, they are "a well *and* a pyramid, but never at the same time. The eye cannot predict the necessary and the arbitrary moment of conversion in which all the serious play of the frame and its modern and contemporary figures seem to be concentrated: the play of the rhythm of presentation and representation, the play of the subject of the art of seeing and the art of describing."[7]

If we compare them to the famous example of the rabbit/duck illustration investigated by Ludwig Wittgenstein and Ernst Gombrich, Stella's paintings do not merely work on the viewers' perceptual and cognitive limits in the recognition of the figures depicted. Rather, the representational undecidability and instability of image produce a spatial effect, by modulating the relation between the observing subject and the observed object. In other words, when confronted with the rabbit/duck illustration, the viewer does not have the illusion of being confronted with a duck or rabbit coming off the page; rather, the graphic representation produces an illusionistic effect that makes it impossible to visualize the two animals at the same time. In contrast

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7 L. Marin, *On Representation* (Stanford: Stanford University Press, 2002): 372.

to that, Stella's paintings produce an illusionistic effect to the extent that they alternately draw the viewer inward – as in a well – or push him or her out, as if the surface had a pyramidal shape. Those who observe Stella's paintings are thus subjected to the rhythmic redundancy of the "opacity" of the painted frame that becomes recognizable – we might say that makes itself "transparent" – in the metaphors of the pyramid and the well.[8] In more general terms than those used by Marin, we might speak of Stella's work as a gestalt effect capable of inducing, alternately, in the viewer both the impression of attraction and that of rejection or distancing. In fact, beyond the series of concentric squares, Stella's artistic research would continue in the 1970s and 1980s by focusing on the relationship between the space

Fig. 1. Frank Stella, *Gran Cairo*, 1962, New York, Whitney Museum of American Art, purchase with funds from the Friends of the Whitney Museum of American Art; © Frank Stella/Artists Rights Society (ARS), New York.

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8 L. Wittgenstein, *Philosophical Investigations* (London: Pearson, 1973); E. Gombrich, *Art and Illusion: A Study in the Psychology of Pictorial Representations* (Princeton: Princeton University Press, 1961).

of the canvas and the pictorial space, between the surface and depth (Fig. 2).
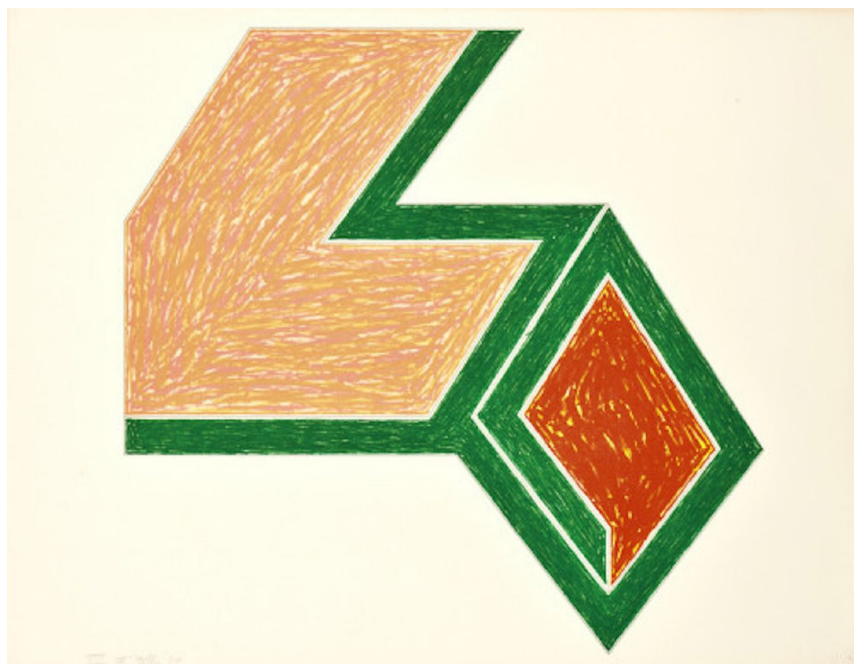
Fig. 2. Frank Stella, *Eccentric Polygon*, 1974, Jane Kahan Gallery, New York; purchased by Walter and Joan Wolf, Indianapolis, Indiana; ©Frank Stella/ Artists Rights Society (ARS), New York.

Beyond the theory of art that is implied in Stella's works, it behoves us to pay particular attention, then, to what he had to say in the first of the Charles Eliot Norton Lectures that he gave at Harvard in 1984. In developing a line of thought that sweeps from Leonardo da Vinci to Seurat, and from Vermeer to Velázquez, Stella focused on a theoretical problem that is crucial in the history of arts and images; a problem that equally concerns both "old" and "new" media. "The necessity of creating pictorial space that is capable of dissolving its own perimeter and surface plane," he says, "is the burden that modern painting was born with."[9] And immediately afterwards he goes on to state that "No one helped lighten this burden more than Caravaggio."[10]

As often happens, when artists are willing to share their theory, their tone tends to be assertive: Stella's remarks are full of ideas for creative practice but possibly a font of perplexity for art historians. Still, how can one not appreciate his attempt to concisely express the transformation

9 F. Stella, *Working Space* (Cambridge-London: Harvard University Press, 1986): 10.
10 Ibid.

that Caravaggio's painting forced on the regimes of pictorial representation of space and bodies? Stella's observations aptly describe Caravaggio's propensity for experimenting with the phenomenological limits of the idea of "realism," by creating environments in which the viewer's gaze must grope its way around, wrapped up in the composition but equally attracted by the vivid emphasis on colour, and by the chromatic nuances seen in some of the details.

Stella's reflections did not stop here. He developed his argument by examining Caravaggio's entire body of works and focuses on a few paintings. He used anachronistic terminology to highlight several aspects that prefigure artistic and technological developments that took place in the following decades as well as to identify their potentialities:

To be able to carry in our minds the space of Caravaggio's large commanding works, such as the Vatican Deposition and the Seven Acts of Mercy from Naples, we need some kind of image to help form an idea about the design and purpose of Caravaggio's pictorial space. The image that comes to mind is that of the gyroscope—a spinning sphere, capable of accommodating movement and tilt. We have to imagine ourselves caught up within this sphere, experiencing the movement and motion of painting's action. [...] The space that Caravaggio created is something that twentieth-century painting could use: an alternative both to the space of conventional realism and to the space of what has come to be conventional painterliness. The sense of a shaped spatial presence enveloping the action of the painting and the location of the creator and spectator is a by-product of the success of Caravaggio's realistic illusionism.[11]

Within a reflection on VR cinema and immersive media, it is the idea of "realistic illusionism" and even more the metaphor of the gyroscope that attracts attention. The gyroscope, invented in the 19th century by French physicist Jean Bernard Léon Foucault is still the basis of virtual reality devices. It is also thanks to it that the visors worn

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11 Ibid.: p. 11.

by viewers can track head movements and thus accurately detect movement along one, two or three axes, thus making the virtual experience possible. Without the gyroscope, there is no possible balance between the viewer's gestures and movements in the virtual environment, nor any possibility of orientation within it.

It is time to give a chance to Stella and his hypothesis that Caravaggio invented the gyroscope and with it virtual reality helmets. But I would like to develop this suggestion in a key that is not merely "technological," by investigating the forms of composition that characterize the pictorial medium and the effects they produce. To do so, it is necessary to re-conceive the American artist's hypothesis into a series of operational questions: what is or would be, exactly, in Caravaggio's painting capable of prefiguring the conditions of illusionism made possible by contemporary technologies? How do his paintings help us understand the dual effect – hitherto described as one of attraction and distancing – that we experience within immersive environments like those of VR cinema?

The two moments of Narcissus

To my knowledge, no contemporary photographer or artist has yet investigated in detail the instant when viewers put on or take off their virtual reality helmets. This is really a pity, because the image of that precise instant could make us think a lot about the potentialities of such technology. We must therefore be content with the myths of the past and their survival in our contemporary practices.

About to plunge into a virtual world, we find the figure of Narcissus. As noted by Andrea Pinotti – who has identified in Narcissus a kind of "conceptual character" of the an-iconic tradition in Western visual culture – there are two versions of the myth: the first aimed at producing a "naïve" image of the young boy who falls into the illusionistic trap of the image (recurring in Plotinus, Pausanias, Marsilio Ficino, etc.); the second coinciding with a "conscious" Narcissus (Ovidian variant), who is aware of the, so to speak,

media environment with which he is confronted and with which he is about to make one body.[12]

It matters little that the *Narcissus* painted at the end of the Sixteenth century is not a signed work by Caravaggio but only an attribution, widely discussed by art historians (Fig. 3). For the purposes of the reasoning proposed in this paper, it should be noted that the young man is already fully rapt and about to plunge into the world of image. Yet, the figure of the double reflection still reveals a gap between two representational and sensible worlds or regimes.

Fig. 3. Caravaggio (attribution), *Narcissus*, 1597-1599, Rome, Palazzo Barberini.

Explicitly taking up the terms proposed by Michael Fried, *Narcissus* constitutes an explication of the two "moments" that Caravaggio's painting produces on viewers. According to Fried – let it be said in passing: a friend

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12 A. Pinotti, *Alla soglia dell'immagine. Da Narciso alla realtà virtuale* (Torino: Einaudi, 2021): 3-6.

and one of the most important interpreter of Stella's work – Caravaggio's pictorial corpus involve a moment defined as "*immersive*, imagining the painter as so caught up, so immersed, in this phase of his work on the painting as to be less than fully aware of any sharp distinction between the painting and himself."[13] The second "'moment,' notionally instantaneous, of separating or indeed recoiling from the painting, of becoming detached from it, which is to say of no longer being immersed in work on it but rather of seeing it, taking it in, as if for the first time; I call that 'moment' *specular*, meaning thereby to emphasize the strictly visual or optical relation between the artist - viewer and the image, or image - artefact, that has just brought into being."[14]

Reading these pages on Caravaggio, thoughts evidently run to the dialectic between "absorption" and "theatricality"[15] identified by Fried himself in the painting of the eighteenth century, or to that between "art" and "objecthood"[16] as a key to theoretical and critical interpretation of the relationship between media, art and spatiality in the second half of the twentieth century. Even before the eighteenth century, well before the twentieth-century and, we might add, contemporary media experience, Caravaggio would have had the ability to reflect in an original way on the tension between the painter and his work (through the use of self-portraiture), between the canvas and the pictorial space (the composition of volumes, the relationship between light and shadow) producing unprecedented effects on viewers, now driving them inward, now pushing them outward.

Hovering between the classicism of the myth and the technological actuality of the present, *Narcissus* is a virtual allegory of the 'moment' of immersion, or perhaps I should say of absorption becoming immersion, conjoined with the strongest

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13 M. Fried, *The Moment of Caravaggio*: 39.
14 Ibid.
15 M. Fried, *Theatricality and Absorption: Painting and Beholder in the Age of Diderot* (Chicago-London: University of Chicago Press, 1983).
16 M. Fried, *Art and Objecthood: Essays and Reviews* (Chicago-London: University of Chicago Press, 1998).

possible statement of the specular separation of the viewer — originally the painter-viewer — from the painting. There is in it also the strongest imaginable thematization of mirroring as distinct from painting, another of the basic polarities that, in varying ratios and combinations, structure much of Caravaggio's art. And of course, it is a scene of hyperbolic self-portraiture, the core practice of his lifelong endeavor.[17]

Narcissus is in a sense, for the purposes of the anachronistic reasoning I am proposing here, a portrait of the exact moment when the viewer is about to put on the headset to access the virtual experience: it is in the middle, between plunging and retreating.

Within Caravaggio: immersion and reflection

Beyond the myth, the comparison between contemporary media and the tradition of western art can be developed through other Caravaggio masterpieces, in which the effect of spatial encompassment is strong. Even better, it is possible to argue that some of Caravaggio's paintings represent the virtual experience as viewed from the outside but not without investigating the effects it produces in those inside.

Let us focus on the *Taking of Christ* (1602) and *The Martyrdom of Saint Ursula* (1610). In the first of these two paintings (Fig. 4), the centre of attention is located on the left, at the point of Judas's dramatic gesture of betrayal, toward which all eyes converge, except for those of the disciple, who flees terrified toward the edge of the frame. In the second painting, considered to be the last that Caravaggio completed before his death, what is represented is the exact moment when Saint Ursula is wounded by Attila after she refuses his advances. What connects the two works, in addition to the horizontal composition and the precise staging of a dramatic event, is the presence of

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17 M. Fried, *The Moment of Caravaggio*: 139.

a figure located on the right side of each painting. This is a man shown in profile: he has a black beard and bushy eyebrows. His head is stretched up, as if he were standing on tiptoe so as to better observe the violent scene unfolding just a few steps in front of him. In the 1602 painting the man is attempting to lighten the darkness of the night and illuminate Judas's kiss by means of a lantern, which he holds in front of himself with his right hand.

This figure is of particular interest for at least two reasons. The first, which Roberto Longhi divined earlier, is that the man on the right side of the image is Caravaggio himself. This is a self-portrait, one of the many in his pictorial corpus, confirmed moreover by its reproduction – like a

Fig. 4. Caravaggio, *Taking of Christ*, 1602, Dublin, National Gallery of Ireland.

Fig. 5. Caravaggio, *The Martyrdom of Saint Ursula*, 1610, Naples, Palazzo Zevallos Stigliano.

signature – in the *Martyrdom of Saint Ursula* (Fig. 5).[18] The second reason concerns the role that this figure plays in both works. The art historian Sergio Benedetti – who has the merit of having rediscovered the original *Taking of Christ*, after years of investigation into various copies – noted that the figure of Caravaggio "is well defined and holds up a lantern, the function of which is purely compositional as it appears to throw no light, the true light source being high on the left, beyond the scene depicted."[19] In a similar way, Leo Bersani and Ulysse Dutoit noted how, in this work, "Caravaggio puts himself within the painting not in order to get closer to his historical subject but rather in order to see himself both illuminating and experiencing congested spaces."[20] Even more explicitly, Giovanni Careri identified in this self-portrait a kind of declaration of intent of the artist that invites us to reflect on our position as spectators: "I paint with light, with light I show a scene that belongs to the past, but also to the present, the armour testifies to this. I am here to see the arrest of Christ but I cannot intervene, as you spectators, witnesses safe from a violence that outrages and fascinates."[21]

By re-conceiving such analytical insights in Fried's terms, the artist's self-portrait with lantern can therefore be conceived of both as being in the process of becoming immersed in the pictorial environment and as becoming "expelled from it in a 'moment' of specularity which was to all intents and purposes the aim and purpose of that work (the establishment of the painting as a painting, as an artifact to be looked at.)"[22]

Retracing our steps to the theoretical notions structuring this paper, with these paintings we are confronted with two different and apparently contradictory effects. At first, like Caravaggio trying to observe the scene, with

18 R. Longhi, "Un originale di Caravaggio a Rouen e il problema delle copie caravaggesche," *Paragone* 121 (1960): 23-36.
19 S. Benedetti, "Caravaggio's *Taking of Christ*, a masterpiece rediscovered," *The Burlington Magazine* 135, no. 1088 (1993): 731-741, 738.
20 L. Bersani, U. Dutoit, *Caravaggio's Secrets* (Cambridge-London: MIT Press, 1998): 57.
21 G. Careri, *Caravaggio. La Fabbrica dello Spettatore* (Milano: Jaca Book, 2017): 234.
22 M. Fried, *The Moment of Caravaggio*: 217.

or without his lantern, we are pushed into the painting as a medial environment made of light and shadow. Then later, once we have searched the environment and once we have recognized the figure of the painter-witness, we are pushed outward, that is to say that we begin to reflect on the pictorial composition and on our position as viewers: in front of an image, with our feet planted on the museum's floor, in Dublin, Naples or in another city.

Putting it in anachronistic terms, one could first argue that the contemporary experiences offered by VR cinema are also characterized by an "immersive" moment: here the field of view itself coincides with a "portable lantern" located on the forehead of the spectator; a wearable lantern that illuminates a spherical space that coincides with full darkness, except for the frontal portion framed from time to time. Darkness that the VR cinema viewer will never have occasion to see or feel, except when it is diegetized in the production of a given narrative effect. At the same time, a "specular" moment, always persists: primarily in the glitches of the digital environment; in the very fact that lowering my gaze to look for my body I tend to find nothing or at least the scarcely credible simulation of arms and legs; in the presence of extradiegetic music, in all those compositional effects – whether intended or not by the video-makers – that invite us to see the image behind the simulation of a virtual environment and in so doing to "reflect" on our position as viewers.[23]

Regarding the image of the pain of others

As in many VR cinema projects, the two paintings described above are about situations of suffering or violence, scenes which invite the viewer to assume the position of a witness but in which, at the same time, it is impossible to immerse oneself completely. One painting by Caravaggio seems capable of interrogating, more than

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23 On the limits of VR cinema, through some concrete examples, see F. Zucconi, "Sulla tendenza utopica nel VR cinema," *Carte Semiotiche* 7 (2021): 118-126.

any other, the paradoxical character of virtual experience, as well as the idea of being able to experience a world and a living condition that are profoundly different from those characterizing the viewer's everyday life.

At the centre of Caravaggio's *Martyrdom of St. Matthew* (1600) is the half-naked, fully lit body of the assassin (Fig. 6). On the left, a group of men in seventeenth-century clothing recoil, trying to shield themselves from the violence. While an angel hands St. Matthew the palm of martyrdom, on the right we see the gesture of a novice walking away. In the foreground, some catechumens lying on the ground observe the scene. The composition is centrifugal: the viewer's gaze gradually moves away from the centre as it moves from one body to another. In the background, one meets a figure characterized by a particularly intense gaze who seems to stare at the act of violence before his eyes. This is the bearded man leaning out from the black background behind the assassin. Again, that man is Caravaggio. Also in this large painting, the painter portrays himself in the role of a witness to a violent act.

Those who would try to go even further in their analysis might go so far as to argue that what Caravaggio painted in *The Martyrdom of St. Matthew* is not simply a self-portrait, but a "self-portrait as painter." To support this hypothesis, I would like to emphasize the inclination of the figure's head to the side to observe the scene as if he had a canvas in front of him (Fig. 7). One could also conceive of the left hand reaching forward as a transfiguration of the palette, while the right hand holds the brush. The artist's sad gaze might then be re-conceived as a concentrated, absorbed gaze. If this were the case, it would be an anticipation of some of the traits that characterize the extraordinary visual *dispositif* that is *Las Meninas* (1656) by Diego Velázquez, notoriously and masterfully analysed by Michel Foucault in *The Order of Things*:

Now he [the painter] can be seen, caught in a moment of stillness, at the neutral centre of this oscillation. His dark torso and bright face are half-way between the visible and the invisible: emerging from
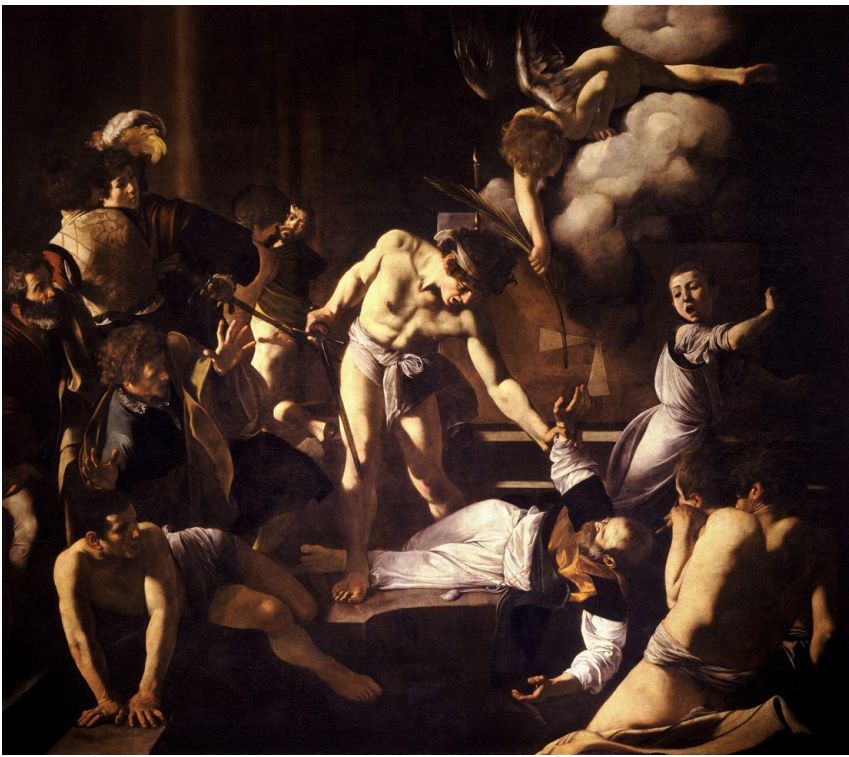
Fig. 6. Caravaggio, *The Martyrdom of St. Matthew*, 1600, San Luigi dei Francesi Church, Rome.
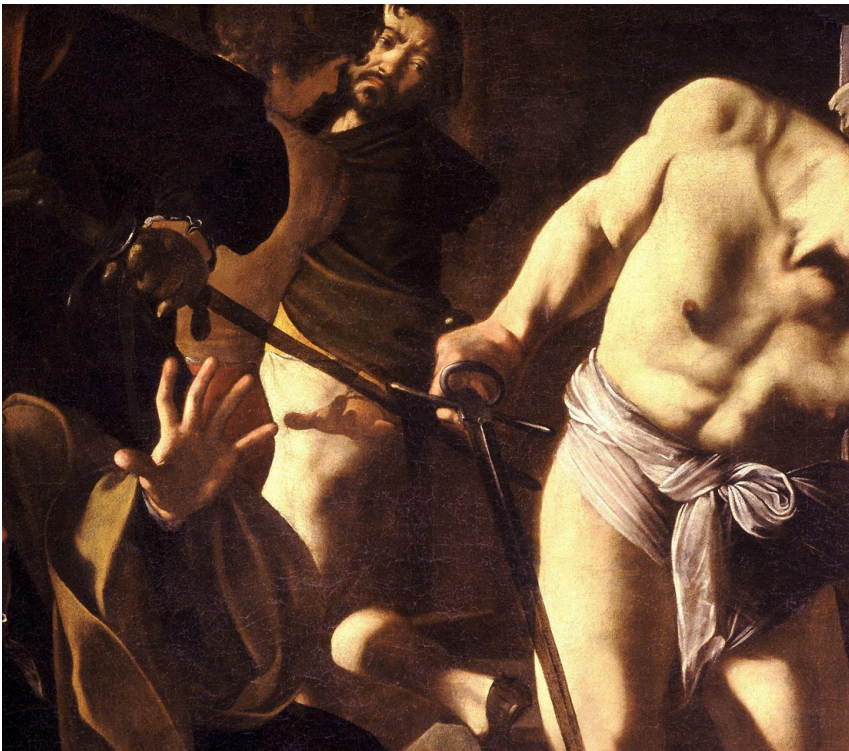
Fig. 7. Caravaggio, *The Martyrdom of St. Matthew*, 1600, Rome, San Luigi dei Francesi Church. Detail.

that canvas beyond our view, he moves into our gaze; but when, in a moment, he makes a step to the right, removing himself from our gaze, he will be standing exactly in front of the canvas he is painting; he will enter that region where his painting, neglected for an instant, will, for him, become visible once more, free of shadow and free of reticence.[24]

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24 M. Foucault, *The Order of Things: An Archaeology of the Human Sciences* (1966) (London-New York: Routledge, 2002): 4.

In both Velazquez's and Caravaggio's master-piece, the self-portrait takes on a theoretical and critical function; they are within the painting and, at the same time, they explicitly invite the viewer to reflect on visual representation, on the point of view that structures it and on the limits of the composition.[25]

This may seem a bold interpretation. Yet, looking closely at the figure of Caravaggio, it can be argued that the image presented in *The Martyrdom of St. Matthew* is not only an image of self "regarding the pain of others" but also and at the same time – turning Susan Sontag's famous expression – an image of self "regarding the image of the pain of others."[26] If in the *Taking of Christ* and *The Martyrdom of St. Ursula* the self-portrait is first and foremost functional in expressing an idea of immersion of the painter-witness in the pictorial event – a closure and full autonomy of the pictorial as an "immersive environment" – in *The Martyrdom of St. Matthew* there is a shift that calls into question the composition of the image and the effect of immediacy of representation. Reading Fried again, this is a work "in which a Caravaggio *semblable* at once rushes to leave the painting and looks back in evident distress, thereby enabling the viewer to recognize his characteristic features on the far threshold of the depicted space."[27] It is not so much or simply that the figure depicting the painter seems about to leave the scene but, as the art historian and theorist writes with great acumen, "rushes to leave the painting" and pushes the viewer's gaze to the threshold of the image. If the self-portraits of 1602 and 1610 tend to provoke an identification between painter and viewer and reinforce the effect of immersion, that of *The Martyrdom*

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25 For a more in-depth reflection on this painting and on the modernity of Caravaggio's self-portrait, capable of activating paths of critical reflection on contemporary media and visual culture, see F. Zucconi, "Regarding the image of the pain of others: Caravaggio, Sontag, Leogrande," *Humanities* 11 (2022), 44. https://doi.org/10.3390/h11020044.
26 The reference is to the title and thoughts developed in the famous book by S. Sontag, *Regarding the Pain of Others* (New York: Picador, 2003).
27 M. Fried, *The Moment of Caravaggio*: 209.

of St. Matthew traces the effect of immediacy back to the pictorial composition that produces it.

As Sontag herself points out in the above-mentioned book, from the seventeenth century to the tradition of twentieth-century reportage, a self-portrait of the painter, photographer, or director is certainly not enough to validate the authenticity and effectiveness of the testimony or its ethical value. The risk of a self-referential drift, even a "narcissistic" tendency, is also discernible behind this trend: why represent ourselves when we are faced with the pain of others? Rather than glibly promote all self-reflexive tendencies, the self-portrait of Caravaggio in *The Martyrdom of Saint Matthew* is useful and interesting to the extent that it is a manifestation of the fact that, despite its illusionistic realism, it remains an image among many other possible images of this event and does not claim to coincide with it and reproduce it through the media for the viewer's benefit.

The self-portrait on the threshold thus becomes a way to intensify the "specular moment" or, in other terms, to underline the fact that even during the more immersive virtual experience, we are just facing an image, a very well structured one. On the one hand, with his gaze, Caravaggio invites the viewer to immerse himself in an encompassing pictorial image; on the other hand, with his positioning and posture, he leads the viewer to observe the theatricality of the scene from another point of view, to analyse it as seen from the outside.

Attraction and distancing

Picking up the thread, Stella's hypothesis was taken up and developed in this paper as a theoretical and analytical metaphor, certainly not in mere technological terms. If the gyroscope fitted in virtual reality helmets makes possible the stable connection between the movements we actually make in the physical world and those in the world of images, talking about Caravaggio's gyroscope meant reflecting on the strategies of producing illusionistic and counter-illusionistic effects, on the balance between the

"immersive" and "specular" moments. Reference to the theoretical and methodological notions proposed by Michael Fried thus made it possible to observe the co-presence of such moments or, rather, such spectatorial effects that persist, by transforming, from the history of Western painting to contemporary immersive devices. Through reference to Susan Sontag's critical theory of photography, it was thus possible to propose a hypothesis for an ethical and political approach to VR. In particular, what has emerged is that the co-presence of illusionistic and counter-illusionistic effects does not constitute a weakening of the experiential and testimonial value of immersive experience. On the contrary, a conscious ethical and political approach to VR seems to be able to develop precisely by making viewers feel the threshold between the environment in which they are physically situated and the virtual one. This is why it is not necessary to rely on technological implementations devoted to perfecting, once and for all, the immersive character of VR cinema and other technological devices. While the slogans that accompanied the launch of many virtual reality projects relied on the simplistic use of the notions of "empathy," "compassion," and "immersion" in a geographical elsewhere, the most interesting aspect of such technology seems to involve its capacity to produce both identification and estrangement.

Like Caravaggio observing the Martyrdom of Saint Matthew, even the gap between the physical world, in which the viewer is placed, and the virtual one can be re-conceived in positive terms within artistic experimentations capable of reflecting critically on the asymmetrical relations between the observer and the observed, between the *here* in which we find ourselves and the *elsewhere* of which we claim to have "direct" experience. In fact, the very ideas of virtual "presence" must be conceived as a media effect, resulting from specific compositional and

technological determinations capable of modulating the relationship between subject and environment.[28]

Examples of artistic projects aimed at investigating such limits are few, but their number is certainly growing. The survey and in-depth study of such experiments exceeds the specific objectives of this paper. To name but one – the most important, and often-addressed[29] – the installation *Carne y arena* (2017) by Alejandro González Iñárritu seems precisely to spur spectators into experiencing their own awkward extraneousness and powerlessness toward a group of refugees from Mexico who are trying to cross over the border to the United States (Fig. 8). Iñárritu's subtitle for the installation – "Virtually present, physically invisible" – expresses, perhaps, the urgent need to tackle the paradoxical character of virtual experience.

Beyond Caravaggio, building on the analysis and concepts elicited by his painting, the field of experimentations of VR cinema and, more generally, virtual reality seems to be able to develop only by taking into account the co-presence of the different moments or effects that define our relationship with such media. Of course, in contemporary virtual experiences, the viewer never has the opportunity to mirror himself or herself, that is, to see his or her own image reflected inside the media environment. The notion of "specularity" as understood in *Narcissus* and Caravaggio's self-portraits seems in this sense to lose relevance. But at this point it should be clear that this notion

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28 On this point, see V. Catricalà, R. Eugeni, "Technologically modified self–centred worlds. Modes of presence as effects of sense in virtual, augmented, mixed and extended reality," in F. Biggio, V. Dos Santos, G.T. Giuliana, eds., *Meaning-Making in Extended Reality* (Roma: Aracne, 2020): 63-90. For reflection in the different forms of exposure, interactivity and modes of presence, see R. Eugeni, *Capitale algoritmico. Cinque dispositivi postmediali* (*Più Uno*) (Brescia: Morcelliana, 2021): 127-174.

29 For an analysis of Iñárritu's installation, see P. Montani, *Tre Forme di Creatività: Tecnica, Arte, Politica* (Napoli: Cronopio, 2017): 132-138; A. D'Aloia, "Virtually present, physically invisible: virtual reality immersion and emersion in Alejandro González Iñárritu's *Carne y Arena*," in *Senses of Cinema* (June 2018), http://sensesofcinema.com/2018/feature-articles/virtually-present-physically-invisible-virtual-reality-immersion-and-emersion-in-alejandro-gonzalez-inarritus-carne-y-arena/, accessed January 10, 2022; A.C. Dalmasso, "The body as virtual frame. Performativity of the image in immersive environments," *Cinéma & Cie* 19, no. 23 (2019): 101-119; L. Acquarelli, "The spectacle of re-enactment and the critical time of the testimony in Inarritu's *Carne y Arena*," in F. Aldama, A. Rafele, eds., *Cultural Studies in the Digital Age* (San Diego: San Diego University Press, 2020): 103-118; R. Diodato, *Image, Art, and Virtuality: Towards an Aesthetics of Relation* (Cham: Springer, 2021): 72-74.

expresses not so much or only the mirroring of one's own image, but the possibility of observing and reflecting on the relationship between subject and environment, between what separates us and what binds us to the image.

Fig. 8. Alejandro González Iñárritu, *Carne y arena*, 2017. ©Emmanuel Lubezki/Alejandro González Iñárritu

To avoid any misunderstanding, let me propose, in conclusion, to call these moments by two very simple terms that I also used in the introduction: *attraction* and *distancing*, where – as in the case of the oppositions proposed by Fried – the second term encompasses the first, constituting a form of meta-reflection on the forms of artistic and media experience.[30] In this sense, attraction defines the concave side of images, the one capable of becoming environment and drawing the viewer to show solidarity with them. On the other hand, distancing expresses the convex side or the modular spatiality of images, the one pointing at the viewer as such and forcing him or her to reflect on his or her own position, on the complex character of every experience. Whether such terms are convincing or not, the articulation of the two "moments" seems to define the ethical and political limits of both old and new immersive

30 For a reflection on the notion of "distance" in the field of media studies, I refer to the introduction and the various contributions in M. Treleani, F. Zucconi, eds., "Remediating Distances," *IMG Journal* 3 (2020).

technologies. Hence the need to keep the door of art history open, imagining an anachronistic approach and aiming for artistic experimentations poised between different media, between two different moments.

Adventures beyond anthropocentrism in virtual reality art

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"Imagine an eye unruled by man–made laws of perspective, an eye unprejudiced by compositional logic, an eye which does not respond to the name of everything but which must know each object encountered in life through an adventure of perception"[1]

Abstract

In the following essay, I consider if and how VR's uncanny ability to create an illusion of presence and generate a sense of body ownership might be used to go beyond our anthropocentric perspective, towards non-human experiences. By adventuring outside the domain of human experience, my goal is to address the affordances and limitations of VR's illusionistic potential. Knowing full well that certain economic pressures preclude artists from pursuing the kinds of provocations I describe in this essay, I nevertheless invite readers to follow along as I explore alternative potentialities of contemporary VR. Specifically, I approach VR here in the hopes of finding ways of engaging with different bodies, spaces, and realities, even if illusorily.

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1   S. Brakhage, "From *Metaphors on Vision*," in P.A. Sitney, ed., *The Avant-Garde Film: A Reader of Theory and Criticism* (New York: Anthology Film Archives, 1978): 120.

Introduction

Many things have changed between the original heyday of virtual reality (VR) in the 1980–1990s and the current revival of the technology since the early 2010s. But while today VR might benefit from the leaps and bounds computers and graphic technologies have witnessed in the intervening decades, and while it might enjoy greater commercial success than ever before, I often feel our imagination around the kinds of experiences enabled by VR has suffered somewhat. We are far removed today from Meredith Bricken's suggestion that in VR: "You can be the mad hatter or you can be the teapot; you can move back and forth to the rhythm of a song. You can be a tiny droplet in the rain or in the river."[2] Likewise, we seem to have strayed from Jaron Lanier's proposition that in virtual reality, "you can visit the world of the dinosaur, then become a Tyrannosaurus. Not only can you see DNA, you can experience what it's like to be a molecule."[3] While Jay David Bolter and Richard Grusin use these two quotes to highlight the illusion of "perceptual immediacy"[4] of immersive virtual reality experiences, I see in these statements something else entirely more interesting: the idea that VR might give us experiences that far exceed the limits of human understanding.

In the following essay, I consider if and how VR's uncanny ability to create an illusion of presence and generate a sense of body ownership might be used to go beyond our anthropocentric perspective, towards non-human experiences. By adventuring outside the domain of human experience, my goal is to address the affordances

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2   M. Bricken, "Virtual worlds: no interface to design," in M. Benedikt, ed., *Cyberspace: First Steps* (Cambridge MA: MIT Press, 1991): 363-382, 372.
3   S. Ditlea, "False starts aside, virtual reality finds new roles," *New York Times* (March 23, 1998): 97.
4   J. Bolter, R. Grusin, *Remediation: Understanding New Media* (Cambridge MA: MIT Press, 2000): 22.

and limitations of VR's illusionistic potential. In so doing, I also aim to explore how VR might be thought of as more than a means to foster empathy for other human beings, whatever the purpose for that endeavour might be.[5] This allows me to discuss immersive technologies and experiences in a context devoid of the problems typically associated with discourses around the concept of "empathy machine."

I begin this essay by addressing the illusion of presence in VR, specifically as it relates to our experience of body-space relations in physical reality. I start by addressing what I argue to be the fundamental anthropocentrism of VR's dominant mode of experience. This crucial detour has me discussing whether VR is capable of representing non-human modes of being in the world. Necessarily, this also means addressing earlier thought experiments in the field of psychology, biology, and philosophy that sought to question "what it is like to be" something other than human. Having done so, I then consider whether VR might have the ability to give us access to non-human realities, or whether it is limited by a fundamental anthropocentrism. Finally, I

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5   On the issue of empathy in VR, see J.H. Murray, "Not a film and not an empathy machine," *Immerse* (October 6, 2016): https://immerse.news/not-a-film-and-not-an-empathy-machine-48b63b0eda93, accessed January 10, 2023; S. Gregory, "Immersive witnessing: from empathy and outrage to action," *WITNESS* blog (2016), https://blog.witness.org/2016/08/immersive-witnessing-from-empathy-and-outrage-to-action/, accessed January 10, 2023; G. Bollmer, "Empathy machines," *Media International Australia* 165, no. 1 (2017): 63-76, https://doi.org/10.1177/1329878X17726794; R. Yang, "If you walk in someone else's shoes, then you've taken their shoes: empathy machines as appropriation machines," *Radiator Blog* (April 5, 2017), https://www.blog.radiator.debacle.us/2017/04/if-you-walk-in-someone-elses-shoes-then.html, accessed January 10, 2023; H. Farmer, "A broken empathy machine," *Immerse* (September 30, 2019), https://immerse.news/a-broken-empathy-machine-can-virtual-reality-increase-pro-social-behaviour-and-reduce-prejudice-cbcefb30525b, accessed January 10, 2023; P. Roquet, "Empathy for the game master: how virtual reality creates empathy for those seen to be creating VR," *Journal of Visual Culture* 19, no. 1 (2020): 65-80, https://doi.org/10.1177/1470412920906260; L. Nakamura, "Feeling good about feeling bad: virtuous virtual reality and the automation of racial empathy," *Journal of Visual Culture* 19, no. 1 (2020): 47-64, https://doi.org/10.1177/1470412920906259; G. Bollmer and K. Guinness, "Empathy and nausea: virtual reality and Jordan Wolfson's *Real Violence*," *Journal of Visual Culture* 19, no. 1 (2020): 28-46, https://doi.org/10.1177/1470412920906261.

look at experiments relating to illusions of body ownership in VR, specifically as they relate to non-human bodies.

As will become abundantly clear over the course of this essay, my goal is speculative—perhaps even provocative—rather than earnest. I write this text as an exercise in exploring what I perceive to be a bias towards anthropocentrism in VR, a medium which has so often been lauded for its ability to simulate otherwise impossible realities.[6] Readers may also see this as a call to action to VR designers and consumers to open their minds to the possibilities offered by contemporary immersive technologies beyond those practices that currently dominate the market. Knowing full well that certain economic pressures preclude artists from pursuing the kinds of provocations I describe in this essay, I nevertheless invite readers to follow along as I explore alternative potentialities of contemporary VR.[7] Specifically, I approach VR here in the hopes of finding ways of engaging with different bodies, spaces, and realities, even if illusorily.

Virtual reality environments: immediacy and presence

It has become something of a truism to recognize that VR is able to foster a sense of presence, that is, the impression of "being there" in a virtual environment distinct from the physical environment that one's body is also occupying. Or, as Mathew Lombard *et al.* put it, presence

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6   I maintain that VR is currently driven by profoundly anthropocentric forces, despite the "anti-anthropocentric drive which," according to Andrea Pinotti, "currently characterises not only the VR world but contemporary visual culture, in various mediums, more generally." A. Pinotti, "What is it like to be a hawk?," in Y. Hadjinicolaou, ed., *Visual Engagements: Image Practices and Falconry* (Berlin: De Gruyter, 2020): 30-47, 44, https://doi.org/10.1515/9783110618587-003. See also R. Grusin, *The Nonhuman Turn* (Minneapolis: University of Minnesota Press, 2015).
7   I also want to recognize that there are the effects of VR are not currently fully known and that much more work must be done to ensure current VR technologies are accessible and ethical. These pressing issues certainly deserve more attention before we can move towards more elaborate explorations of the outer limits of VR.

describes, "the perceptual illusion of non-mediation."[8] In this context, the perceived lack of mediation is predicated on VR's ability to foster a convincing illusion of a space that reproduces the way we see the world in our daily lives: as a three-dimensional volume in which our bodies can move and act. And while on their own the affordances of head-mounted displays (HMD) could be used to create any number of effects and illusions, the dominant practice of contemporary immersive media has been to reproduce our habitual modes of (visual) perception: looking ahead from an upright position through a pair of eyes which we can move around (either in their orbits, by moving our head, or our body) to see the surrounding environment.

In an earlier essay, I described VR as inherently subjective, following Jonathan Crary's incisive discussion of "subjective vision."[9] By extension, I would also argue its default mode of experience–that for which it was designed and that which is dominant to this day–is also intrinsically *anthropocentric*. This is because "subjective," in this context, refers to the idiosyncrasies of human vision.[10] By the same token, I describe an apparatus which relies on these unique and fallible qualities of perception as subjective. In the case of VR, the HMD hinges upon the following subjective qualities of human vision: its binocularity, its "egocentric" perspective, and the individual's ability to move their point of view on the world through six degrees of freedom of movement along three dimensions. Here, egocentrism describes an approach to body-space relations

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8   M. Lombard, T. Ditton, "At the heart of it all: the concept of presence," *Journal of Computer-Mediated Communication* 3, no. 2 (1997), https://doi.org/10.1111/j.1083-6101.1997.tb00072.x.
9   P. Bédard, "La machine subjective? Les appropriations cinématographiques des dispositifs immersifs contemporains," *Canadian Journal of Film Studies* 28, no. 1 (2019): 66-92, 74, https://doi.org/10.3138/cjfs.28.1.2019-0012; J. Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge MA: MIT Press, 1992).
10   See again J. Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*.

which take the individual as a point of reference.[11] In other words, the egocentric perspective considers the human body as a "pivot around which the three dimensions of spatial extension arrange themselves and from which they ultimately proceed."[12] This could just as easily be called *anthropocentric*.

I continue to subscribe to the idea that VR's apparatus and the default mode of experience it proposes are subjective, egocentric, and anthropocentric. That is because in most cases, the illusion of presence fostered by immersive virtual environments plays off this characteristic centrality of our body in our perception of space. Head-mounted displays become viewports into different and often completely fantastical realities, but these spaces are still explored from an egocentric perspective, with the body as invariable centre of gravity. If we assume the goal of most virtual reality experiences is to create a satisfying illusion of presence in a virtual environment–whatever the purpose for that may be–it makes perfect sense why this strategy has remained so dominant. However, this is not the only avenue. As an example, a slew of recent (flat) video games have embraced the affordances of their medium's monocular perspective to create fascinating optical illusions and truly impossible body-space relations. The worlds explored in *Antichamber* (Demruth, 2013), *Superliminal* (Pillow Castle Games, 2019), *Manifold Garden* (William Chyr, 2019), *Spaceflux* (Colin Ardelean, 2020), *Hyperbolica* (CodeParade, 2022), and *Parallelia* (SincArt Studio, 2022) exceed our natural conception of space by presenting all manner of physically impossible environments: non-Euclidean, hyperbolic, fractal, etc. In so doing, they draw more inspiration from M.C. Escher's depictions of space than

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11   W.R. Sherman, A.B. Craig, *Understanding Virtual Reality: Interface, Application, and Design* (San Francisco: Morgan Kaufman Publishers, 2003): 296.
12   E.S. Casey, *The Fate of Place: A Philosophical History* (Berkeley: University of California Press, 1997): 208. Emphasis added.

from what we find in Leon Battista Alberti's theorization of renaissance perspective. What if VR were to also stray from the beaten path and indulge in such perspectival fancies?

In the contemporary immersive media landscape, precious few experiments with non-anthropocentric spaces have surfaced–at least to my knowledge.[13] In mid-2020, Diego Montoya shared Spacetime, which he described as a "special relativity VR simulation." The experiment allows users to explore a room where the speed of light is much slower than usual: "You can experience space contraction, time dilation and light Doppler effects as you move"[14] (Fig. 1a and 1b). Among various physical distortions the experience enables–all of which are impossible to encapsulate in written form–the designer explains that "[t]he world feels very 'wobbly' when moving very close to the speed of light, almost liquid." While space remains

Fig. 1a

13 I discuss the limits of any analysis of contemporary virtual reality in P. Bédard, "La machine subjective? Les appropriations cinématographiques des dispositifs immersifs contemporains."
14 D. Montoya (@diego_montoya _), "I built a special #relativity VR simulation for @oculus Quest, where the speed of light c is much lower than usual. You can experience space contraction, time dilation and light Doppler effect as you move. 1/n," Tweet, August 7, 2020, https://twitter.com/diego_montoya_/status/1291745102700765184, accessed January 10, 2023.
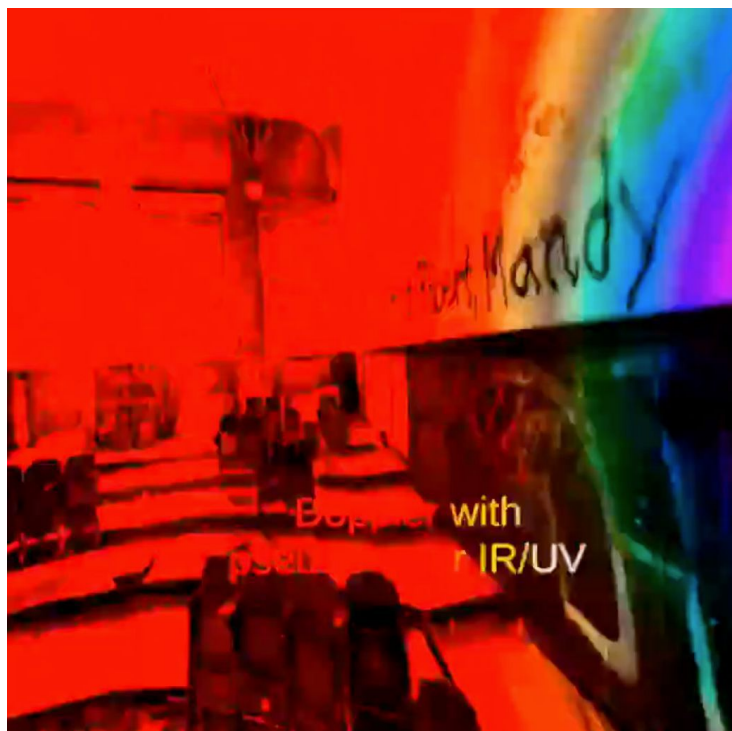
Fig. 1b

Fig. 1a and 1b. Diego Montoya, *Spacetime*, 2020

three-dimensional in Spacetime, the user's relations to that space far exceed the limits of our habitual modes of perception. With that said, I would hesitate to say that they exceed anthropocentrism, since the transformations that space undergoes throughout the experiment result from the user's movements. Space is not transformed. Our perception of it is.

As with the earlier quoted videogames, Montoya's project is the exception rather than the norm. Indeed, I still believe that as long as VR remains tied to the three or six degrees of freedom model of spatial engagement which takes the body as its centre, there is little it can do to avoid this egocentric mode of experience. With that said, nothing is keeping VR designers from creating virtual environments which are abstract rather than representational.[15] In other words, perhaps the solution to exceeding anthropocentric perspectives in VR might be to reject the notion of "perspective" altogether. However, doing so might

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15   An example I recently encountered would merit further attention in this regard. In *Lockdown Dreamscape* (Nicolas Gebbe, 2022), an innovative visual process was used to distort the image such that objects seemed to meld into one another. A slow movement through the distorted space led me to discover novel spatial relations. The experience was at once nauseating and thrilling.

require more nuanced explorations of the affordances of virtual bodies. It might also ask that we question "what it is like to be" non-human, and whether VR is at all capable to furnish an answer to that question.

What it is like to be [   ]

Whether it has been asked about animals, insects, or "things" in general, the question of "what it is like to be" this or that–whatever it may be–recognizes that our perspective as human animals is limited and distinct enough from other forms of being to preclude us from knowing or even understanding them.[16] The reality behind this seemingly impassable chasm between ourselves and others is made clear through the concept of *Umwelt*, as theorized by Jakob von Uexküll. While it is true that all things (living or otherwise) occupy the same physical reality, Von Uexküll introduces the notion of *Umwelt* to suggest that all beings do not necessarily share the same environment or *world*.[17] The sensorial attunement of different animals varies to such a degree that the very meaning of "world" differs from one creature to another.

The word *Umwelt* can be translated as "self-centred world." This suggests the inherently subjective or egocentric nature of a given entity's particular version of, and relation to, a world. This interpretation of *Umwelt* as "self-centred" or "subjectively-perceived" world is made even more evident when looking at the notion of subjectivity itself, understood here as that which is exclusive to a given

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16   This has far-reaching implications within debates on the notion of empathy in virtual reality.
17   J. von Uexküll, *A Foray into the Worlds of Animals and Humans with A Theory of Meaning* (1934), trans. J.D. O'Neil (Minneapolis: University of Minnesota Press, 2010). The ties between von Uexküll's *Umwelt* and VR have been highlighted by Andrea Pinotti in an illuminating chapter. See Pinotti, "What is it like to be a hawk?"

individual (i.e., subject).[18] Indeed, as Maike Sarah Reinerth and Jan-Noël Thon define it, "subjectivity" designates that to which an individual has privileged access. While this definition of subjectivity does satisfyingly describe the exclusive character of Umwelt, the parallel breaks down when we realize subjectivity is most often discussed in terms of the unique way in which a given subject "sees" things. The reason for this breakdown has far-reaching implications, specifically when it comes to the non-anthropocentric aims of this essay.

Where the concept of *Umwelt* shines and where the questions of "what it is like to be" something other than human come into play is precisely when the human sensorium–of which sight is often taken to be the most privileged example–is no longer sufficient. Von Uexküll with his famous study of the tick, Thomas Nagel with his example of the bat, and Ian Bogost in his *Alien Phenomenology* all focus on the worldly experience of insects, animals and things that are commonly understood as blind–that is, when sight is understood from an anthropocentric perspective.[19] What drives these thinkers, then, is precisely to understand how these creatures sense, navigate and exist in a version of the world that is completely different from that of humans, even though we might inhabit the same spaces at any given time. How does the world of the bat differ from ours when its primary mode of experience is defined by its use of echolocation? How is the tick's experience of the world influenced by its reliance on sensing the heat, fur, and butyric acid that signify the presence of its main prey, namely mammals? How different is the world for things

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18   M.S. Reinerth, J.N. Thon, eds., *Subjectivity Across Media: Interdisciplinary and Transmedial Perspectives* (New York: Routledge, 2017). For a more sustained discussion of subjectivity in VR, see P. Bédard, "La machine subjective? Les appropriations cinématographiques des dispositifs immersifs contemporains."
19   T. Nagel, "What is it like to be a bat?," *The Philosophical Review* 83, no. 4 (1974): 435-450, https://doi.org/10.2307/2183914; I. Bogost, A*lien Phenomenology, or, What It's Like to be a Thing* (Minneapolis: University of Minnesota Press, 2012).

whose very mode of existence would even preclude us from describing them has "experiencing" the world?

   "When we ask *what it means to be something*," Bogost summarizes, "we pose a question that exceeds our own grasp of the being of the world."[20] In brief, these ask that we set aside our privileged modes of experience for a moment and engage–even if imaginatively–with other realities parallel and equal to our own. My interest in asking these questions in the context of an essay on virtual reality, then, comes from the fact that I see it as a tool for exploring and perhaps even exceeding the limits of anthropocentric perspectives.[21] Indeed, while Reinerth and Thon remark upon the impossibility of accessing the subjectivity of others *per se*, the editors also suggest that media of all kinds (from literature, to movies, to games, etc.) can succeed in fostering a sense of *intersubjectivity*. This process could also be called empathy, namely "the ability to share and understand the experiences of others," or, as Kate Nash defines it, "an affective response grounded in an imaginative engagement with the experience of the other."[22] Whether we call it intersubjectivity or empathy, the belief behind these concepts is that different media can make use of their unique affordances to suggest to users how a given character might subjectively perceive a given event or experience. Can VR overcome its fundamental anthropocentrism and help users imaginatively project themselves in the experiences of others, precisely when these exceed their habitual range of possible experiences?

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20 I. Bogost, *Alien Phenomenology, Or, What It's Like to be a Thing*: 30. Original emphasis.
21 Pinotti might say that this desire to exceed anthropocentrism is itself anthropocentric, as it posits humans as having an exceptional capacity to access other modes of being in the world, which other creatures do not possess. See Pinotti, "What is it like to be a hawk?".
22 H. Farmer, "A broken empathy machine," K. Nash, "Virtual reality witness: exploring the ethics of mediated presence," *Studies in Documentary Film* 12, no. 2 (2018): 119-131, 124, https://doi.org/10.1080/17503280.2017.1340796.

Accessing non-human realities through technology

An initial response to this last question might be that it cannot. Because VR HMDs are (predominantly) audiovisual devices and because they are tuned to the human sensorium, they cannot, by definition, make us see and hear more than what our eyes and ears can perceive normally.[23] As Andrea Pinotti adroitly explains, such attempts to represent non-human realities through technology:

[...] cannot patently hope to escape Nagel's caveat. Since they are visually rendered on a screen, a compound-eye vision, a left-right-eye independent vision or an infrared vision will always be visions processed by a human eye-brain system. Human species-specific organisation operates as a physiological and phenomenological a priori that cannot simply be bypassed. This is, of course, true also for any sort of VR simulation of non-human ways of experiencing the world: they all ultimately have to be processed by such human a priori.[24]

This makes it seemingly impossible for HMDs to exceed our typical senses of sight and hearing, to say nothing of being able to use it to go beyond our ordinary perceptual habitus and perceive the world as a bat, tick, or other creature might. But does it mean VR cannot help us *imagine* what the world might look like to a different being?

The fact is that we already use tools in our daily lives that make visible to us phenomena to which our eyes and ears are not sensitive. The clock makes visible

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23   To that effect, "[David] Eagleman has noted that the part of the electromagnetic spectrum that is visible to humans is less than a ten-trillionth of the electromagnetic field, and therefore much goes undetected in our lives apart from a 'shockingly small fraction of the surrounding reality." L. Jarvis, "Body-swapping: self-attribution and body transfer illusions (BTIs)," in *Immersive Embodiment: Theatres of Mislocalized Sensation* (Cham: Springer International Publishing, 2019): 99-154, 113. See also D. Eagleman, "The Umwelt," in J. Brockman, ed., *This Will Make You Smarter* (London: Doubleday, 2012): 143-145.
24   A. Pinotti, "What is it like to be a hawk?:" 46.

the passage of time, while other instruments transform a range of different extrasensory stimuli into visible data (e.g., spectrometer, barometer, Geiger counter, Magnetic Resonance Imaging scanner, etc.). Through these tools, we can gain access to phenomena that are strictly speaking "invisible," yet which become visible all the same thanks to the appropriate apparatus. Having been made visible, these phenomena are not necessarily *legible* to all. As Don Ihde explains, the relation with the world in which we enter when using such tools is *hermeneutic*, meaning it requires that we possess the knowledge and skills necessary to *interpret* the data presented to us through these instruments; one must know how to speak the machine's language, and to *read* the world through it.[25]

Thinking of VR as a tool to engage hermeneutically with aspects of the world which we cannot naturally perceive is one possible avenue for thinking of it as a way to exceed the anthropocentric perspectives to which it has generally been relegated. We can see traces of this approach at play in several projects by the artist collective Marshmallow Laser Feast (MLF), notably in *In the Eyes of the Animal* (2015), *Treehugger: Wawona* (2016), and *We live in an Ocean of Air* (2018). In each of these projects, the artists use "terrestrial laser scanners" to create what are commonly known as "point clouds." The density and colour of these clouds can be changed to create more or less detailed pointillist representations of physical spaces. MLF uses these to translate ways of "seeing" or being in the world that are in excess of human understanding. The

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25   "Hermeneutic relations," Evan Selinger explains, "do not amplify or replicate the body's sensory abilities; instead, they engage our linguistic and interpretative aptitudes. In this context, technologies that facilitate hermeneutic relations are best understood as being 'text-like'; their effective utilization requires interpretation through the activity of reading." E. Selinger, *Postphenomenology: A Critical Companion to Ihde* (New York: SUNY Press, 2012): 5. An example that is closer to art and illusion might be anamorphosis. To see the anamorphosis hidden in an image, viewers must know how to position themselves in such a way as to reveal the image. See D.L. Collins, "Anamorphosis and the eccentric observer: inverted perspective and construction of the gaze," *Leonardo* (1992): 73-82, https://www.jstor.org/stable/i270958.

effect lies halfway between scientific imagery and impressionism, as sparse arrays of point clouds leave much to the viewer's imagination. *In the Eyes of the Animal*, for example, puts its viewers in the eyes of four different animals and insects (owl, frog, dragonfly, and mosquito), each with its
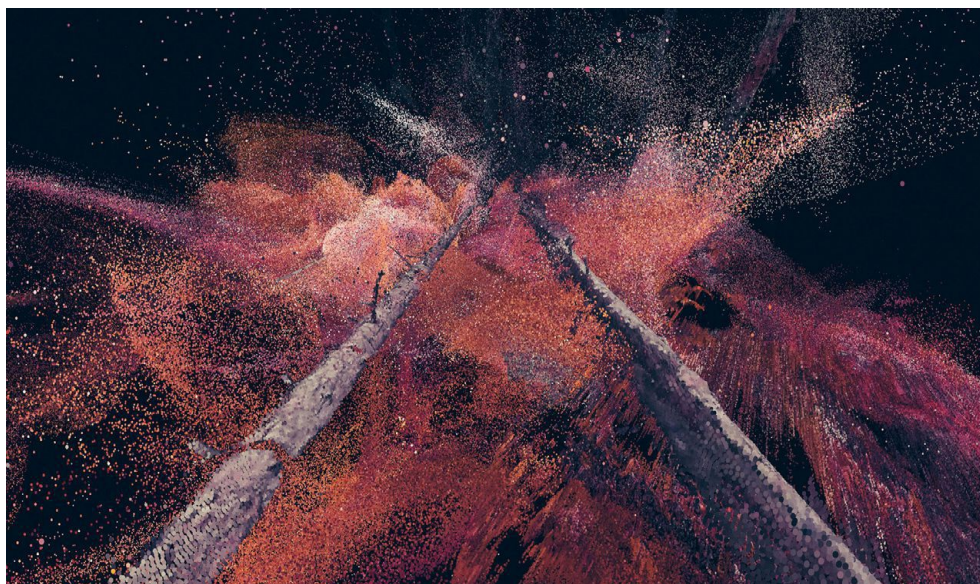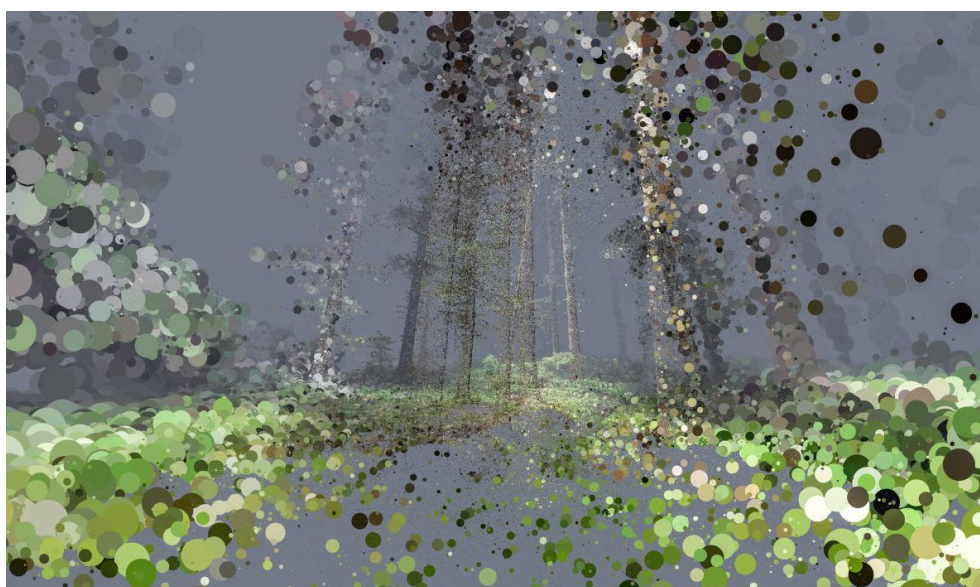

Fig. 2a

Fig. 2b

Fig. 2a and 2b. Marshmallow Laser Feast,
In the Eyes of the Animal, 2015

own way of perceiving a forest (Fig. 2a and 2b). Meanwhile, *Treehugger* and *Ocean of Air* each focus on trees and on the scope and time frame of their biological processes. Although all the creatures represented in these projects share the same environments (i.e., the forest), they each have

their own *Umwelt*, which MLF represents through different densities of point clouds and different colour filters.

Some critics may point to the fact that what MLF does in their project may not be called hermeneutical, in that the tools they use do not translate the actual, literal perception of these insects and animals.[26] It would also be fair to note that users would not be adequately equipped to interpret the world as perceived through these tools, even if their scientific accuracy was beyond reproach. This would be missing the point. It would be more appropriate to say that what MLF creates are artistic renditions of what the authors imagine the world might look like to different non-human animals. Their projects are best understood, then, as invitations to *imaginatively explore* what the *Umwelt* of a mosquito, dragonfly, frog, owl, or even a tree might be made of.

Recall that for Reinerth and Thon, different media can effectively seek to *simulate* certain aspects of a subjective experience as perceived by a particular individual by appealing to different aesthetic or narrative strategies, as well as the imagination of the user (viewer, reader, player, etc.).[27] What we have yet to explore, however, is whether VR is capable of simulating experiences that exceed the boundaries of the human body. And since, as Maurice Merleau-Ponty writes, "I am conscious of the world through the medium of my body,"[28] how the body appears and functions in VR has far-reaching implications. So while what MLF (among other artists) creates might *look* different than how we see the world, the question still stands as to if and

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26   MLF typically collaborates with scientists in relevant fields to help them translate the data recorded. With that said, Pinotti's reminder that data represented onscreen for human consumption is not equivalent to the source stimuli still holds true, lessening any claim these artistic experiences might want to make as to their accuracy. See Pinotti, "What is it like to be a hawk?"
27   M.S. Reinerth, J.N. Thon, "Introduction," in M.S. Reinerth, J.N. Thon, eds., *Subjectivity Across Media: Interdisciplinary and Transmedial Perspectives*: 1-25, 3. Original emphasis.
28   M. Merleau-Ponty, *The Phenomenology of Perception* (New York: Routledge, 2010): 94-95.

how might VR allow users to *act* differently than they can in their own human bodies.

Embodying the non-human

While the illusion of presence is often acknowledged in discussions of VR, the various kinds of embodied illusions the medium offers are just as relevant, readily achievable, and arguably even more fundamental.[29] It is not surprising, then, that the body, its representations, and our perception thereof have received much attention from the fields of psychology and neuroscience, especially in recent years. For instance, in their work on the so-called "Proteus effect," Nick Yee and Jeremy Bailenson have demonstrated how "an individual's behaviour conforms to their digital self-representation independent of how others perceive them."[30] While most scholarship that invokes this effect focuses on the behavioural aftereffects of inhabiting other kinds of human bodies (e.g., in terms of gender, age, race, ability, etc.), some have explored the effects derived from inhabiting non-human bodies.[31] These lay the groundwork for the explorations to which this essay aspires, but it is possible to go further still.

A great many studies have been conducted on the topic of the "body ownership illusion," or the so-called "body transfer illusion." These illustrate how our body schema is amenable to change when presented with sufficiently

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29   I use the term "medium" loosely here, as contemporary VR is more appropriately described as an apparatus which pre-existing media are attempting to adopt. For more on that debate, see my forthcoming "Many births of VR."

30   N. Yee, J.N. Bailenson, "The Proteus effect: the effect of transformed self-representation on behavior," *Human Communication Research* 33, no. 3 (2007): 271-290, https://doi.org/10.1177/0093650208330254.

31   See 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.

convincing data.[32] Importantly, this adaptation also works in cases of illusion, when the brain is tricked into adopting external elements. This process can also be triggered in virtual reality applications. Starting from the now famous rubber hand illusion, studies have detailed different ways in which users can feel ownership of an artificial limb, such that they are deluded into thinking that this foreign object is part of their own body.[33] Others have focussed on body transfer illusions, suggesting that even full-body stand-ins such as mannequins and digital avatars can be absorbed into a user's body schema. VR is a particularly powerful tool for fostering this illusion since, as one notable paper suggests, "in VR, there are near-infinite opportunities for both extending and radically altering our virtual (and hence perceptually real) bodies."[34]

The notion of "homuncular flexibility" further supports the idea that the mind can adapt to "exotic morphologies, distortions, extensions and reductions" of body

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32   See M.R. Lesur *et al.,* "The plasticity of the bodily self: head movements in bodily illusions and their relation to Gallagher's body image and body schema," *Constructivist Foundations* 14, no. 1 (2018): 94-105, https://doi.org/10.5167/uzh-162795; S. Seinfeld *et al.,* "User representations in human-computer interaction," *Human–Computer Interaction* 36, no. 5-6 (2021): 400-438, https://doi.org/10.1080/07370024.2020.1724790; A. Maselli, M. Slater, "The building blocks of the full body ownership illusion," *Frontiers in Human Neuroscience* 7 (2013): 1-15, https://doi.org/10.3389/fnhum.2013.00083; M. Botvinick, J. Cohen, "Rubber hands 'feel' touch that eyes see," *Nature* 391, no. 6669 (1998): 756, https://doi.org/10.1038/35784; S. J. Ahn *et al*., "Experiencing nature. Embodying animals in immersive virtual environments increases inclusion of nature in self and involvement with nature;" N. Yee, J.N. Bailenson, "The difference between being and seeing: the relative contribution of self-perception and priming to behavioral changes via digital self-representation," *Media Psychology* 12, no. 2 (2009): 195-209, https://doi.org/10.1080/15213260902849943; H. Farmer, A. Tajadura-Jiménez, M. Tsakiris, "Beyond the colour of my skin: how skin colour affects the sense of body-ownership," *Consciousness and Cognition* 21, no. 3 (2012): 1242-1256, https://doi.org/10.1016/j.concog.2012.04.011; H. Farmer, L. Maister, M. Tsakiris, "Change my body, change my mind: the effects of illusory ownership of an outgroup hand on implicit attitudes toward that outgroup," *Frontiers in Psychology* 4, no. 13 (2014), https://doi.org/10.3389/fpsyg.2013.01016; H. Farmer, L. Maister, "Putting ourselves in another's skin: using the plasticity of self-perception to enhance empathy and decrease prejudice," *Social Justice Research* 30, no. 4 (2017): 323-354, https://doi.org/10.1007/s11211-017-0294-1.
33   M. Botvinick, J. Cohen, "Rubber hands 'feel' touch that eyes see:" 756.
34   W. Steptoe, A. Steed, M. Slater, "Human tails: ownership and control of extended humanoid avatars," *IEEE Transactions on Visualization and Computer Graphics* 19, no. 4 (2013): 583-590, https://doi.org/10.1109/tvcg.2013.32. Notably, the authors also suggest that: "Our instinctive ability to rapidly and dexterously incorporate such objects and learn how to use such tools provides a clue to the remarkable plasticity of how the human brain represents the body and encodes space."

configurations.[35] It is interesting to note that already between 1989 and 1991, *ad hoc* experiments were being conducted by VR pioneer Jaron Lanier and his team at VPL on an individual's ability to take ownership of "weird avatars that were still usable."[36] Avatars with unusual point of view placements (e.g., eyes at hip level), extremely long extremities, and even non-human avatars were experimented with.[37] In the latter case, Lanier reminisces about a lobster avatar which was designed by Ann Lasko-Harvill, then Director of Product Design at VPL Research.[38] Some of these informal experiments have since been proven by more robust studies. Notably, Andrea Stevenson Won and Jeremy Bailenson teamed up with and Jaron Lanier to test the ability of users to incorporate supernumerary limbs by mapping their controls to "the rotation of a wrist, the flex of an ankle, or some combination of the two."[39] This came as a response to the limitation of the human body in regard to the fact that, "[a]s the lobster body includes more limbs than a person, there were not enough parameters measured by the body suit to drive the lobster avatar in a one-to-one map."[40]

An important limitation to the illusion of body ownership or transfer which studies on the topic often

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35   Ibid. See also A.S. Won *et al.,* "Homuncular flexibility in virtual reality," *Journal of Computer-Mediated Communication* 20, no. 3 (2015): 241-259, https://doi.org/10.1111/jcc4.12107; A.S. Won, J. Bailenson, J. Lanier, "Homuncular flexibility: the human ability to inhabit nonhuman avatars," *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable, and Linkable Resource* (2015): 1-16.
36   Ibid.: 2.
37   K. Kilteni *et al*., "Extending body space in immersive virtual reality: a very long arm illusion," *PloS one* 7, no. 7 (2012): 1-15, https://doi.org/10.1371/journal.pone.0040867; S.J. Ahn *et al*., "Experiencing nature. Embodying animals in immersive virtual environments increases inclusion of nature in self and involvement with nature;" T. Feuchtner, J. Müller, "Extending the body for interaction with reality," *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (2017), https://doi.org/10.1145/3025453.3025689.
38   J. Lanier, "Homuncular flexibility," in *2006: What is your Dangerous Idea? Edge: The World Question Center* (2006), https://www.edge.org/response-detail/11182, accessed January 10, 2023.
39   A.S. Won *et al*., "Homuncular flexibility in virtual reality:" 242. Interestingly, the authors gesture towards our earlier discussion of "what it is like to be [   ]" when, in the very first line of their article, they ask: "What if you could become a bat." Ibid.: 241.
40   A.S. Won, J. Bailenson, J. Lanier, "Homuncular flexibility: the human ability to inhabit nonhuman avatars:" 2-3.

highlight is the required "realism" of the external object. That is, "the need for an object to preserve precise, informative corporeal structural features in order to be integrable as one's own body part."[41] In other words, anthropomorphism is often presented as an important–if not essential–factor in the illusion of body ownership. Does this mean the move beyond human perspectives for which I am advocating in this essay is a nonstarter?

Redemption for this idea might yet be found in more recent approaches to the illusion of body ownership which point to a crucial element that is otherwise overlooked in the earlier quoted studies. Namely, in their meta-analysis of "user representations," Sofía Seinfeld and colleagues have shown that while "[u]nrealistic visual appearance, such as the visual discontinuity of the artificial body, also reduces the feeling of body ownership," it is also true that "[b]ody ownership illusions are effectively induced through *congruent multisensory stimulation*."[42] Earlier studies focussed on illusions generated by visual stimuli supplemented with synchronous tactile feedback (e.g., the rubber hand is stroked at the same time as the physical hand). Meanwhile, active engagement with the illusory body augmentation has been shown to play an important role in the success of this illusion. For instance, Marte Roel Lesur *et al*. suggest that while "the literature shows that not just any fake body or object can elicit illusory ownership," at the same time, "in the presence of sensorimotor coherence, there are some examples of illusory ownership over implausible virtual bodies."[43] The redeeming quality of contemporary VR technologies in this regard is precisely their ability to afford their users agency, interactivity, and

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41 A. Maselli, M. Slater, "The building blocks of the full body ownership illusion:" 12.
42 S. Seinfeld *et al.,* "User representations in human-computer interaction:" 416-417. Emphasis added.
43 M.R. Lesur *et al*., "The plasticity of the bodily self: head movements in bodily illusions and their relation to Gallagher's body image and body schema:" 101

multisensory feedback which work in concert to create many of the contingencies that are known to facilitate such body ownership illusions.
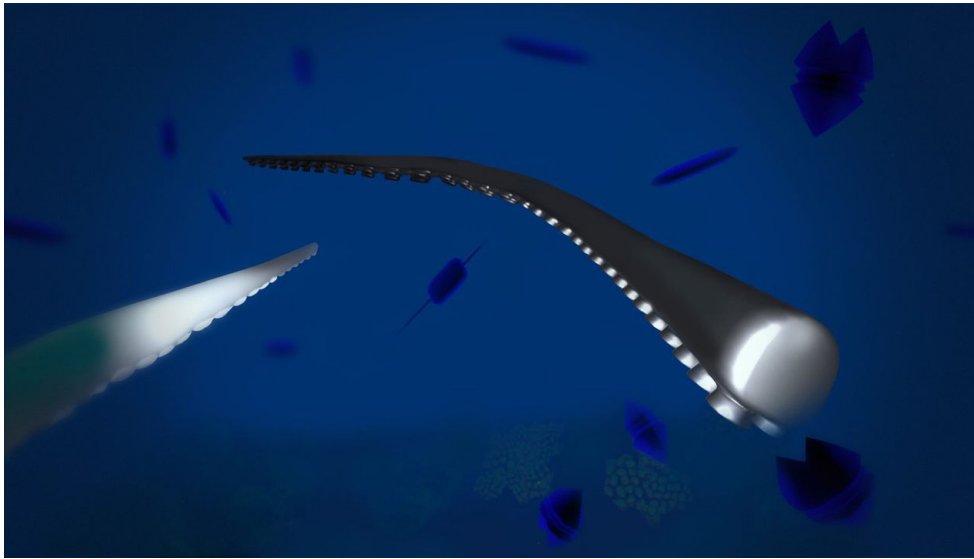
Fig. 3a
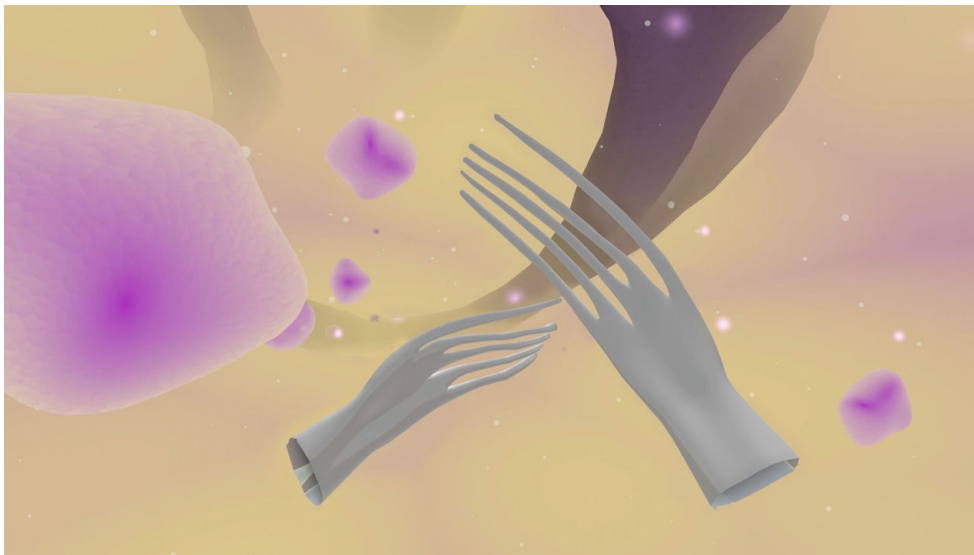
Fig. 3b

Fig. 3a and 3b. Non-human bodies in *Plastisapiens* (Miri Chekhanovich and Édith Jorisch, 2022). Credit: National Film Board of Canada (2022)

True as it might be that most recent VR experiences remain tied to humanoid avatars, some have pushed the boundaries of what counts as realistic body, while others have experimented with bodies that are altogether non-human. One such notable example is the VR experience *Plastisapiens* (Miri Chekhanovich and Édith Jorisch, 2022), a piece of "surrealist ecofiction" which asks viewers to imagine a future where human evolution has been shaped by our exposure to microplastics in the air we

breathe, the water we drink, and the food we ingest; the Anthropocene has here been replaced by what we might call the Plasticene. Throughout its 15–minutes runtime, *Plastisapiens* asks its viewers to adopt a number of new bodies, from a prehistoric betentacled creature to the eponymous human-plastic hybrid, whose hands seem to be made of thin plastic (Fig. 3a and 3b). In both cases, "hands" are the only part of their body users can see, leaving the rest up to their imagination.

Meanwhile, hand tracking is used to manipulate these new alien-looking appendages. The player's agency is made evident in their ability to move their hands in predictable ways. Here, part of the success for the body ownership illusion is ensured by the synchronous movement of the hand in physical reality and the appearance of the corresponding movement of the alien limb, as seen in the HMD. In my own experience of *Plastisapiens*, I had no issue whatsoever knowing how to manipulate my tentacles to successfully reach the objects in my vicinity, adapting to their limits and affordances within a matter of seconds. Furthermore, the experience employs haptic feedback through the controllers to add a sense of multisensory correspondence between what the eye registers the tentacle having touched, and what the physical (i.e., human) hand feels having touched as well. Agency, interactivity, and multisensory feedback therefore join forces to foster a sense of sensorimotor coherence, thereby facilitating the illusion of body ownership despite the lack of realism of the bodies on offer.[44]

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44   See also the oft-cited experience *Birdly* (Somniacs AG, 2015), another good example of agency and synchronous multisensory feedback contributing to successful illusory ownership of non-human animal bodies.

Conclusion

Fascinated as I am by the possibilities opened up by the idea of inhabiting non-human bodies, I cannot help but see the limitations of this kind of *temporary* foray into the world of non-human animals. If VR as it exists today struggles to make us see things from the perspective of another human being, as so many have already demonstrated, can it truly show us what it is like to be an animal, or any other non-human creature for that matter? Further limitations come up when we begin to question VR's efficacy as an illusion. In a recent essay on the myth of total illusion in virtual reality, Janet Murray insists that, more than any medium before:

Interactive environments demand more explicit partnership than just the willing suspension of disbelief; they become real through the "active creation of belief" by inducing and satisfying specific intentional gestures of engagement. As soon as we stop participating, because we are confused or bored or uncomfortably stimulated, the illusion vanishes.[45]

Indeed, Murray is careful to remind us of a fact that is rarely highlighted in studies on illusions in VR, namely that effects such as the body ownership illusion are difficult to achieve and more difficult still to maintain.[46]

On one hand, I want to join Murray in insisting on the important role played by individual users in fostering the kinds of illusions for which I am advocating in this essay. In an earlier paper on empathy in VR, I came to a conclusion that applies just as well to the idea

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45   J.H. Murray, "Virtual/reality: how to tell the difference," *Journal of Visual Culture* 19, no. 1 (2020): 11-27 https://journals.sagepub.com/doi/abs/10.1177/1470412920906253. Emphasis added. See also J.H. Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (1997) (Cambridge MA: MIT Press, 2017): 136-139.
46   "The rubber/virtual hand experiment is truly delusional, but it is important to note that it is a fragile and momentary delusion." Ibid.: 17.

of imaginatively projecting oneself in the experience of non-human or non-living beings: "users must *know how* and *want to* use this tool."[47] The non-anthropocentric effects which I describe in this essay are difficult to achieve for users who do not know how–or much less care–to use VR as a tool to explore spaces and bodies which exceed their natural capabilities. On the other hand, I also want to recognize that the very idea of optical illusion hinges upon the *illusory* nature of the phenomenon. This assumes the automatic and involuntary process by which we can succumb to illusions; optical or otherwise. When the necessary conditions are met, we cannot help but fall victim to illusions. Could VR's affordances be used to such effect?

I am also keen on suggesting a fruitful avenue might lie in effects that are not quite illusions, but rather something we might call "games of perception," or even hallucinations.[48] Further research could be done in this regard to echo Crary's work on subjective vision as it was utilized in the creation on optical toys in the 18th and 19th centuries. To that effect, we should also consider the scholarship that has been produced on the revelatory potentials of optical technologies used in ways that defy anthropocentric concerns. I am thinking here of Stan Brakhage's call for a radical exploration of cinema's visual capabilities, as well as of William Wees' study of experimental cinema's ability to "exceed" the limitations of human vision.[49] In both cases, nonnormative uses of a technology lead to drastic effects, as heretofore dominant modes of representation are swept aside in favour

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47   This essay is forthcoming in the *Canadian Journal of Film Studies*.
48   For more on illusions and hallucinations in VR, see C. Paolucci, "Perception, hallucination, virtual reality. From controlled hallucination to *Resident Evil 7: Biohazard*," *AN-ICON. Studies in Environmental Images*, no. 1 (2022): 112-128, https://doi.org/10.54103/ai/15443; P. Montani, "The hallucinatory aspect of virtual reality and the image as a 'bilderschrift'," *AN-ICON. Studies in Environmental Images*, no. 1 (2022): 154-172, https://doi.org/10.54103/ai/15441.
49   W.C. Wees, *Light Moving in Time: Studies in the Visual Aesthetics of Avant-Garde Film* (Berkeley: University of California Press, 1992).

of more eccentric–or even excessive–ways of engaging with worldly phenomena. And while both examples relate to cinema, there is no reason why VR should not be amenable to such experimental fancies. Where is VR's Brakhage? Its surrealist or Dadaist movement? Its fearless pioneers?

Hallucinatory syndromes / Immersion in the image. Classical theories and perspectives

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Abstract   From the outset, the inventors of 3D, VR/AR and analogue and digital immersion thought of these devices as functional models of our perceptive capacities, serving to expand our sensory knowledge and to support our communications based on multisensory storytelling. How is it that a solid critical tradition then assimilates them to hallucinatory phenomena? The answer lies in marketing techniques that have always associated dreams and illusions with the desire to play with reality. But there is a deeper, epistemic reason. The sources of scientific thought of hallucinations are marked, in the 19th century, by the theory of "sensations without objects." Perception being distorted, the knowledge it provides is pointless. It is therefore possible to replace the vacant object with our desires to act out subjectively the real. This conviction initiated by Dr. Jean-Étienne Dominique Esquirol has survived to the present day. However, the history of the scientific approach of hallucinations shows another theoretical framework, particularly prolific but curiously forgotten: the theory of reality monitoring and arbitration of sources of information provided from Dr. Henri Ey. We propose to forge on these concepts a critical tool of the current mediadesign.

Keywords   Hallucinatory syndromes   Immersion in the image

Classical theories and perspectives

What if we were to compare immersion in artificial sensoriality (or "virtual" - although this last word is more of a showcase than a solid concept) to all the phenomena of treachery, feints, and sensory artifices, phosphenes, illusions, dreams, effects of psychotropic substances, and more specifically to hallucinatory states?

This is, obviously, a marketing slogan for various VR devices, but let's not forget that in the similar context of the appearance of technical novelties in the cinema of the 1970s, Jean-Louis Baudry[1] has been able to make a banality forged in extra-scientific circles the foundation of an important vein in the theory of filmic narration. It was also at this time that the controversy around the "oneiric" character of cinema sometimes led to accusations of oneirism, the latter term clearly designating a mental disorder. If then today, we evoke the comparison VR / illusion, it is to take advantage of the heuristic potential of this metaphor. Indeed, the long history of scientific understanding of illusion phenomena and their methods of remediation can provide an interesting intellectual tool for clarifying the relationship between cultural practices in VR and reality. We will proceed in parallel, on the perceptual level, by approaching the comparison between the episodes of disturbed perception and the sessions of immersion in the sensory peripherals of computers acting on the mode of interactivity and visual and sound spatialization, as well as on the intelligible content plan, by approaching the comparison between the construction of illusory meaning by the subject presenting nosologies relating to perception, and the construction of narrative meaning during the use of VR products.

This approach will first lead to the highlighting of contrasting results, similarities and dissimilarities between the mechanisms of perception in different types of perceptual failure and of perception in immersive environments. Secondly, faced with a certain lack of intelligibility in the relationship between VR practices and the real world, we will take advantage of a brief history of the theories of

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1   J.-L. Baudry, "The device," *Communications* 23 (1975): 56-72.

sensory dysfunctions and hallucinations which, after a terminological reframing in the light of standards in the current cognitive sciences, will allow us to propose, on the inspiration of the theory of monitoring of informational sources of Dr. Ey, a critical epistemology of Virtual and Extended Reality.

Nature of sensory experiences in immersive devices: towards the digital modeling of vision and gesture

In the register of symbolic behaviors, the visual production of Man started, according to the facts attested since 100,000 BP, probably by adornment and the addition of aesthetic elements to natural or artificial objects such as tools, to then pour in the production of artifacts aimed at reproducing, in a gesture of externalization, the retinal image and the process of its mental treating, the vision of the world. Thus, appeared pictorial artefacts, around 40,000 BP and sculptural and architectural productions (additions to natural shelters) around 32,000 BP. The first representations (the bestiary) already implicitly composed with the notion of dimension, first by spreading out over the surfaces (2D + the roughness of the natural surface) and then by regaining the rudiments of perspective, which is a way of raising awareness of the constraints of the process of visual perception: the light imprint of reality in three dimensions, its projection on the retina (in 2D + the concave nature of the back of the eye) and the cerebral processing of the image retinal reconstruction, thanks to the various 3D indices, the reality of the spatial relationships present in the ecological *niche*.[2,3]

The ergonomics of vision dispenses with the 3D image since the human brain is capable of restoring depth from the flat image. But it should be noted that if it is just

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2   T. Deacon, *Symbolic Species* (New York: W.W. Norton, 1997); J.-L. Baudry, "The device:" 56-72.
3   D. Lewis-Williams, *The Mind in the Cave: Consciousness and the Origins of Art* (New York: Thames and Hudson, 2002).

suggested in the 2D image by the elements of perspective reproducing the indices of depth, spatiality is present in the imagery from the art of caves and rocky surfaces, also by the bias of the accumulation of the sources of visual information, an accumulation which, once again by cerebral processing, reproduces the immersion of the cognitive subject in the environment parameterized in three dimensions. Humans have never ceased to reproduce space in their visual symbolic productions, from rock walls, through the vaults of temples and dwellings, to immersive "analog" installations such as "circular perspectives" or the "*vedute.*"

Digital immersive devices, which appeared in the mid-1960s, took over the game of 3D/2D/3D transition, first optical and then mental. But unlike previous devices, the pioneer of digital graphics and VR, Ivan Sutherland, drawing inspiration from Gestalt Theory, by descent from Köhler, passing through Green, Wallach, O'Connell and Gibson, adds an important element, by placing ourselves from the start on the level of bio-inspiration that we also call cognitive realism.[4]

The fundamental idea behind the three-dimensional display is to present the user with a perspective image which changes as he moves. The retinal image of the real objects which we see is, after all, only two-dimensional. Thus, if we can place suitable two-dimensional images on the observer's retinas, we can create the illusion that he is seeing a three-dimensional object. Although stereo presentation is important to the three-dimensional illusion, it is less important than the change that takes place in the image when the observer moves his head. The image presented by the three-dimensional display must change in exactly the way that the image of a real object would change for similar motions of the user's head. Psychologists have long known that moving perspective images appear strikingly three-dimensional even without stereo

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4   B.F. Green, "Figure coherence in the kinetic depth effect," *Journal of Experimental Psychology* 62, no. 3 (1961): 272-282, https://doi.org/10.1037/h0045622; H. Wallach, D.N. O'Connell, "The kinetic depth effect," *Journal of Experimental Psychology* 45, no. 4 (1953): 205; J.J. Gibson, *The Perception of the Visual World* (Cambridge: The Riverside Press, 1950), https://doi.org/10.1037/h0056880.

presentation; the three-dimensional display described in this paper depends heavily on this "kinetic depth effect."[5]

The physiological approach adopted by the inventors of immersive environments places us not only in the 3D image, in the saturation of the visual field by the circular and spatial character of this image or by the accumulation of images imitating the surrounding space, but it also allows us to add to our relationship to the image, the motor and gestural dimension, through which we regain one more stage in the process of symbolic representation of reality: its "kinesthetic" and "manipulative" dimension, the possibility of acting on the image inspired by the actions that the Human exercises on his environment.

In an experience of immersive cave or a semi-immersive installation, we are subject to the perceptual action of a 3D image produced by the display device: the projection run by a computer equipped with graphic synthesis capabilities of a synthetic image itself produced by graphics software or resulting from the capture of reality as it is the case with a digital image captured by photography, videography, or scanning then synthesized as a 3D model of this captured reality. The visual effects of the embossed image, which is not a real 3D model that can be positioned at will within the geometrically simulated 3D space and be used, but rather a handling of the image reduced to its positioning relative to the surface of objects and not with the conservation of truthful reports of depth. This narrow depth technique is broadly used in 3D cinema which, for obvious economic reasons, using the twin-lens cameras with surface relief vision more often than real "full" 3D models constructed geometrically or raised by algorithms. In several installations, the 3D image is also reinforced by the stimulations coming from other sensory generators. This image, alone or reinforced, fills a large part of our sensory field. It imposes itself as perceived reality so much so that

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5   I.E. Sutherland, "A head-mounted three-dimensional display," *Proceeding AFIPS '68,* (1968) https://doi.org/10.1145/1476589.1476686.

it constitutes a partial substitution of reality that coexists with the other fragments of reality felt through the active fields of the senses that are not, or not entirely affected by the 3D image or by generators of complementary sensations. In this way, the perceptual field[6] of the subject in the immersive experience is composed of a blend of sensations coming from the directly perceived external and internal reality, and sensations coming from a digital generator of 3D images often combined with other digital generators of sensations, auditory, olfactory, or even tactile.

Review of illusion-producing phenomena

The phosphene was commented on by the Ancient Greeks as a specific mode of appearance of images, by the pressure[7] of the eyeball. The famous South African anthropologist David Lewis-Williams attributes to the phosphene a preponderant role in the creation of non-figurative parietal icons of the Upper Paleolithic. Hermann von Helmholtz was passionate about the study of this phenomenon and recorded several varieties of it. Produced by direct, mechanical, or electromagnetic stimulation of the sight's organs, the phosphene constitutes an experience often founding the awareness of the functioning of the sensory pathways in juvenile subjects, experience of the duality and at the same time of the interdependence of the ocular and mental image.

The illusions, studied since antiquity among the peoples of the Mediterranean region but also in Asia, especially in India, they are first linked to the problem of apparent and relative magnitudes in astronomical observations of the celestial vault, and then to atmospheric phenomena, to the role of shadow and finally to all sorts of

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6   Also called "receptive field" and defined as follows: "A specific region of sensory space in which an appropriate stimulus can drive an electrical response in a sensory neuron." D.H. Hubel, T.N. Wiesel, *Brain and Visual Perception: The Story of a 25-year Collaboration* (Oxford-New York: Oxford University Press, 2005).
7   O.J. Gruesser, M. Hagner, "On the history of deformation phosphenes and the idea of internal light generated in the eye for the purpose of vision," *Documenta Ophthalmologica* 74 (1990): 57-85.

optical reverberations produced by different "screens," vapors, smooth surfaces, and liquid surfaces. Although the Platonic philosophical teaching of perceptual skepticism derives directly from this experience, the study of illusions nevertheless leads to the beginning of sensory realism.[8] The Platonic analysis of the cave with "screen" effects (projections, reflections, traces, etc.)[9] is also one of the first treatises on perception in which the foundation of all prescientific and scientific theories of knowledge (gnoseology), the dichotomy "perception versus cognition" clearly appears. From an epistemic perspective, it should be remembered that perception is considered in Antiquity as an interaction between the sensory organs, the medium (undulatory, caloric, material, etc.) of contact with the thing, and the thing itself, the object of perception, while the term cognition is reserved for the mental interpretation of the signal that the sensory organs transmit to the understanding. Both Plato, Aristotle, and philosophers of late Antiquity like Plotinus attached great importance to the versatile nature of the contact medium which under different conditions and under different surrounding constraints can give the distorted image of the thing. The role of the mind, the understanding or the intellection is above all to exercise control over the sensory sphere. Current cognitive sciences have a rather unitary vision of the nervous system and consider the sensory organs as extensions of the brain...

Oneiric activities provide Ancient Humanity with an enormous reservoir of stories that are both mnesic and premonitory. The imaginary, the abductive force of the creative projection on the "commonplace" world produces a reasoning that confirms the subject in his role, if not central then certainly active, in the gnostic process. In short, the dream is an omnipresent source of the explanatory hypotheses of reality, as Baudry says when relating the contributions of the dreamlike sphere discovered by Freud:

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8 M. Sobieszczanski, "Two key factors in the history of communicating immersive environments: mix of reality vs. cognitive realism," *LINKs-series*, no. 1-2 (2019), https://hal.archives-ouvertes.fr/hal-02281583.
9 Plato, *The Republic*, Book VII.

The transformations wrought by the sleep in the psychic appara-tus: removal of cathexis, lability of the different systems, return to narcissism, withdrawal of motor skills (impossibility of resorting to the reality test), contribute to producing the specific characteristics of the dream: its capacity for figuration, translation of thought into image, reality accorded to representations.[10]

Another experience, at the individual level, and - among all prehistoric peoples - strongly collective, is provided using psychotropic substances. The inoculation of a chemical factor modifying both, perception, and consciousness, affects as well the centripetal sensory afferents, and their centrifugal control, most often thalamic but also caused by neocortical intellectual patterns. And if in current societies the practice of narcotics is mainly associated with personal deviance and destructuring addictions, in prehistory and antiquity, drugs served as a (bio)chemical substrate for divinatory trances. These states were both reserved for the use by a restricted class of hierophants, and essential for social regulation in general and for the management of individuals, particularly during initiation rites and rites of passage.[11]

Towards the clinical approach of hallucinatory phenomena

Often times, individuals performing the same types of behaviors without the (bio)chemical support are viewed by the Ancients as representatives of the deity itself, and their verbal and iconic creations as direct expressions of religious truths that may serve as a vehicle for the intelligibility of reality. Western science began to take interest in the pathological dimension of these people and to associate different clinics with them. Thus, the head doctor of the

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10   J.L. Baudry, "The device:" 56-72.
11   J. Clottes, D. Lewis-Williams, *Les Chamans de la Préhistoire. Trans et Magie dans les Grottes Ornées* (Paris: Le Seuil, 1996); E. Guerra-Doce, "The origins of inebriation: archaeological evidence of the consumption of fermented beverages and drugs in prehistoric Eurasia," *Journal of Archaeological Method and Theory Theory* 22 (2014): 751-782 https://doi.org/10.1007/s10816-014-9205-z.

Salpêtrière, Jean-Étienne Dominique Esquirol, interpreted in 1838 the difference between illusions and hallucinations based on the nature of their references to reality, which led him to the definition of pathological hallucinations *by preterition*. "Perception without an object" is a normative view of the phenomenon which insists on its perceptual nature while denying the percept of this perception, and ultimately its object, in accordance with a "common sense." Relayed without any critical readjustment by later researchers, J. Baillarger, J.-P. Falret, E. Régis or P. Guiraud,[12] this conception had to wait for the second half of the twentieth century to finally, in the research of Dr. Henri Ey, lead to the study of the nature of the hallucinatory process itself.

The much-vaunted merit of Ey's synthesis is first of all its distinction between hallucinosic eidolia and delirious hallucinations which are, alone, hallucinations properly speaking.

"The eidolia do not come from a delusional functioning of the patient and are *compatible with reason*, in this they can be qualified as 'psychonomy'. It is a 'non-delusional hallucinatory modality'. The subject finds them 'unreal', incongruous in relation to his perceptual experience: he knows that he is hallucinating."[13]

We will return to this definition in the context of certain immersive experiences with virtual spaces, such as vacuum or narrowing, producing effects of somatic reactions even though the subject is aware of the "virtuality" of these spaces and their characteristics.

On the other hand, the definition of delusional hallucinations provides us with another important theoretical dimension:

Thus, for Ey "The hallucinatory phenomenon experienced by the subject must [...] have a double character: that of affecting his sensitivity or his sensoriality and that of being projected out of his subjectivity" ([2] p. 44–45). The patient must thus be able to attest

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12   G. Gimenez, M. Guimont, J. Pedinielli, "Study of the evolution of the concept of hallucination in classical psychiatric literature," *L'evolution psychiatrique* 68 (2003): 289-298.
13   Ibid.

to a sensory experience ("I see, I hear, I feel") by his reference to the attributes of sensoriality and support the objectivity and reality of this experience.[14]

This means, in essence, that a cerebral effect positioned in the sensory information processing areas, in certain clinical circumstances, can be correlated by intra-cerebral communication pathways with a cortical effect that mobilizes the oscillation between knowledge current (operational) and the thought of presumption, inclinations, convictions (doxic).

In this situation, it is clear that there is a detachment of the sensory areas from the sensory organs, or rather a functional doubling of the cerebral support. On the one hand, there is evidence that patients suffering from hallucinations often achieve to conceive that the people accompanying them, the caregivers in this case, are not subject to the same phenomenon. On the other hand, the same patient simultaneously develops a hallucinatory syndrome. The sensations "with object" do not disappear, on the contrary, the "generic" sensory excitations accompany the delirious subject throughout his "specific" experiences.

In the article by G. Gimenez, M. Guimont, J.-L. Pedinielli, we read: "Minkowsky's remarkable text on *Le temps vivant*, and in particular the chapter 'Towards a psychopathology of space', which shows very well the possible cohabitation, in the same subject, of a hallucinatory neo-reality and a perceptual reality, often remaining actively separated by processes of splitting."[15]

The "Perception without an object" was biased by its implicit use of the physiologically improbable, direct inversion of nervous influx[16] in the optic or auditory nerves. In reality, the sick subject carries out two processes both highly demanding in terms of synaptic energy: that of the

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14   Ibid. Here the article refers to H. Ey, *Treatise on Hallucinations*, vol. 2 (Paris: Masson and Co, 1973).
15   Ibid. The article refers to E. Minkowsky, *The Lived Time. Phenomenological and Psychopathological Studies* (Neuchatel: Delachaux and Niesle, 1933).
16   The blocking of the inversion is ensured by the mechanism of the alternation of refractory periods and periods of excitability of the elementary nerve cell.

control of the real and that of the control of his own cerebral activities of the sensory areas pathologically autonomized to the point of competing with the gnosic results of perception. Under the light of current neuroscience results supported by functional cerebral imaging, MRI and positron emission device, the etiology and consequently the nosography of delusional pathologies is shifting from the psychoanalytical vision where the sphere of symbolic topics takes pathologically precedence on the phenomenal sphere, towards a neuro-cognitivist vision compatible with the hypotheses of Dr. Ey, as Thomas Rabeyron states it:

hallucinations should first be considered from the point of view of "reality monitoring," a process that is part of a larger whole called "source monitoring." According to Bentall (1990), hallucinations would thus be the consequence of a bad categorization: an internal perception, a representation, or a reminiscence, instead of being represented as coming from inside, would be categorized by the brain as coming from outside. There would therefore be confusion between internal source and external source, confusion being more specifically at the level of the thalamus, a real system for filtering information reaching the cerebral cortex.[17]

In fact, we are here in a process of intracerebral communication where, both in the presence of a meticulous monitoring of reality[18] and independently of its gnosic results and its metacognitive achievements,[19] the different neocortical areas exchange with each other. In this play, essentially triangular, the central position is ensured by (1) the thalamic zones which seem to distribute flows joining (2) the prefrontal cortex with (3) sensory, parietal or posterior,

17   T. Rabeyron, "Exceptional experiences: between neuroscience and psychoanalysis," *Research in Psychoanalysis*, no. 8 (2009). The reference "Bentall (1990)" refers to R.P. Bentall, "The illusion of reality: at review and integration of psychological research on hallucinations," *Psychological Bulletin* 107, no. 1 (1990): 82.
18   Let us remember the experiences cited by Merleau-Ponty where schizophrenics systematically thwarted attempts at scenographies recalling their imaginary world: M. Merleau-Ponty, *Phénoménologie de la Perception* (1945) (Paris: Gallimard, 2011). See also the connection between Merleau-Ponty and Dr. Ey, in: T. Grohmann, "Délire et hallucination en schizophrénie: une perspective phénoménologique," *Phainomenon* 28 (2018): 103-125.
19   On this subject, see the "Higher-order thought theory" by David Rosenthal, in D. Rosenthal, *Consciousness and Mind* (Oxford-New York: Oxford University Press, 2005).

somatosensory, auditory and visual areas. The implication of the latter is proved indirectly by research combining the pathological phenomenon of synesthesia, the non-voluntary association of sensations originating from different sensory modes, and hallucinatory sensations. This particular research has produced increasing evidences since Binet's founding experiments.[20]

Reality monitoring

With the dimension of "reality monitoring," the theories of hallucinations begin to move away from their origins anchored in a naive realism where the third instance of a healthy observer arbitrated, in the light of "common" and "objective" representations, the pathological representations of reality produced by the sick subject. In fact, they also abandon the solipsistic simplifications of a "a world to yourself" in which the patient would have been locked up. We are here within the framework of a duality where the two gnosic procedures hold comparable "realizing" forces from the point of view of their aesthesies. The nosological qualification of dysfunctions no longer consists in arbitrating between the flow of consciousness of the sick subject and the flow of consciousness of the healthy subject, but in qualifying the way in which a subject oscillates between the two gnosic modes reputed to be constructive.

It is therefore the attentional processes that make the nosology of delusional mental behaviors and not the hallucinations themselves, or again, in other words: we speak on hallucinations when the "fictio-creative" activities occur, by the alteration of the attentional processes, to substitute themselves to the interoceptive and exteroceptive controls of reality.

Attentional processes, whether defined according to peripheral filter theories or central manager theories, cannot be associated with an organic function or, even less, with a delimited convolution or a particular nerve bundle.

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20 A. Binet, "The problem of colored hearing," *Revue des Deux Mondes* 113 (1892): 586-614.

These are complex states of mobilization of cognitive resources assembling different parts of the nervous system, appearing to be identifiable with the different functional aspects of the circuits assigned to the different other purposes, as it is the case of the reticular system disposed on the path joining the lower bulbar region to the lateral and posterior hypothalamus. Following the inventory of convergent experimental facts, some theories on the rhythms of cerebral electro-biological activities, detectable at the cortical and subcortical level, propose here some interesting hypotheses, in particular on the role of theta waves.[21] These processes are also associated with the presence of certain cognitive event-related potential (ERP) and in particular the famous N400 discovered in 1978 by Kutas and Hillyard.[22]

The attentional processes have the capacity to move,[23] by means of calibration and thalamic reinforcements, not only in the direction of association or selection of external sources of sensory stimuli but also in the direction of interchange and variation of the internal sources,[24] among which we count usually different kinds of memory,[25] but also hallucinogenic stimuli.[26] It is at this level that the problem of indissociation between the veracity and

21   M.C.M. Bastiaansen *et al.*, "I see what you mean: theta power increases are involved in the retrieval of lexical semantic information," *Brain and Language* 106 (2008): 15-28, https://doi.org/10.1016/j.bandl.2007.10.006.

22   M. Kutas, K.D. Federmeier, "Electrophysiology reveals semantic memory use in language comprehension," *Trends in Cognitive Sciences* 4, no. 12 (2000): 463-470, https://doi.org/10.1016/S1364-6613(00)01560-6.

23   M.I. Posner, "Orienting of attention," *Quarterly Journal of Experimental Psychology* 32 (1980): 3-25.

24   J.K. Roth *et al.*, "Similar and dissociable mechanisms for attention to internal versus external information," *NeuroImage* 48 (2009): 601-608.

25   E. Awh, E.K. Vogel, S.H. Oh, "Interactions between attention and working memory," *Neuroscience* 139, no. 1 (2006): 201-208, https://doi.org/10.1016/j.neuroscience.2005.08.023.

26   R.P. Bentall, "The illusion of reality: at review and integration of psychological research on hallucinations," *Psychological Bulletin* 107, no. 1 (1990): 82, https://doi.org/10.1037/0033-2909.107.1.82; M.K. Johnson, C.L. Raye, "Reality monitoring," *Psychological Review* 88 (1981): 67-85, https://psycnet.apa.org/doi/10.1037/0033-295X.88.1.67; M.K. Johnson, S. Hashtroudi, D.S. Lindsay, "Source monitoring," *Psychlogical Bulletin* 114 (1993): 3-28, https://doi.org/10.1037/0033-2909.114.1.3; G. Brébion *et al.*, "Reality monitoring failure in schizophrenia: The role of selective attention," *Schizophrenia Research* 22, no. 2 (15 Nov. 1996): 173-180, https://doi.org/10.1016/S0920-9964(96)00054-0; A. Schnider, "Spontaneous confabulation, reality monitoring, and the limbic system - a review," *Brain Research Reviews* 36, no. 2–3 (2001): 150-160, https://doi.org/10.1016/S0165-0173(01)00090-X; J.K. Roth *et al.*, "Similar and dissociable mechanisms for attention to internal versus external information," *NeuroImage* 48 (2009): 601-608.

the coherence of different topics, imaginary and sensory, must occur. From then on, the fictitious topics that we will begin to call fictional (*see below*), can exercise a "realizing" role they can effectively embed into the sensible real, by the means of intensity of esthesia (contribution from sensory areas), sequential plausibility, and causal relevance (contributions from frontal areas). From the moment when the "realization" efficiency is obtained, the altered attention moves indiscriminately from the external to the internal and withdraws from its task as a source checker. Thus, on the double psychic substrate, emerges an internal fiction without the subject being able to exercise any criticism towards it. In the patient, the source of suffering stems more from the awareness of this impotence of discernment than from the disconcerting contents of the hallucinations themselves. Even if the patient still has the possibility of diverting his attention, what his attention points to is, in both directions, internal and external, impetuously "real." As Dr. Ey said, delusional work is characterized by "foreignness, incoercibility, assertiveness and aesthesis." Foreignness, because the internal and external sources have the same rank of veracity and can therefore be interchangeable; incoercibility because this process prevails over the mechanisms of anti-hallucinatory coercion; assertiveness because the sequences of topics obtained through hallucinations can serve as a basis for the subject's discursive activities; and aesthesia because the subject is aware of the fact that thanks to the strident aesthesia of his hallucinations he can distinguish them from ordinary memory material, but cannot to mobilize enough to distinguish them from perceptual sensations.

We are touching here on the doxic status of hallucinations and in this the comparison between sensory immersion with artificial origin and hallucinations becomes for us more than a superficial metaphor. In schizophrenia, the activations of sensory areas stimulated by prefrontal activities and categorized by thalamic operations bring out a threshold effect beyond which the complex neural substrate is ready to exercise a creative role and generates

a fictional "effect." This "effect" is both gnosic, active in the symbolic sphere, and assertoric in the domain of the subject's discursive approach. To summarize, in pathological states of this type, fiction begins to compete, through attentional maneuvers, with the real apprehended by the sensorial way.[27]

Hallucinogenic function vs. Cultural and artistic creations

It is obvious that the comparison between immersion in artificial sensory devices and hallucinatory states overlaps with the very old theoretical concerns of specialists in literature and cinema, notably René Wellek and Austin Warren,[28] and Jean-Louis Baudry,[29] concerning the status of the "presented reality" in the verbal story and in the visual narration. On this topic, for methodological reasons, we propose to dissociate two blocks of questions: what comes from *diḗgêsis* and what comes from mimesis, in order to better synthesize them later on.[30]

On the one hand, the comparison of immersion and hallucination appears as existential experiences. We call "existential" the situations and the experiences that are attached to them, when it is a question, for a human subject, of facing an immediate environment, offering to his perception the sensory substrate which allows him to carry out his habitual activities: standing, sitting, walking, etc.,

27   The subject being aware of the imbalance between the respective parts of the internal fiction and of its "reality monitoring," falls into the suffering stemming from the anxiety of failing in reality. In this, schizophrenia involves a double danger: that which stems from the often disconcerting nature of the "visions" and that of the depression provoked by the awareness of one's own failures in the duty of reality.
28   R. Wellek, A. Warren, *Theory of Literature* (New York: Harcourt, Brace, 1948). "As Wellek and Warren (La Théorie littéraire) point out, there is a use for these invented stories, which is to entertain and instruct, a use that should not be confused with forgetting boredom. Fiction triggers desire, pleasure, escape and knowledge, without the seriousness of a duty to accomplish, a lesson to learn. This plural pleasure is to live adventures that daily life refuses us, to which we access by proxy. The knowledge transmitted by fiction is of a different order from that provided by science, philosophy or history." Yves Chemla about F. Tremblay, *La Fiction en Question* (Balzac-Le Griot editor, 1999) coll. Littératures à l'essai, Montréal, in *Acta Fabula*, Autumn 2000, vol. 1, no 2, Ecole Normale Supérieure, Paris.
29   J.L. Baudry, "The device:" 56-72.
30   E. Souriau, "The structure of the film universe and the vocabulary of filmology," *Revue internationale de filmologie* 7-8 (1951).

activities whose purpose lacks a delayed-causal goal, the "short-term" behavior. The notion of immediacy must also be addressed. Situations are immediate when the goals pursued by the subject affect his current vital needs, unlike the pursuit of medium and long-term goals. In this sense, we are forced to separate, for example, the expectation of resolution of a legal case that mobilizes our energy for several years, from the posture that we adopt in the last minutes before the last trial, although the lasting experience conditions, to a certain extent, the momentary behaviors, and vice versa; the punctual and immediate existential experience merges, in a certain way, with the image and the memory that we have of the entire event.[31]

On the other hand, the immersion can be compared with the effects of fiction which are elaborated in the brain of the readers of literary stories and the spectators of cinematographic storytelling. Here, it is not a question of evaluating the effects of immersion by the yardstick of immediate perceptions, which can feed temporary postural reactions, move in the relative field of vision, explore its space immediately adjoining our body or behave according to the volumes found, suggested by the 3D image-models of the show unfolding before the eyes of the subject, but it is a question of listing the psychological and somatic effects of a "world" which is constructed in the process of mediated communication, through signs and their bodily and technical supports, i.e. writing, icon, image-movement. It is a question, for example, of distinguishing two perceptual occurrences, in the complex reaction that we can have when seeing and manipulating, including by our movements, the model of the staircase of the Capitol of Washington drawn up for the CAVE at California Institute for Telecommunications and Information Technology (CALIT2) in San Diego: the monumental effect of architecture and the symbolic effect produced by the political heritage of the

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31   In *The Trial* of Franz Kafka, the literary effect of "reversal of experiences" consists precisely in this substitution of the momentary experiences of the waiting corridors in the legal institutions of the Austro-Hungarian Empire, for the synthetic experience of the long period between the indictment and the execution of the sentence.

United States. Although the distance separating the sign from its denotat is arranged as a continuum running from presence, through deferred presence and through the trace of presence, to the sign of presence, the consciousness and gnosic processes arising therefrom are categorized according to the jurisdiction of discrete boundaries. Verbal and visual narrations do not lead to the same results as immediate perceptions, coming from the real environment.

Our hypothesis is that the productions of human culture both generate and use the same human abilities to produce fiction, without this process resulting from any pathology. In other words, in the healthy creative subject, fiction benefits from substantially the same psychic substrate as hallucinations in schizophrenics, but the attentional processes retain all their effectiveness in them. In delirious patients, there is an increase of the psychic substrate which manages and admits to the doxic sphere the different sources, internal and external, without making any discernment between them, or rather transgresses this discernment. In the healthy creative human, the same fictional process does not come from a doubling of the psychic apparatus but from an externalization of the psychic contents "projected" on an apparatus or a device which in the process of communication exercises a fictional function. In humans as "consumer" of culture and receivers of the creative message, there is no confusion between the two flows either, there is, on the other hand, from his point of view, a duplication of the substrate of cultural productions, a substrate that sometimes can be apprehended in what it offers as affordances to direct sensory and postural cognitive actions, and sometimes as a generator of fiction on the basis of quasi-affordances that can be seized by the sensory-motor brain areas correlated to the frontal areas via the weighting of the thalamic zone. This latter process can be initiated by the action of the mirror neuron system.

The person subject to hallucinations oscillates between the two streams of consciousness, the creator mobilizes his attentional processes in order to work on the perceived reality in a manner similar to the ways fictional

topics inhabit him. And since the parity of the flows of the "*intus*" and of the flows of the "*extra*" is in him maintained and oriented according to the precedence of the perceptual, his internal fiction is itself "perception oriented."

Perspectives of applied research in 360° imaging

The tradition of research definitely established since the 2010s, especially at the continuation of the theoretical work of David Bordwell,[32] first in different academic centers, in Japan,[33] in the United States,[34] and then spread in vast circles of internationals researchers,[35] offers experimental research involving spectators, individual and collective,[36] engaged in actions of narrative construction based on the video-film creations. In our book from 2015[37] we commented on the difference between the spatio-symbolic narrative construction in the frontal cinema with central and oriented projection and attempts of the spherical and interactive cinema. In this latter area the theory predominant seems to be organized around the environmental concept of enaction.[38] Note that this concept also applies

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32   D. Bordwell, *Narration in the Fiction Film* (London-New York: Routledge, 1987).

33   M. Kimura *et al.*, "Human visual system automatically encodes sequential regularities of discrete events," *Journal of Cognitive Neurosciences* 22, no. 6 (2010): 1124-1139, https://doi.org/10.1162/jocn.2009.21299.

34   J.E. Cutting, "Perceiving scenes in film and in the world," in J.D. Anderson, B.F. Anderson, eds., *Moving Image Theory: Ecological Considerations* (Carbondale: Southern Illinois University Press, 2005): 9-27.

35   K.S. Heimann *et al.*, "Cuts in action: a high-density EEG study investigating the neural correlates of different editing techniques in film," *Cognitive Science* 41 (2017): 1555-1588, https://doi.org/10.1111/cogs.12439; K. Pajunen, *Immersed in Illusion, an Ecological Approach to the Virtual* (Jyväskylä: Bookwell, Acta Universitatis Lapponiensis, 2012); P. Francuz, E. Zabielska-Mendyk, "Does the brain differentiate between related and unrelated cuts when processing audiovisual messages? An ERP study," *Media Psychology* 16, no. 4 (2013): 461-475; P. Tikka *et al.*, "Enactive cinema paves way for understanding complex real-time social interaction in neuroimaging experiments," *Frontiers in Human Neuroscience* (2012), https://doi.org/10.3389/fnhum.2012.00298.

36   K. Lankine *et al.*, "Consistency and similarity of MEG- and fMRI-signal time courses during movie viewing," *NeuroImage* 173 (2018): 361-369.

37   M. Sobieszczanski, *Les Médias Immersifs Informatisés. Raisons Cognitives de la Réanalogisation* (Bern: Peter Lang, 2015): 300.

38   P. Tikka, V. Rasmus, K. Mauri, "Narrative logic of enactive cinema: obsession," *Digital Creativity* 17, no. 4 (2006): 205-212, http://dx.doi.org/10.1080/14626260601074078.

to classical cinema, as has been underlined in Bordwell's founding works...

Can we believe that going through the comparison between hallucinations and cognitive effects of the interactive and immersive cinema can provide us with a tool, both theoretical and empirical, even more powerful? If we imagine a multi-scale analysis proving the existence of a multi-layered and harmonized neural substrate, specialized in performing arbitration tasks between different sources of information: external, internal, and those used for weighting memory of sensory-motor anticipations, we can hope that the monitoring of reality can become this powerful tool.

There are three preliminary problems to pose as the epistemological background before proceeding to analysis of information sources in video-film products.

Frontal cinema operates its management of attentional points within the framework of a language put into place through the process of acculturation for 120 years. This device, both technical, grammatical and semantic shapes the audience of the cinema by constituting a quasi-cognitive functionality which participates in the construction of the image of the world in the broad sense. There is here a kind of sloping of a cultural function in the field of generic cognition. Experiences in spectation and the construction of the image of the world, both: from truthful world and the world as illusion, must first take care to put out of the game the artefact of the appearance of classic cinema.

Immersive or spherical cinema is part of another "grammar." Its "editing," the rules of his language, is a "natural editing," called for by Pasolini,[39] is operated by bodily movements, gaze movements and ocular saccades. The same "objective" real can be looked at in different

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39   "When we talk about the semiology of cinematographic language, we must at the same time talk about the semiology of reality," extract from an interview with Pier Paolo Pasolini by André S. Labarthe on 15/11/1966.

ways by the same person and by the different spectators, according to their own management of attentional points.

And finally, immersive cinema manages its spatio-temporal referential external to the device of the same way that it manages the spatiality and the dynamics of the contents which are presented into the device. In other words, the grammar of cutting and exploring of the sensitive, natural and artefactual material, is the same as that which governs our spatio-temporal relationship to the world. The perspective of empirical research on the hallucinatory illusion can then lead to the establishment of a normative system allowing people subject to hallucinations to exchange with their caregivers not by means of art-therapy, but by means of the shared control of sources of information on reality.

The haptics of illusion.
An account of touch across theories, technologies and museums

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Abstract

Touch represents one of the latest and most complex frontiers of virtuality: a sense which historically seems to have carried the burden of proof on reality, by definition resistant to illusory environments. The paper begins from this assumption to trace a history of illusion across authors and theorists that have debated the statute of haptics, building a dialogue between philosophical dilemmas and technological developments. Moving both from an aesthetic and psychophysiological viewpoint, the article will root its analysis in an historical-artistic account, augmenting the discussion with a series of case studies from the museum sector. The introduction of haptic technologies within cultural institutions, which dates back to the last three decades, proves an interesting field to test the functions which touch plays in both educational and imaginative scenarios. The open question being whether modern technologies should aim at replicating haptic realism in miming phenomenological accuracy, or whether the most innovative applications need to aspire to a more environmental employment of touch.
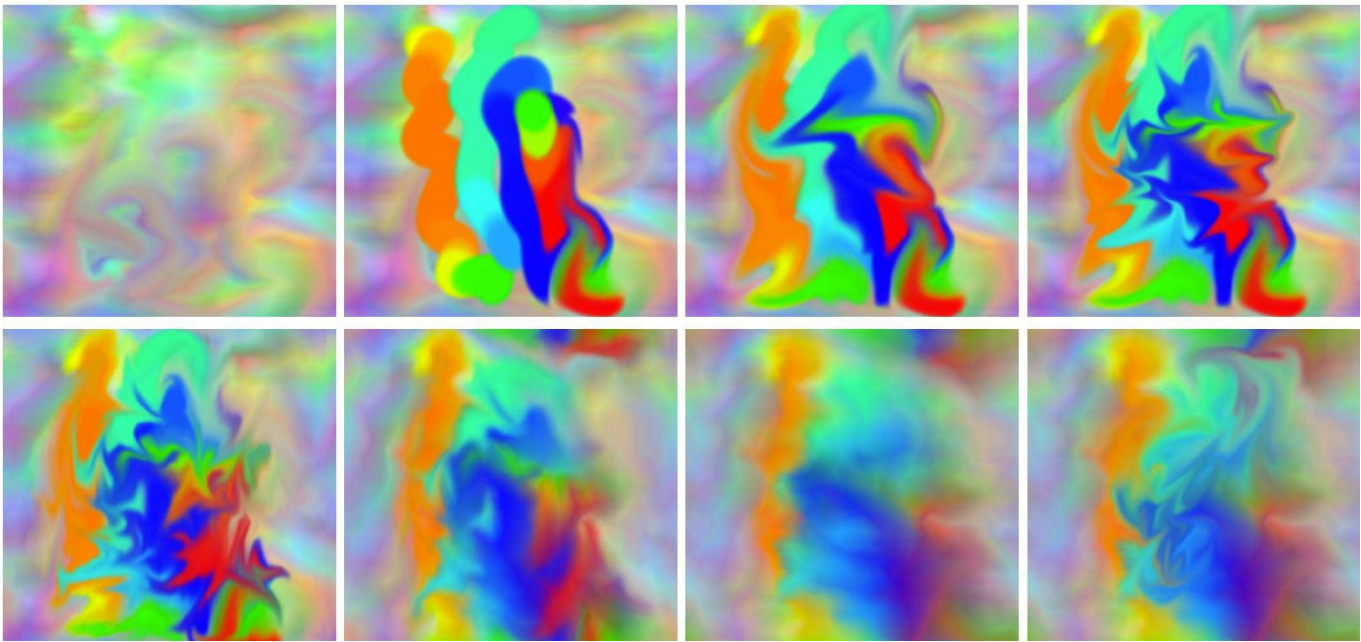
Fig 1. Creation of a new style of media art using digital paints in a harmonization of the senses of vision and touch.

It seems that we have so often been warned not to touch
that we are reluctant to probe the tactile world even with our minds.
Constance Classen
The Deepest Sense. A Cultural History of Touch, 2012

Introduction

In his *Post-Scriptum* addendum, alongside his monumental survey on the polysemy of touch in Nancy through the history of Western philosophy, Derrida denounced a widespread prejudice whereby "one spontaneously has the tendency to *believe* that touching resists virtualization."[1] Through this acute remark, the French philosopher underlies a consolidated *topos* that attributes to the sense of touch the ability to convey a direct and objective knowledge of the things of the world, captured in their physical and even theoretical dimension.[2] By questioning the supposed identity relationship between touch and objectivity, the author opens a new perspective on the subject, widening the ways in which the world of haptics could be conceptualized and practiced. For the purpose of the

1 J. Derrida, *On Touching – Jean-Luc Nancy* (Stanford: Stanford University Press, 2005): 300.
2 Cfr. J.-L. Nancy, *Corpus* (Paris: Metailie, 1992): 76; M. Paterson, *The Sense of Touch: Haptics, Affects and Technologies* (Oxford: Berg, 2007): 2-3; C. Classen, D. Howes, *Ways of Sensing* (New York: Routledge, 2014): 89; A. Gallace, C. Spence, *In Touch with the Future: The Sense of Touch from Cognitive Neuroscience to Virtual Reality*, (Oxford: Oxford University Press, 2014): 3.

argument presented here, Derrida's considerations prove pivotal: the aim will be to try and deepen his assumption, investigating the relationship between illusion, haptic perception and works of art. Addressing the possibility that both the theory and practice which anticipate and guide haptic experiences and technologies account for an illusory character, escaping the grounds of undeniable certainty and adherence to reality which are at times linked to the discourse on touch.

This study will in fact envisage the possibility that illusion imposes itself as a constitutive figure of haptic feeling both on a theoretical level and on a technical one. The research will focus on how the experience of touching plastic objects changes from the analogical dimension to the digital one, first from a theoretical point of view and then across a range of case studies within the museum sector. In the peculiar phenomenon of touching sculpture in a virtual environment employing haptic devices, the *illusion* changes its function: before a theoretical figure, it becomes an experiential strategy. Not necessarily aimed at generating a phenomenological surplus, which as we will see most technologies are not able to offer, but at offering the possibility of a semantic shift on an emotional and aesthetic level. The study will begin with an assessment of Derrida's theorizing on the haptic and on virtuality, highlighting the inherent illusory character that seems to be shared by both virtual haptic museological experiences and the theorizing of "haptic" itself, a link captured by the author already in his work *On Touching*. While borrowing from Derrida the relevance of museum practices as case studies for the discussion on the haptic, this article will however assess evidentiary accounts in the second section of the text. Before addressing the case studies, it was deemed necessary to elaborate two relevant premises. On the one hand, a thorough account of haptic technologies and of the current theoretical issues that guide their design will be presented, with reference to the challenges posed by haptic illusions. On the other hand, a historiographic account of the fundamental role that the concept of illusion

has played in the theorizing of the haptic discourse will be offered. Through this analysis, we aim to hopefully demonstrate the structural role played by the figure of illusion in both theoretical and technological designs, strengthening the rationale which serves as the guiding principle of the discussion at hand. The second section, following Derrida's intuition and using museological haptic technologies case studies, will try to assess how these premises relate to the cultural offer available to the public. Beginning from the relationship between touching and cultural artifacts, and more specifically sculptures, which has played a central role in both philosophical and museological undertakings, a history of touch in museums will be briefly traced, connecting contemporary endeavors to their historical predecessors. Then a series of relevant case studies will be presented, trying to understand, by looking closely at their design and reception, what aspect of the haptic experience they aimed to leverage on, and therefore which epistemic and experiential qualities were privileged. It will emerge that when museums are trying to reinstate the evidentiary nature of the haptic experience, and focus on mimicking a reductive understanding of the phenomenology of touch, the results might be scientifically interesting yet not experientially powerful. By contrast, when the more evocative and illusory qualities of the haptic are investigated, exploiting a more environmental and multifaceted account of the haptic experience, a new and promising use of haptic technologies is possible.[3]

"Tact beyond the possible:"[4] illusion as a figure of the haptic between historiography and psycho-aesthetics

The teleological value of the human hand as a pro toto organ of the sense of touch is a recurring trope in the history of philosophy, from Kant, through Herder, de

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3 Although the paper is the result of a collective research and reflection work made by the two authors, the first section was written by Valentina Bartalesi, the second one by Anna Calise.
4 J. Derrida, *On Touching*: 66.

Miran, Husserl, until Katz, Focillon, Révész, and Gibson.[5] In Derrida's analysis the haptic, assumed as a not *strictu sensu*[6] sense that "virtually" involves the sensorium in its obscure intricacy,[7] is qualified by the peculiar "motor activity"[8] of the human hand. Yet, while recognizing the constitutive motility of this sensory faculty, Derrida refuses such preliminary immediacy, claiming with Nancy its "local, fractal, modal" nature.[9] If these adjectives partially complicate the meaning of touching on an ontological level, they seem to encourage the reflection towards a technical sphere, according to an address that Derrida tries to verify. As a proof of the fragility of a way of thinking that *a priori* denies the possibility of virtualizing touch, the philosopher presents a significant case study for that time: the *Haptic Museum* in California.[10]

In spite of the limited evidence still available with regards to this institution, its mission appears clear. As Margaret L. Mclaughlin of the Integrated Media Systems Center (University of Southern California) states:

Our IMSC team has used haptics to allow museum visitors to explore three-dimensional works of art by "touching" them, something that is not possible in ordinary museums due to prevailing "hands-off" policies. Haptics involves the modality of touch–the sensation of shape and texture an observer feels when exploring

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5 J. Derrida, *On Touching*: 41-42, 95, 122, 140. See in this respect: L.A. Jones, S.J. Lederman, *Human Hand Function* (Oxford: Oxford University Press, 2006): 6; A. Benjamin, "Endless touching: Herder and sculpture," *Aisthesis. Pratiche, linguaggi e saperi dell'estetico 4*, no. 1, (2011): 73-92, https://doi.org/10.13128/Aisthesis-10983; H. Focillon, "Éloge de la main" (1934), in *Vie des Formes* (Paris: Presses Universitaires de France, 1981); G. Révész, *The Human Hand* (London: Routledge & Kegan Paul, 1958); J.J. Gibson, "Observations on active touch," *Psychological Review* 69, no. 6 (November 1962): 477-491, https://doi.org/10.1037/h0046962.
6 J. Derrida, *On Touching*: 53, 149.
7 Ibid.: 42.
8 Ibid.: 142.
9 As noted by: "But there again-and this, too, has to be clear only upon the condition that tact does not concentrate, does not lay claim as Descartes's touching does to the privilege given to immediacy, which would bring about the fusion of all the senses and of 'sense.' Touching, too, touching, first, is local, modal, fractal", J.L. Nancy, *Corpus*: 76.
10 J. Derrida, *On Touching*: 300-301; M.L. Mclaughlin *et al*., "The haptic museum," *Conference: Proc. of the EVA 2000 Florence Conf. on Electronic Imaging and the Visual Arts* (March 2000), https://www.researchgate.net/publication/229433104_The_Haptic_Museum, accessed December 11, 2022.

a virtual object, such as a 3D model of a piece of pottery or art glass.[11]

Although presumably the first example of a haptic museum equipped with exosomatic technologies,[12] Derrida's case includes many factors that have become constitutive in subsequent museological proposals. By interacting with the *PHANToM haptic device*[13] or wearing the exoskeleton glove *CyberGrasp*,[14] at those times futuristic apparatuses, visitors could proceed to the manual exploration of virtual artifacts, digitized by employing 3D cameras such as *ColorScan* or *Virtuoso*.[15] Technically, the "haptic human-computer interaction (HCI)" requires a structural triad composed of "human user, interface device, and virtual environment synthesized by computer."[16] Through "haptic-rendering algorithms,"[17] the device provides specific stimuli arising from the interaction between the "haptic device representation" (the user's avatar) and the

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11 M.L. Mclaughlin *et al.,* "The haptic museum:" w.p.
12 Among the twentieth-century experiences, one of the first tactile museum exhibitions dedicated to blind people was organized by The American Museum of New York in 1909. While in the 1970s, numerous worldwide museums realized tactile pathways dedicated to the visually impaired, the first Haptic Gallery was opened by the National Portrait Gallery in Washington D.C. on March 1st 1979, as the Smithsonian Archive documentation testifies. See in this respect: H.F. Osborn, *The American Museum of Natural History: its origin, its history, the growth of its departments to December 31, 1909* (New York: The American Museum of Natural History, 1909): 148; Chronology of Smithsonian History, "NPH Haptic Gallery Opens" (March 1st 1979): https://siris-sihistory.si.edu/ipac20/ipac.jsp?&profile=all&source=~!sichronology&uri=full=3100001~!1462~!0#focus accessed December 11, 2022; Council on Museums and Education in the Visual Arts, *The art museum as educator: a collection of studies as guides to practice and policy* (Berkeley: University of California Press, 1978).
13 Designed by the MIT Artificial Intelligence Laboratory in 1994, "PHANToM is a convenient desktop device which provides a force-reflecting interface between a human user and a computer." Inserting the index fingertip into a thimble or interacting with a stick, PHANToM consists in "a system capable of presenting convincing sensations of contact, constrained motion, surface compliance, surface friction, texture and other mechanical attributes of virtual objects." T.H. Massie, J.K. Salisbury, "The PHANToM haptic interface: a device for probing virtual objects," *Dynamic Systems and Control* 55, no. 1 (1994): w.p.
14 Commercialized in 2009, "the *CyberGrasp* device is a lightweight, force-reflecting exoskeleton that fits over a *CyberGlove* data glove (wired version) and adds resistive force feedback to each finger. With the *CyberGrasp* force feedback system, users are able to feel the size and shape of computer-generated 3D objects in a simulated virtual world." Please see: *CyberGrasp, CyberGlove System*: https://static1.squarespace.com/static/559c381ee4b0ff7423b6b6a4/t/5602fc01e4b07ebf58d480fb/1443036161782/CyberGrasp_Brochure.pdf, accessed December 11, 2022.
15 M.L. Mclaughlin *et al.,* "The haptic museum:" w.p.
16 D. Wang et al., "Haptic display for virtual reality: progress and challenges," *Virtual Reality & Intelligent Hardware* 1, no. 2 (April 2019): 137 https://doi.org/10.3724/SP.J.2096-5796.2019.0008.
17 Ibid.: 141-143.

photogrammetric restitution of the object in a virtual environment (the haptic image).[18] Hence, according to the object-relational data model, users receive tactile and kinesthetic feedback geared towards the stimulation of the mechanoreceptors on the fingertip (for *PHANToM*) and on the whole hand surface (if wearing *CyberGrasp*) during the exploration of the virtual object.[19] More specifically, the subject perceives vibrotactile feedback which should make him or her feel those sensations that are connotative of touching the physical object,[20] absent in its *ilemorphic habitus* albeit realistically tangible in its morphological properties of size, weight, surface, and texture.[21]

Beyond the issues more strictly related to the physiology of the experience, it is here relevant to examine how these researchers have recorded the act of touching a virtual object. Unexpectedly, the members of the Californian IMSC, as well as the French philosopher, feel the need to put in inverted commas locutions such as "touching," "remote touching," or "realistic sensations of touching."[22] The grammatical *escamotage* of the quotation marks clearly betrays the necessity, be it more or less incidental, to denounce the presence of expressions bent to a "special or translated" use. In the technical gesture that the Haptic Museum visitor makes exploring virtual artifacts, Derrida glimpses the theoretical locus where "immediate contact"[23] discloses its own illusory and ontologically fictitious dimension, opening a chasm within the very meaning of touch: ultimately, what is the object of touch? Is this an illusion of

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18 K. Salisbury, F. Conti, F. Barbagli, "Haptic rendering: introductory concepts," *IEEE Computer Society* 24, no. 2 (March/April 2004): 25-26, https://doi.org/10.1109/MCG.2004.1274058.

19 P.P. Pott, "Haptic Interfaces," in L. Manfredi, ed., *Endorobotics. Design, R&D, Future Trends* (Academic Press, 2022).

20 Even if, according to Salisbury and Srinivasan "the resulting sensations prove startling, and many first-time users are quite surprised at the compelling sense of physical presence they encounter when touching virtual objects," the improvement of haptic feedback constitutes one of the main purposes of this kind of technology. J.K. Salisbury, M.A. Srinivasan, "Phantom-based haptic interaction with virtual objects," *IEEE* (September/October 1997): 6-10, https://doi.org/10.1109/MCG.1997.1626171.

21 As Derrida notes, describing the above-mentioned experience, "we can thus feel the weight, form, and structure of the surface of a Chinese vase while 'holding' a three-dimensional digital model," J. Derrida, *On Touching*: 301.

22 Ibid.

23 Ibid.

touch or what Madalina Diacuno prefers to define in terms of "illusionary touch"?[24] If so, how to illustrate the phenomenology of such an illusion?

The noun "illusion," from the Latin *illudere* (in, "against," *ludere* "to play"), describes an "act of deception; deceptive appearance, apparition; delusion of the mind."[25] However, in the specialist lexicon on haptic perception the expression "haptic illusion" more rigorously recounts a "disruption of the physical coherence between real movement and feedback forces, used to create the illusion of a non-existent feature or to compensate with the illusion the sensation of an undesired detail."[26] As convincingly established by the critical literature since Révész, several haptic illusions have been codified and are currently under investigation.[27] It should also be noted that a similar illusion, even though different in terms of the neurological reaction experienced with haptic prostheses in virtual environments, is daily negotiated by the user in the interaction with touch screens. The most recent media-archeological studies have investigated this ambiguous nature of "touching," recording the hiatus which systematically occurs when the consumer digitally interacts with the contents that pass through the "display."[28] In this regard, Simone Arcagni has recently pointed out how touch screens solicit a kind of experience "as if there were no longer a mediation between the idea of doing and the action that takes place in our hands" by

24 M. Diaconu, "Illusionary touch, and touching illusions," in A. Tymieniecka, ed., *Analecta Husserliana. The Yearbook of Phenomenological Research. Human Creation Between Reality and Illusion*, vol. 87 (Cham: Springer, 2005): 115-125.
25 "Illusion," *Online Etymology Dictionary*: https://www.etymonline.com/word/illusion, accessed December 11, 2022.
26 M. Grunwald, ed., *Human Haptic Perception. Basics and Applications* (Basel: Birkhäuser, 2008): 649.
27 The main haptic illusions include "size-weight illusion," a tangible version of the "Muller-Lyer illusion," the "horizontal-vertical illusion" and the "Ponzio illusion." See in this regard: M.A. Heller, E. Gentaz, "Illusions," in M.A. Heller, E. Gentaz, eds., *Psychology of Touch and Blindness* (New York-London: Psychology Press - Taylor & Francis Group, 2014): 61-78.
28 F. Casetti, "Primal screens," in C. Buckley, R. Campe, F. Casetti, eds., *Screen Genealogies. From Optical Device to Environmental Medium* (Amsterdam: Amsterdam University Press, 2019): 45; F. Casetti, "Che cos'è uno schermo, oggi?," *Rivista di Estetica* 55 (2014): 28-34 https://doi.org/10.4000/estetica.969. According to Francesco Casetti, touch screens represent the most effective type of display (ibid.: 29), a device that the author links to an instant, "passive" and disengaged communication. Consistently to the current hypertrophic consumption of images, Casetti's display "exhibits, not reveals. It offers, not engages" (ibid.) and this happens because the touch screen "puts images in our hands" (ibid.).

intensifying the sensation of proximity between user and content.[29] Raising attention to the dangers inherent in the automation of touching, David Parisi has introduced the military phrase "Fingerbombing," highlighting the "distanced, detached and destructive" nature of interaction with the touchscreen of a *Nintendo DS*.[30] Furthermore, citing Thomas Hirschhorn's brutal video clip *Touching Reality* (2012), Wanda Strauven has denounced the moral and technical break between screen and display, whereby the object of touch results in the screen and not the images passing through it.[31] Once more, what do the subjects touch and what do they perceive by touching and consuming?[32]

  In light of this ontological uncertainty, the ability to confer and simulate the highest degree of realism to the haptic experience of virtual content through a heterogeneous range of devices – among the most futuristic devices should be mentioned *AirPiano*,[33] *VibroWeight*,[34] *WeHAPTIC*[35] – is generally considered one of the overriding

29 S. Arcagni, *Visioni Digitali: Video, Web e Nuove tecnologie* (Torino: Einaudi, 2016): 301.
30 D. Parisi, "Fingerbombing, or 'Touching is Good': The Cultural Construction of Technologized Touch," in M. Elo, M. Luoto, eds., *Figure of Touch: Sense, Technics, Body* (Helsinki: The Academy of Fine Arts at the University of the Arts Helsinki, Tallinna Raamatutrükikoja OÜ, 2018): 83.
31 W. Strauven, *Touchscreen Archeology* (Lüneberg: Meson Press, 2021): 112-116. Cfr. W. Strauven, "Marinetti's tattilismo revisited hand travels, tactile screens, and touch cinema in the 21st Century," in R. Catanese, ed., *Futurist Cinema* (Amsterdam: Amsterdam University Press, 2018): 70.
32 See in this respect: M. Racat, S. Capelli, "Touching without touching: the paradox of the digital age," in M. Racat, S. Capelli, eds., *Haptic Sensation and Consumer Behavior. The Influence of Tactile Stimulation in Physical and Online Environments* (Nature Switzerland: Springer, 2020).
33 *AirPiano* constitutes "an enhanced music playing system to provide touchable experiences in HMD-based virtual reality with mid-air haptic feedback". For more information see: I. Hwang et. al., "AirPiano: enhancing music playing experience in virtual reality with mid-air haptic feedback," *2017 IEEE World Haptics Conference* (WHC): 213-218 https://doi.org/10.1109/WHC.2017.7989903.
34 VibroWeight represents "low-cost hardware prototype with liquid metal" employing "bimodal feedback cues in VR, driven by adaptive absolute mass (weights) and gravity shift:" X. Wang *et. al.*, "VibroWeight: simulating weight and center of gravity changes of objects in virtual reality for enhanced realism," *Human Computer Interaction* (2022): https://doi.org/10.48550/arXiv.2201.07078.
35 *WeHAPTIC* (Wearable Haptic interface for Accurate Position Tracking and Interactive force Control) "shows improved performances in terms of finger motion measurement and force feedback compared with existing systems such as finger joint angle calculation and precise force control:" Y. Park et. al., "WeHAPTIC: a Wearable Haptic interface for Accurate Position Tracking and Interactive force Control," *Mechanism and Machine Theory* 153, (November 2020): https://doi.org/10.1016/j.mechmachtheory.2020.104005.

objectives for improving these technologies.[36] Furthermore, even though since the invention of the first haptic device in 1948[37] continuous improvements have been made, contemporary interfaces present both a qualitative and quantitative *deficit* compared to the human haptic sensitivity, calling for "urgent requirement to improve the realism of haptic feedback for VR systems, and thus to achieve equivalent sensation comparable to the interaction in a physical world."[38]

While the expression "haptic realism," coined by the philosopher of science Mazviita Chirimuuta in 2016, opens the hypothesis of a scientific perspectivism based on interaction with the world,[39] the same expression when related to haptic interfaces assumes a more technical connotation. As Sushma Subramanian points out in a conversation during the 2020 World Haptics Conference with Ed Colgate, Professor of Mechanical Engineering at Northwestern University, although haptic technologies still go through a "primitive" state, the short-term goal in their design is to "develop a new tactile language that mimics the kinds of maneuvers we make with three-dimensional objects" in which "the challenging part is to make us feel them."[40] A leading producer such as the Berlin-based Lofelt attempts to make interaction with the touch screen more realistic by combining sounds with the corresponding haptic vibrations

36 A. Brogni, D.G. Caldwell, M. Slater, "Touching sharp virtual objects produces a haptic illusion," in R. Shumaker, ed., *Virtual and Mixed Reality* (Berlin Heidelberg: Springer, 2011): 234-242; A. Gallace, M. Girondini, "Social touch in virtual reality," *Current Opinion in Behavioral Sciences* 43 (February 2022): 249-254, https://doi.org/10.1016/j.cobeha.2021.11.006. It should be noted how the design of "pseudo-haptic feedback" is also nodal to the experience of touching in virtual environments. See in this regard A. Maehigashi et. al., "Virtual weight illusion: weight perception of virtual objects using weight illusion," *CHI '21 Extended Abstracts* (May 2021), https://doi.org/10.1145/3411763.3451842. Furthermore, the design of an effective haptic illusion in a virtual environment is related to scale and precisely to the so-called "Body-scaling effect": P. Abtahi, "From illusions to beyond-real interactions in virtual reality," *UIST '21: The Adjunct Publication of the 34th Annual ACM Symposium on User Interface Software and Technology* (October 2021): 153-157, https://doi.org/10.1145/3474349.3477586.
37 As David Parisi reports, the invention of the first mechanical force feedback master-slave manipulator in nuclear field is due to the engineer Raymond Goertz of the Atomic Energy Commission for the Argonne National Laboratory. D. Parisi, *Archaeologies of Touch. Interfacing with Haptics from Electricity to Computing* (Minneapolis, London: University of Minnesota Press, 2018): 220-221.
38 D. Wang, "Haptic display:" 137.
39 M. Chirimuuta, "Vision, perspectivism, and haptic realism," *Philosophy of Science* 83, no. 5 (December 2016), 746-756 https://doi.org/10.1086/687860.
40 S. Subramanian, *How to Feel. The Science and Meaning of Touch* (New York: Columbia University Press, 2021): 250-251.

so that the user participates in an immersive experience. As Lofelt founder Daniel Büttner asserts: "it is all an illusion, but it seems incredibly real."[41] In a similar direction, the most advanced research conducted by the *Intelligent Haptic* program of the Max Planck Institute for Intelligence System aims to implement the sensitivity of electrovibrations.[42] Evidence that haptic perception is one of the most promising experimental fields for the virtual world is reflected in the great number of HORIZON programs supported by the European Union in the last five years,[43] mainly dedicated to *Mid-Air* and *Mixed Haptic Feedback* technologies. Ultrahaptics, launched in 2013, consists in a haptic device system in which the force feedback is positioned

above interactive surfaces and requires no contact with either tool, attaching to the surface itself. Instead, haptic sensations are projected through a screen and directly onto the user's hands. It employs the principle of acoustic radiation force whereby a phased array of ultrasonic transducers is used to exert forces on a target in mid–air.[44]

H-Reality devices, on the other hand, employing mixed haptic feedback technology "aim at combining the contactless haptic technology with the contact haptic technology and then apply it into virtual and augmented reality

41 R. Banham, "Haptic happenings: how touch technologies are taking on new meaning," *Dell Technologies* (October 21, 2019): https://www.delltechnologies.com/en-us/perspectives/haptic-happenings-how-touch-technologies-are-taking-on-new-meaning/, accessed December 11, 2022.
42 Y. Vardar, K.J. Kuchenbeker, L. Behringer, "Challenging the design of electrovibrations to generate a more realistic feel," *Haptic Intelligence Max Planck Institute for Intelligent Systems* (April 6, 2021): https://hi.is.mpg.de/news/challenging-the-design-of-electrovibrations-to-generate-a-more-realistic-feel, accessed December 11, 2022.
43 Among them we point out: Horizon 2020 (CORDIS), *TACTIle Feedback Enriched Virtual Interaction through Virtual RealITY and beyond,* (July 1, 2019-September 30, 2022): https://cordis.europa.eu/project/id/856718/it, accessed December 11, 2022; Horizon 2020 (CORDIS), *Multimodal Haptic with Touch Devices* (March 1, 2020-February 29, 2024): https://cordis.europa.eu/project/id/860114/it, accessed December 11.
44 T. Carter *et. al*., "Ultrahaptics: multi-point mid-air haptic feedback for touch surfaces," *UIST '13: Proceedings of the 26th Annual ACM Symposium on User Interface Software and Technology* (St. Andrews, UK: October 8-11, 2013): 505-506.

technologies."[45] These projects encourage "to achieve high-fidelity sensations through technology that is easy and comfortable to use, for both interactive augmented reality (AR) and immersive virtual reality (VR) experiences";[46] rendering potentially less unreachable that horizon of touch virtualisation from which Derrida took his cue.

In assessing the role that illusion plays for the effective functioning of haptic technologies, it can be questioned whether this prevalent position is distinctive of the digital era or if it represents a consolidated trope in haptic historiography, often centered on the theoretical and practical opportunity to touch – or not! – sculpture, at times accused of being the least illusory of the arts.[47] In undertaking the investigation from "haptics"[48] to "haptic,"[49] we will proceed in a parallel line to the essentially optical one

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45 "H-Reality," FET FX. Our future today (2020): http://www.fetfx.eu/project/h-reality/; see also: X. de Tinguy, C. Pacchierotti, A. Lécuyer, "Capacitive sensing for improving contact rendering with tangible objects in VR," *IEEE Trans Vis Comput Graph – IEEE Transactions on Visualization and Computer Graphics* 27, no. 4 (December 2020): 2481-2487, https://doi.org/10.1109/TVCG.2020.3047689.

46 Horizon 2020 (CORDIS), Mixed Haptic Feedback for Mid-Air Interactions in Virtual and Augmented Realities (October 1, 2018- March 31, 2022): https://cordis.europa.eu/project/id/801413/it, accessed December 11, 2022.

47 Is given below the renowned passage in Benedetto Varchi's *Paragone* (1547) in which painters vituperate sculpture by stating: "They argue again from the difficulty of art, where, distinguishing the difficulty into two parts: in fatigue of body, and this as ignoble they leave to sculptors: and in fatigue of wit, and this as noble they reserve for them, saying that, besides the different manners and ways of working and coloring, in fresco, oil, tempera, glue and gouache, painting makes a figure foreshorten, [it] makes it seem round and raised in a flat field, making it break through and seem far away with all the appearances and vagueness that can be desired, giving to all their works lumens and shadows well observed according to the lumens and reverberations, which they hold to be a most difficult thing; and in conclusion they say that they make appear what is not: in which thing they seek effort and infinite artifice", B. Varchi, *Lezzione. Nella quale si disputa della maggioranza delle arti e qual sia più nobile, la scultura o la pittura* (Firenze: Fondazione Memofonte, 1547): 38.

48 The plural noun *haptics*, deriving from the Greek feminine *haptikós* and the Neo-Latin *hapticē*, a term coined in 1685 by Isaac Barrow in *Lectiones Mathematicae XXIII*, is literally translated as "science of touch". Haptics refers to the science of touch in a techno-media perspective, denoting the tactile feedback generated by those devices which, by sending artificial stimuli at proprioceptive, limbic and muscular levels, simulate the sensation of actual contact: "Haptics," *Merriam-Webster Dictionary* (online): https://www.merriam-webster.com/dictionary/haptics, accessed December 11, 2022.

49 The Greek etymon *haptō*, from which derive the word *haptos* (tangible, sensitive), the predicate *háptein* and the adjective *haptikós*, from which derive the French *haptique*, the German *haptisch/Haptik* and the English haptic, means variously "able to come into contact with" (*haptikós*) and "to clasp, grasp, lace" (*háptein*).

stabilized by Riegl,[50] bearer of a critical fortune culminating with the later reworkings elaborated by Deleuze,[51] Maldiney,[52] Dufrenne[53], Marks[54] and Barker.[55] Concerning the covertly panoptic conception of the haptic that had been spreading in German *Kunstwissenschaft* since Hildebrand's studies,[56] it is necessary to turn our attention to the developments taking place in the psychophysiological area around the same years. In the wake of Heinrich Weber's pioneering studies on the sense of touch, in which sensory illusions after limbs amputation[57] (the so-called *Phantom Sensations*)[58] were classified as not accidentally probed; the first use of the term haptic in 1892 by another eclectic Berliner, Max Dessoir, was systematized almost simultaneously by Edward Titchener.[59] The rehabilitation of this

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50 As Andrea Pinotti notes via Révész, "It is significant that, the year after the publication of *Kunstindustrie*, in an article in which he argues with Strzygowski, Riegl admits that the term *taktisch* (*tastbar,* from the Latin *tangere*) can lead to misunderstandings, and declares himself willing to adopt instead the term haptisch (from the Greek *hapto*), which the physiological literature had since long employed in its research on sensoriality. Perhaps a way, that of moving from Latin to Greek, to avoid any possible reference to the actual manual palpation and reaffirm the fundamental strength of the *haptisch,*" A. Pinotti, "Guardare o toccare? Un'incertezza herderiana," *Aisthesis. Pratiche, linguaggi e saperi dell'estetico* 2, no. 1 (2009): 186, https://doi.org/10.13128/Aisthesis-10953, trans. mine. For a first bibliographical framing of Riegl's haptic construction see: M.R. Olin, *Forms of Representation in Alois Riegl's Theory of Art* (University Park: Pennsylvania State University Press, 1992); M. Iversen, *Alois Riegl: Art History and Theory* (Cambridge, MA: MIT Press, 1993); S. Melville, "The temptation of new perspectives" (1990), in D. Preziosi, ed., *The Art Of Art History. A Critic* (Oxford: Oxford University Press, 2009): 274-283; G. Vasold, "'Das Erlebnis des Sehens'. Zum Begriff der Haptik im Wiener fin de siècle," *Maske und Kothurn* 62 (2016): 46-70.
51 G. Deleuze, *Francis Bacon. Logic of Sensation* (1981), trans. D.W. Smith (London-New York: Continuum, 2003): 122, 189.
52 See in this regard: A. Pinotti, "Style, rythme, souffle: Maldiney and kunstwissenschaft," in J.-P. Charcosset, ed., *Parole Tenue: Colloque du Centenaire du Maldiney á Lyon* (Milan: Mimesis Edizioni, 2014): 49-59.
53 See in this respect: A. Pinotti, ed., *Alois Riegl. Grammatica storica delle arti figurative* (Macerata: Quodlibet, 2018), XLVI.
54 We refer specifically to the postcolonial construct of haptic visuality that Laura Marks derives and resemantizes from the lesson of Regl's heritage: L.U. Marks, *Touch: Sensuous Theory and Multisensory Media* (Minneapolis-London: University of Minnesota Press, 2002): 4-7; L.U. Marks, *The Skin of the Film. Intercultural Cinema, Embodiment, and the Senses* (Durham-London: Duke University Press, 2000): 162-171.
55 J.M. Barker, *The Tactile Eye. Touch and the Cinematic Experience* (Berkeley-Los Angeles-London: University of California Press, 2009): 37-38.
56 See in this regard: A. Pinotti, *Il corpo dello stile. Storia dell'arte come storia dell'estetica a partire da Semper, Riegl, Wölfflin* (Milano: Mimesis, 2001). See specifically the third section entitled "Occhio e mano:" 179-221.
57 M. Grunwald, M. John, "German pioneers of research into human haptic perception," in M. Grunwald, ed., *Human Haptic Perception. Basics and Applications* (Basel: Birkhäuser, 2008): 19.
58 T. Weiss, "Phantom sensations," in M. Grunwald, ed., *Human Haptic Perception. Basics and Applications* (Basel: Birkhäuser, 2008): 283-294.
59 D. Parisi, *Archaeologies of Touch*: 105.

obsolete Greek term, already Homeric and Aristotelian,[60] reflects Dessoir's will to deepen the investigation on touch by distinguishing the sensations of contact from the active exploration (*Pselaphesie*).[61] This distinction, destined to become normative, emerged in the context of a network of experimental psychology laboratories scattered throughout the United States and orbiting around the Harvard Psychological Laboratory, inaugurated in 1875 by William James, although active only since 1892.[62] While in 1890, James was able to discuss the "fallacy of the senses," taking his cue from the prominent Aristotelic finger illusion,[63] consulting Harvard Laboratory appendix for the two years 1892-1893 shows how scientific trials on touch proceeded simultaneously to the study of optical illusions.[64] A similar experimental path would culminate in 1893 with the presentation of the *Apparatus for Simultaneous Touches* by William Krohn at Clark University.[65]

On the plexus mentioned above, the aesthetical and historiographical discourses are inserted and intertwined, sanctioning the passage from the properly physiological illusion of touching to a metaphorical one, embodied by the rhetorical figure of "as if," direct relative of Derrida's inverted commas. That such a rhetorical stratagem constitutes a much older matter is recalled by the well-known *querelle* of Herderian uncertainty. As already pointed out by Andrea Pinotti, in his aesthetic treatise *Plastik*, Herder seems to allude to the possibility of a virtual touch, reproaching the sculptor who has never touched, not even in a dream,

60 M. Perniola, *Il Sex Appeal dell'Inorganico* (Torino: Einaudi, 1994): 95.
61 M. Dessoir, *Über den Hautsinn* (Separat-Abzug aus Archiv für Anatomie und Physiologie: Physiologische Abtheilung. 1892): 242.
62 G. Bruno, "Film, aesthetics, science: Hugo Münsterberg's laboratory of moving images," *Grey Room* 36 (Summer 2009): 88-113, https://doi.org/10.1162/grey.2009.1.36.88.
63 W. James, *The Principles of Psychology* (Ontario: York University, 1890): 87.
64 H. Munsterberg, *Psychological Laboratory of Harvard University* (Harvard: Harvard University Press, 1893). Munsterberg recorded notes include: "Instrument for studying the fusion of touch sensations. After Krohn; made in Cambridge"; "Instrument for touch reaction, etc;" "Touch-reaction instrument, with twenty different stimuli. By Elbs, Freiburg. $20". See also: Bruno, "Film": 101-102.
65 W.O. Krohn, "Facilities in experimental psychology in the colleges of the United States" (1894), in C.D. Green, ed., *Classics in the History of Psychology* (Toronto: Tork University): https://www.sapili.org/subir-depois/en/ps000128.pdf; D. Parisi, *Archaeologies*: 144-147.

his creation.[66] "The illusion has worked,"[67] the philosopher will add, when the eye takes on the movements of the hand and then of a very thin ray, an emissary of the soul, which kinaesthetically embraces the sculpture as it becomes a body. In the wake of Konrad Lange's *Illusionsästhetik*[68] and J.H. Kirchmann and E. Von Hartmann's doctrine of illusional feelings, the already mentioned Dessoir would achieve an even more drastic conclusion. Declaring that every work of art mainly satisfies a single sensory channel, this sensorial limitation "guarantees its illusory character," generating the paradoxical situation of "a conscious self-deception, of a continued and deliberate confusion of reality and illusion."[69]

However, it was not until the art-historical debate of the early 1950s – while the earliest haptic devices were designed – that an open polarization was reached regarding whether or not sculptures should be touched. On the one hand Herbert Read, moving from the psychological studies of Arnheim, Wundt, Lowenfeld, and Révész, could argue that "for the sculptor, tactile values are not an illusion to be created on a two-dimensional plane: they constitute a reality of being conveyed directly, as existent mass. Sculpture is an art of palpation."[70] On the other hand, a fervent detractor such as the modernist Greenberg would have drastically overturned this assumption.[71] Both consistent readers of Berenson, whose normative and ambivalent

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66 A. Pinotti, *Guardare o toccare*: 189; J.G. Herder, *Sculpture. Some Observations on Shape and Form from Pygmalion's Creative Dream* (1778), ed. J. Gaiger (Chicago-London: The University of Chicago Press, 2002): 41.
67 A. Pinotti, *Guardare o toccare:* 189; J.G. Herder, *Some Observations*: 41.
68 For an introduction to the subject see: D. Romand, "Konrad Lange on 'the Illusion of Materials' in painting and visual arts: revisiting a psychoaesthetic theory of the perception of material properties," in J. Stumpel, M. Wijntjes, eds., *Art and Perception. An International Journal of Art and Perception Science, Special Issue: The Skin of Things: On the Perception and Depiction of Materials* 7, no. 3-4 (2021): 283-289.
69 M. Dessoir, Aesthetics and Theory of Art. *Ästhetik und Allgemeine Kunstwissenschaft* (1906), trans. S.A. Emery, (Detroit, Wayne State University Press, 1970): 53.
70 H. Read, *The Art of Sculpture* (London: Faber & Faber, 1954): 49.
71 We are referring specifically to Greenberg's harsh and inflexible review of Read's monograph: C. Greenberg, "Roundness isn't all," (November 25, 1956), in J. O' Brian, ed., *Clement Greenberg: Collected Essays and Criticism* 3 (Chicago: The University of Chicago Press, 1995): 272.

"tactile values"[72] find a more truthful attestation in the corollary categories of "ideated sensations," "ideated satisfactions" and "ideal sensation of contact,"[73] Read and Greenberg finally reached an unexpected consonance. Whilst Read claimed the experience of sculpture as distinctive of haptic perception and, specifically, for the prehensility of the hand; Greenberg denied the appropriateness of such fruition, attributing tactile stimuli to the visual sphere. Meanwhile, Herder's uncertainty remains. Indeed, as David J. Getsy noted, it is ultimately unclear whether Read wished for a knowledge of the plastic work through its palpation or maintained such contact on a substantially preliminary and physiological condition.[74]

In order to enrich the *corpus* of sources of such a *querelle* numerous other examples could be made; nonetheless, one of the most promising scenarios for its analysis, as prophetically announced by Derrida, is offered by the exploration through haptic interfaces of digitized artifacts in museums. When the veto of touching the work of art lapses and the distinction between actual and fictional flattens out, which horizons are opened by the possibility of touching? Will it be a "tactile vertigo" in the sense of Baudrillard, in which the virtual object expired at the status of a *trompe-l'œil* image soliciting a "tactile hyper presence of things, as though one could hold them," despite its phantasmagorical essence?[75] Can these finally touchable bodies add much

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72 A. Brown, "Bernard Berenson and 'tactile values' in Florence," in J. Connors, ed., *Bernard Berenson: Formation and Heritage* (Cambridge, Massachusetts: Villa I Tatti, The Harvard University Center for Italian Renaissance Studies, 2014). For an analysis highlighting the subtle pantheism underlying Berenson's work, see: A. Pinotti, "The touchable and the untouchable. Merleau-Ponty and Bernard Berenson," *Phenomenology 2005* 3, no. 2, (2007): 479-498.
73 B. Berenson, *Aesthetics and History* (New York: Doubleday & Company, 1948): 24-25, 74.
74 As David J. Getsy pointedly notes: "Read did not necessarily argue that the viewer must touch the sculpture in order to appreciate it, as Greenberg would have us believe. Rather, it was the aggregate experience of tactility that provides us with an ability to assess ponderability and the non-visual traits of any object. Our haptic sensibility and our sense of the physical environment are both closely tied to our own ever-developing repertoire of tactile and physical experiences"; D.J. Getsy, "Tactility or opticality, Henry Moore or David Smith: Herbert Read and Clement Greenberg on *The Art of Sculpture*, 1956," in R. Peabody, ed., *Anglo-American Exchange in Postwar Sculpture, 1945–1975* (Los Angeles: Getty Publication, 2011): 111-112.
75 J. Baudrillard, *Seduction* (1979), trans. B. Singer (Montréal: New World Perspectives. Culture Text Series, 1990): 62-63.

to the illusory palpation of the work of art on a semantic level, if not on a phenomenological one?

Haptic technologies and museums, the imaginative frontiers of the phenomenology of touch

In order to present a critical account of how haptic technologies are being employed in museums, and to investigate to what extent the projects designed within these environments fully explore the illusory potential of virtual haptic experiences, a preliminary discussion on analog touch in museums is needed. The use of haptic technologies within museum settings,[76] which has widely increased in the last decades, is in fact not something new to cultural experiential models,[77] and more the reinstatement of practices which had been common policies in museums from their foundation to the middle of the nineteenth century. While today it is "generally taken for granted that museums collections are not for touching"[78] seventeenth- and eighteenth-century museum visitors were customarily free to pick up precious and delicate relics, enjoying their sense of touch as a fundamental part of their overall experience. More specifically, touch in early museums was used for four different reasons:[79] learning (as touching an object provided relevant information that through sight could not be obtained, like its weight), aesthetic appreciation (touch was considered to allow an embodied understanding of the

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76 For a comprehensive account on how the importance of touch has been re-evaluated in the museum sector in the past three decades please cfr. G. Black, T*he Engaging Museum: Developing Museums for Visitor Involvement* (Oxford: Routledge, 2005); E. Pye, *The Power of Touch: Handling Objects in Museums and Heritage Contexts* (Walnut Creek, CA: Left Coast Press, 2007), H. Chatterjee, *Touch in Museums: Policy and Practice in Object Handling* (Oxford: Berg, 2008); F. Candlin, *Art, Museums and Touch* (Manchester: University of Manchester Press: 2010), and S. Dudley, ed., *Museum Objects: Experiencing the Properties of Things* (London: Routledge, 2012).
77 C. Classen, *The Deepest Sense. A Cultural History of Touch* (Chicago: University of Illinois Press, 2012): 136-146.
78 Ibid.: 137.
79 A synthetic account of the reasons why touch was a common practice in museums can be found in Classen, *The Deepest Sense*: 139-142. For other discussions on the topic please cfr. D. Howes, "Introduction to sensory museology," *The Senses and Society* 9, no. 3 (2014): 259-267 https://doi.org/10.2752/174589314X14023847039917 and R.F. Ovenell, *The Ashmolean Museum*, 1683–1894 (Oxford: Clarendon Press, 1986).

nature of the display), imaginary potential (by holding an artifact visitors could get emotionally in touch with its original owner or maker) and healing powers (especially religious relics, when touched or eaten,[80] where deemed able to cure illnesses and pains). As it appears evident already from this first account, not all yet some of the functions of touch in museums had to do with the potential to empower imaginative accounts, associating the role of touching not only with evidentiary information, yet also with intangible and elusive, even powerful, qualities. From the mid of the nineteenth century touch was banned from museums:[81] conservation matters became more and more relevant, while parallelly touch in itself came to be classified as a secondary sense, one "associated with irrationality and primitivism."[82] These two reasons account for two extremely different discourses, one linked to practical aspects and to the preservation of cultural heritage, the second pertaining to a conceptual sphere, having to do with epistemic premises and their museological consequences.

Today, well into the third decade of the 21st century, the situation in museums seems to be closer to that of three centuries ago than to the end of the last Millenium. Touch seems to have regained its epistemic status,[83] and modern haptic technologies allow its employment without the need to endanger precious artifacts. The great difference, however, is that machines and proxies mediate the haptic experience, defining its phenomenology. The question which arises, at this point, seems to be to what extent these technologies are and will be designed with the aim

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80 For a historical account of the healing powers of ancient religious relics cfr. K. Arnold, "Skulls, mummies and unicorns' horns: medicinal chemistry in early english museums," in R.G.W. Anderson *et al., Enlightening the British: Knowledge, Discovery and the Museum in the Eighteenth Century* (London: The British Museum Press, 2003), also E. Brown, *An Account of Several Travels through a Great Part of Germany* (London: Benjamin Tooke, 1677), and D. Murray, Museums: *Their History and Use*, vol. 1. (Glasgow: James MacLehose and Sons, 1904): 40, 50, 73.

81 For an account of the historical reasons which led to this change cfr. Classen, *The Deepest Sense*: 143-146, and F. Candlin, *Art, Museums and Touch*.

82 C. Classen, *The Deepest Sense. A Cultural History of Touch*: XIV.

83 For a discussion on the epistemic value of touch please cfr. C. Classen, *The Book of Touch* (Oxford: Berg Publishers, 2005), M. Peterson, *The Senses of Touch* (London: Routledge, 2007), M.P. Gadoua, "Making sense through touch. Handling collections with Inuit Elders at the McCord Museum," *The Senses and Society* 9, no. 3 (2014): 323-341 https://doi.org/10.2752/1 74589314X14023847039719.

to mirror the original analog functions of touch, or whether they will be built and employed with the goal to expand the potential of the haptic experience. With regards to this, it will be important to understand on which of the qualities of touch – amongst the seventeenth century list aforementioned – they will leverage on. Whilst, on the one hand, they could aim at faithfully reproducing the phenomenological qualities of touch, the paragraphs above have shown how there is a wider illusory character that these technologies could be aiming at capturing, one which could hopefully open up new experiential frontiers.

Whilst there isn't one single comprehensive account which maps the state of the arts of haptic technological development in the museum system, literature in this field has been growing recently. This thanks to researches that discuss the regained relevance of touch in educational settings, together with publications which analyze individual projects designed and carried through by museum research centers.[84] A vast number of these studies highlight how haptic technologies allow visitors to "explore new paradigms of interaction"[85] leveraging on the "quality and usefulness of computer-based exhibits."[86] This is granted as the sense of touch "is an essential part of how we interact, explore, perceive and understand our surroundings"[87] and therefore incorporating object based learning in museum

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84 For other interesting case studies analyzing the role of haptic technologies in museums please cfr. R. Comes, "Haptic devices and tactile experiences in museum exhibitions," *Journal of Ancient History and Archeology* 3, no. 4 (2016) https://doi.org/10.14795/j.v3i4.205; F. Fischnaller "The last supper interactive project. The illusion of reality: perspective and perception," in G. Amoruso, ed., *Putting Tradition into Practice: Heritage, Place and Design, Lecture Notes in Civil Engineering* 3, (Cham: Springer International Publishing, 2018) https://doi.org/10.1007/978-3-319-57937-5_73; M.H. Jamil *et al.*, "The role of haptics in digital archaeology and heritage recording processes", *2018 IEEE International Symposium on Haptic, Audio and Visual Environments and Games* (HAVE) (2018): 1-6 https://doi.org/10.1109/HAVE.2018.8547505.
85 A. Frisoli *et al.*, "Evaluation of the pure-form haptic displays used for exploration of works of art at museums," report on the project findings, 2005 retrieved at https://www.researchgate.net/publication/228584199_Evaluation_of_the_pure-form_haptic_displays_used_for_exploration_of_works_of_art_at_museums/ related on the 31/01/2022.
86 S. Brewster, "The impact of haptic 'touching' technology on cultural applications," in J. Hemsley, V. Cappellini, G. Stanke, eds., *Digital Applications for Cultural Heritage Institutions*, (Aldershot: Ashgate, 2005): Chap. 30, 273-284, 282.
87 M. Novak *et al.*, "There is more to touch than meets the eye: haptic exploration in a science museum," *International Journal of Science Education* 42, no. 18 (2020): 3026-3048 https://doi.org/10.1080/09500693.2020.1849855.

experiences increases autonomy and satisfaction.[88] The information that visitors can acquire through touch appears today relevant as it did at the beginning of museum history, and it has become obtainable without endangering the artifacts. 3D replicas of material artifacts associated with a range of wearable or desktop devices are the predominant technologies used across museum experiments, engaging users through mainly force feedback and kinetic stimuli.[89] While providing an account of the state of the arts of the literature and case studies in this sector is not one of the goals of this essay, a series of examples have been chosen as they have been deemed relevant to the research at hand: assessing to what extent haptic museum experience expand and explore their full – at times illusory – potential.

A widely discussed experiment in the field is the Museum of Pure Form, "a collective project ran in the early 2000s by a series of European museums creating 3D digital replicas of their artifacts and making available a technology which allowed for the haptic experience of them."[90] This pivotal program engaged a series of museums across Europe[91] who collected a shared archive of digital replicas of their statues, and then produced a touring exhibition which installed wearable devices (exoskeleton wearable arm) and or desktop devices (two robotic arms departing from support columns placed in front of the visualization screen) in front of the original statues.[92] Overall, findings on the experiment registered both amusement (70% of attendees) and instructiveness (39%) across visitors.[93] The shared belief, confirmed by the analysis conducted simultaneously as the

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88 M. Novak *et al.*, "There is more to touch that meets the eye:" 3044.
89 In the literature it is possible to find studies which evaluate both collaborative endeavors and researches ran by single institutions. Overall, the collaboration between universities or tech companies and cultural institutions seems a fundamental premise in order to allow for trials and studies that evaluate the impact of these projects.
90 A. Frisoli, "Evaluation of the pure-form haptic displays used for exploration of works of art at museums."
91 The Galician Centre for Contemporary Arts in Santiago de Compostela, the Museo dell'Opera del Duomo in Pisa, the National Museum of Fine Arts in Stockholm, the Conservation Centre at National Museums Liverpool and the Petrie Museum of Egyptian Archaeology in London.
92 A. Frisoli, "Evaluation of the pure-form haptic displays used for exploration of works of art at museums:" 2.
93 Ibid.: 6.

project, was that the opportunity to use a device to touch the digital replica of a statue while looking at it enforced the learning experience. Something which, as aforementioned, was deemed constitutive of the relevance of touch in early museum experiences. As this case study shows, together with many that have followed, it seems that one of the main concerns of museum professionals and researchers in designing digital haptic experiences seems to be supplying to the lost opportunity to touch the artworks, thus enabling the visitor to enjoy a wider range of information regarding the statue and, consequently, enriching the learning experience. This, however, faces a series of relevant limitations on the phenomenological level, as discussed above with reference to Wang's analysis in *Haptic Display.* It appears, from this first account, that the use of haptic technologies is not necessarily seen as a strategy to experiment and widen the cultural experience, yet instead as a way to recuperate something that contemporary curatorial practices do not allow – namely to touch originals. With reference to this point, it is interesting to see that there are several researches actually comparing the haptic experience that visitors can have touching the replica of an artifact or its 3D version.[94] It appears that "the comparison between the haptic device and the replica showed that the multi-finger tactile interaction with the replica produced considerably richer information than the single-point contact of the haptic device."[95] What the citation implies is that the technology used provided a less phenomenologically rich experience

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94 Interesting accounts on this debate can be found in M. Dima, L. Hurcombe, M. Wright, "Touching the past: haptic augmented reality for museum artefacts," in R. Shumaker, S. Lackey, eds., *Virtual, Augmented and Mixed Reality. Applications of Virtual and Augmented Reality.* VAMR 2014. *Lecture Notes in Computer Science*, vol. 8526. (Cham: Springer, 2014) https://doi.org/10.1007/978-3-319-07464-1_1. Also cfr. S. Ceccacci *et al.*, "The role of haptic feedback and gamification in virtual museum systems," *Journal on Computing and Cultural Heritage* 14, no. 3 (2017) https://doi.org/10.1145/3453074, and F. Stanco *et al.*, "Virtual anastylosis of Greek sculpture as museum policy for public outreach and cognitive accessibility," *Journal of Electronic Imaging* 26, no. 1, 011025 (2017) https://doi.org/10.1117/1.JEI.26.1.011025.
95 M. Dima, L. Hurcombe, M. Wright, "Touching the past: haptic augmented reality for museum artefacts:" 6.

compared to the touching of the printed replica, which if possible is deemed a better alternative.

As of today, the technical limitations that most devices used in museums present contribute to a scenario where physical touch, even if of replicas, seems to be favored. The reasons why haptic technology is preferred are not experiential factors; they have to do with practical and managerial concerns, such as the fact that digital replicas do not occupy physical space and that they can be experienced also remotely. It appears that these technologies, if competing on a purely phenomenological level and trying to mirror haptic experiences that occur in reality, are destined to have a limited contribution to cultural experiences, being the only alternative yet not a solution which in itself holds value.

Other case studies can however add further layers to the use of haptic technologies in museum settings, offering opportunities that neither physical statues nor printed replicas could elicit. A research published by the *Journal of Electronic Imaging* illustrates the case of the virtual anastylosis of a Greek sculpture, operated by digitally combining a head and a torso held in two different heritage sites in Sicily.[96] The two ancient pieces, one hosted in the Museum of Castello Ursino in Catania and the other in the Archeological Museum of Siracusa, were hypothesized by archeologists to be parts of the same statue due to stylistic features. This theory was, however, never proved as neither of their hosting institutions was willing to dislocate one of the pieces for the necessary analysis to be performed. Through digital imaging and 3D rendering it was however possible to demonstrate the perfect match of the two parts of the statue, creating a new object that was then made accessible through the use of haptic technology – in this case the haptic device 3D Systems Touch – and thanks to the collaboration with the Center for Virtualization and Applied Spatial Technologies, University of South Florida. A

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96 F. Stanco *et al.*, "Virtual anastylosis of Greek sculpture as museum policy for public outreach and cognitive accessibility."

dedicated effort was made to ensure that the new technology would account for people with cognitive and physical disabilities, another potentiality that haptic technologies hold and on which research is being tailored.[97] Whilst this case highlights the strategic contribution that modern technologies can provide to both research and fruition, it could be argued that the added value here is given by the fact that this statue could have otherwise never been *seen or felt*, yet not in a manner which depends, from a specifically phenomenological perspective, on the haptic technology itself. Hence reinforcing the understanding that the main use of these technologies is directed towards reinstating the original – and lost – hard value of touch, not necessarily adding new levels of experience.

Another case, involving virtually touching the torso of Michelangelo's *David* at Monash University,[98] can prove useful to enrich the discussion on the use of haptic technologies in museums. What emerges from this study, which in terms of research methodology mirrors the vast majority of cases in the literature in creating a 3D digital replica and then experiencing it through the *Phantom*, is that the images reproduced digitally "allow the user to focus on particular details that they may overlook otherwise."[99] What appears here is that the virtual experiential setting creates the opportunity for the user to actually grasp some details of the statue that he would have not been able to experience with either the original or with a 3D printed

97 There are a number of experiments within the field of haptic technologies which focus specifically on accessibility for people with impared cognitive and physical abilities. An interesting research center is the one of the University of Glasgow, which ran two trials in this field, one called *Senses in Touch II,* and the other *MultiVis project*. A complete account of the two researches can be found in Brewster, "The impact of haptic 'touching' technology on cultural applications:" 279-282. Another interesting research which discusses the potential of haptics for the visually impaired is G. Jansson, M. Bergamasco, A. Frisoli, "A new option for the visually impaired to experience 3D art at museums: manual exploration of virtual copies," *Visual Impairment Research* 5, no. 1 (2003): 1-12 https://doi.org/10.1076/vimr.5.1.1.15973. Also cfr. R. Vaz, D. Freitas, A. Coelho, "Blind and visually impaired visitors' experiences in museums: increasing accessibility through assistive technologies," *The International Journal of the Inclusive Museum* 13, no. 2 (June 2020): 57-80, https://doi.org/10.18848/1835-2014/CGP/v13i02/57-80.
98 M. Butler, P. Neave, "Object appreciation through haptic interaction," *Proceedings of the 25th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (Melbourne: Ascilite, 2008), 133-141.
99 Ibid.: 140.

replica. The flexibility of digital images, their potential to be modulated, modified and enlarged, appears, in this case, to actually add a further layer to the visitor experience. The higher attention to detail deepens and expands the experience in a manner that is specific of, and exclusive to, digital haptic technologies.

Whilst this last example seems to slightly brighten the scenario described, the cases discussed so far account for an employment of haptic technologies which struggles to emancipate itself from a traditional understanding of touch in cultural experiences. The three cases analyzed, far from providing a comprehensive account of the multitude of programmes that have been carried out across the museum sector in the past years, have however been chosen as they are representative of the main trends found in the literature. Overall, researchers seem to have been focused mainly on trying to bring back an aspect of experience which was lost, and less keen on the advanced possibilities that haptic technologies might hold. With reference to the technological and historical discussion presented above, regarding haptic illusions, it does not appear that these seem to be at the center of experimental designs in the museum sector, where the understanding of touch seems to recall more the "hard undeniable evidence" school than the more subtle and rich understanding of the haptic which encompasses its illusory character. This depends on a number of reasons, related to both cultural, professional and economic factors. A further fundamental aspect to take into account, when discussing the use of haptic technologies in museums, is in fact the high cost of these devices. The more sophisticated they are, the higher their prices, which makes it difficult for museums to afford them, even harder to update them. Main advancements with haptic technologies are in fact usually in other fields of research with richer funding, such as medicine and engineering. This leads to the second limitation, namely that to innovatively experiment with these technologies, technical and diverse professional skills are required. Even though most programmes within museums are run in collaboration

with universities and research centers, the degree of complexity that pertains to these projects needs a pull of professionals which is hard to put together and coordinate in the current economic and professional climate.

There are, however, a few interesting cases that, at times even without the use of high budgets and elevated skills, seem to leverage on the wider range of possibilities that these technologies offer. Interestingly enough, these also relate to two of the original functions of touch valued in early museums: the aesthetic enrichment of the experience and the emotional potential of haptics. It appears that when haptic technologies are being employed with the aim of enacting and recalling these elements – as opposed to when they try to give back the evidentiary character of touch – the result are more imaginative endeavors, allowing for the creation of a further semantic level of experience.

One first interesting case is a very recent experiment conducted at University College London, where a student has designed a device which, through the use of capacitive touch sensors, wants to "help us understand what an artist felt at the time they created their work by recreating their sensory experiences."[100] The project idea, which rests on the theoretical background of embodied knowledge as an extension of the mind and of embodied practice as a means to feel the emotions of an artist,[101] was inspired by an artwork: *The Face of Christ* by Claude Mellan, hosted in the UCL Art Museum. By looking closely at the artwork, the author of the project realized that the whole drawing had been made through the design of one single spiraling line, a unique technique. His idea was therefore to design a device which could enable the viewer to create

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100 F. Taylor, "Recreating sensory experience: how haptic technology could help us experience art in new ways," *UCL Culture Blog*, (July 13, 2020) https://blogs.ucl.ac.uk/museums/2020/07/13/recreating-sensory-experience-how-haptic-technology-could-help-us-experience-art-in-new-ways/ on the 31/01/2022, accessed December 11, 2022.
101 When the author discusses embodied knowledge as an extension of the mind the reference is I. Martínková, "Body ecology: avoiding body–mind dualism," *Loisir et Société / Society and Leisure* 40, no. 1 (2017): 101-112, https://doi.org/10.1080/07053436.2017.1281528; whilst when discussing embodied practices as a means to feel emotions of artists the specific reference in the literature is D. Freedberg, V. Gallese, "Motion, emotion and empathy in esthetic experience," *Trends in Cognitive Sciences* 11, no. 5 (2007): 197-203, https://doi.org/10.1016/j.tics.2007.02.003.

a contact with the motion that had originated the artwork, building a direct emotional connection with the artist. As the author describes it "through an audio feedback loop, the device I designed takes in touch inputs from a viewer of the artwork and returns a religious-sounding choral soundtrack when the spiral gesture from the engraving is drawn correctly with a finger. The spiral gesture," he adds, "was directly extracted from *The Face of Christ* with the help of a custom python script which made use of various image analysis libraries."[102] What can be highlighted in reading about this project, which at this point consist of just a first artisanal prototype, is the way in which haptic technologies are used to explore unusual and often overlooked aspects of artworks. Whilst the potential of these technologies in broadening the field of aesthetic experience is well established, there are some developments specific to this case worth expanding on. Interestingly enough, the author refers specifically to the idea of building a connection with the painter who made *The Face of Christ*, recuperating the same reasoning that mid eighteenth-century museum goers had when holding a precious object.[103] In comparing the attempt to get in touch with the past before and after haptic technologies, moreover, the added value brought by the device seems clear. Whilst in the original case a visitor had to actively exercise the power of imagination in order to build a connection, in this instance the device guides the user into the experience, leveraging on the emotional potential of a multisensory environment which starts from the drawn line, develops into an haptic apparatus and is then sublimated through sound. What emerges with regards to this example, and in contrast with the ones analyzed before, is the way in which the designer of the project has overcome the need to merely attempt to replicate the touching experience, and decided to exploit both the phenomenological and the imaginative potential of the technology

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102 F. Taylor, *Recreating sensory experience: How haptic technology could help us experience art in new ways.*
103 A detailed account of an emotional and imaginative encounter between a museum goer and an artifact can be found in S.A. La Roche, *Sophie in London, 1786: Being the Diary of Sophie Von La Roche*, trans. C. Williams (London: Jonathan Cape, 1933): 107-108.

at his disposal. Further, this has been done in an artisanal and experimental fashion, not through the use of excessive resources and a big team of professionals.

Another experimental program worth considering, in this case definitely a more costly and collective endeavor, is an exhibition held at Tate Britain in 2015, Tate Sensorium (Fig. 2).[104] The research background behind this project refers to a scientific field which experiments with the power of haptics to elicit emotions. More specifically, these projects study how mid-air haptic technology – a specific subset – is able to condition human emotions (e.g., happy, sad, excited, afraid) through tactile stimulation.[105] While the literature in the field of mid haptics is still at a very early experimental stage, and definitive conclusions are yet to be drawn, progress has been made in mapping the correlation between aspects of haptics and emotional states. What was done at Tate was to organize an exhibition which built a fully sensory environment around four paintings: *Interior II* by Richard Hamilton, *Full Stop* by John Latham, *In the Hold* by David Bomberg, and *Figure in a Landscape* by Francis Bacon. In a detailed article[106] presenting a study on the exhibition, the specific experience of *Full Stop* is analyzed. What the curators did was to position a mid-air haptic device in front of the painting, and synchronize a range of mid-air haptic patterns inside the device with a self-developed software that could read Musical Instrument Digital Interface (MIDI) inputs. The design was curated by a sound designer who could control the mid-air haptic patterns (frequency, intensity, and movement paths) to create a desired experience synched with music. As detailed through the article, this exhibition was the first time that mid-air haptic technology was used in a museum context

104 *Tate Sensorium* website, https://www.tate.org.uk/whats-on/tate-britain/ik-prize-2015-tate-sensorium, accessed January 31, 2022.

105 M. Obrist *et al.*, "Emotions mediated through mid-air haptics," *Feeling and Communicating Emotions*, (Seoul: Crossing, 2015): 2053-2062 https://doi.org/10.1145/2702123.2702361. A discussion on the futuristic potential of mid air haptic technologies was anticipated above, with reference to the incentives that the European Union is making available to further these research fields.

106 C.T. Vi *et al.*, "Not just seeing, but also feeling art: mid-air haptic experiences integrated in a multisensory art exhibition," *International Journal of Human-Computer Studies*, vol. 108 (Elsevier Ltd, 2017): 1-14 https://doi.org/10.1016/j.ijhcs.2017.06.004.

over a prolonged period of time and integrated with sound to enhance the experience of visual art. This "work demonstrates how novel mid-air technology can make art more emotionally engaging and stimulating, especially abstract art that is often open to interpretation,"[107] as it was proved by collecting positive feedback from over 2500 visitors. The aim of the authors, as clearly stated across the research, was to advance understanding of multisensory signals in relation to art, experiences and design, based on novel interactive technologies. Referencing back to the reasons why touch was valued in early museums, this experiment seems to fit in the category which uses haptics to enhance the aesthetic experience of the visitors: anticipating that haptics carry value not only on a purely informative sensory level, but eliciting a wider level of complexity.

Conclusions

Overall, there seems to be a wide potential for using haptic technologies in museum settings and leveraging on the ways in which these devices can contribute to the cultural experience of artifacts. The two final case studies here examined clearly exemplify how haptic technologies can help in generating a new experiential layer, one which rests on a complex phenomenological understanding of the haptics and establishes an active dialogue with the entire sensorium of the experiencer. Both cases show a designed synchronization between the tactile experience and the sense of hearing, suggesting that one of the ways to experiment with the haptic is by interrogating a more environmental and organic understanding of the relationship between the senses. Interestingly, the more complex and enhancing experiences are characterized by stimuli that do not just mimic the act of touching, thus attempting to reinstate the lost chance of touching the artwork, yet play with the illusory potential of haptics and with the other

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107 Ibid.: 1.

qualities of touch valued in early museums: the evocative and imaginistic potential of the haptic experience.

The analysis from the museum sector, when linked to the technological and historical accounts regarding the link between the haptic and the figure of illusion, suggests the value of exploring the ways in which haptic technologies can emancipate us from a reductive understanding of touch. Certainly, all museum endeavors and experiments will have to take into account a variety of practical and concrete concerns, which also play an important part in defining the destiny of cultural projects. It is not given that exploring the illusory potential of haptic technologies represents in itself the best choice for a museum research. Yet, it can be concluded that when designed in an open dialogue with our whole sensorium these technologies appear empowered in their visionary potential, making Derrida's observation more actual than ever: the nexus between touch and virtuality is as real as it gets.
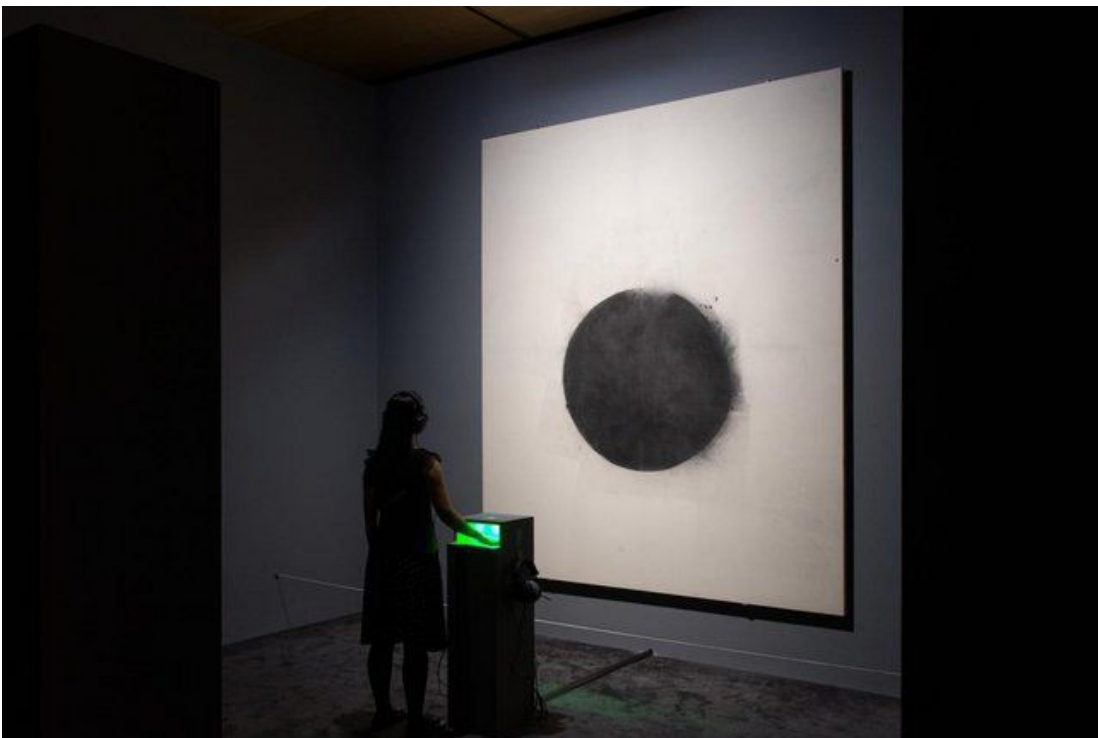

Fig 2. Tate Sensorium exhibition at Tate Britain in 2015, installation shot of *Full Stop* (1961) by John Latham © John Latham Estate. Photo: Tate. Illustration of a participant experiencing the second painting combining vision, auditory, and haptic.

Clothes with no emperors: the materiality of digital fashion

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Abstract

Digital garments are tailored computationally and dressed virtually. Intended to be displayed rather than worn, digital fashion exemplifies the function of aesthetic commodities as defined by Gernot Böhme: the production of atmospheres – intangible qualities arising from a material encounter – towards the staging of life. Yet, made from pixels instead of fabric, virtual garments beckon a new conceptual framework for the role of materiality in atmospheric productions. Drawing from new media and affect scholars, this essay traces the display of digital garments across three sites: the e-commerce website, social media, and the runway show. By analyzing the visual and literary production surrounding digital fashion, this essay proposes "elemental surface" as a representational technique and rhetorical strategy through which digital garments produce and intensify the body's affective presence. Situating Böhme's formulation of atmosphere in dialogue with the notion of "aura" put forth by Walter Benjamin, the study of digital fashion foregrounds the role of environmental perception in the history of haptic technology.

Introduction

Scrolling through an online fashion catalog, you come across a piece of clothing that reminds you of your favorite song: it is bold but not *too* bold, casual with just the right amount of edge. You add the item to your shopping cart. At checkout, you are asked to upload a photo of yourself. So you pose in front of the camera, dressed minimally under good lighting. One business day later, instead of arriving in a package in the mail, the garment appears as an email attachment in your inbox, carefully composited onto the photo you have uploaded.

Since its inception in 2008,[1] digital clothing has quickly gained traction in the fashion industry, giving rise to independent digital fashion houses as well as partnerships with well-established clothing brands. Daria Shapovalova, the cofounder of DRESSX, summarizes digital fashion as being "all about how we can replicate the experience of physical clothes in digital."[2] The statement is counterintuitive at first sight. Made from pixels instead of fabric, digital garments cannot shield our bodies from the bracing winds of winter or the unwanted gaze of another. But if we refrain from taking Shapovalova's statement at face value, it emerges as a profound commentary on the phenomenology of clothing and, by extension, the contemporary socioeconomic system upon which the fashion industry operates. For Shapovalova, digital garments are not here to represent but to replicate. But to replicate *what*? Interesting is the absence of a verb: do digital garments replicate the

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1   "Carlings: The First-Ever Digital Clothing Collection," H.R. Watkins III, https://www.haywoodwatkinsiii.com/digital-clothing-collection, accessed December 7, 2021. In 2018, the Scandinavian retailer *Carlings* introduced the first digital fashion collection.
2   "Digital Clothing Is the Future of Fashion | Dell Talks with Daria Shapovalova," Dell, YouTube video, 8:12, 2021, https://www.youtube.com/watch?v=iKBePuTOB6U, accessed January 10, 2023.

experience of *wearing* "physical" clothes or that of *seeing* physical clothes?

Made to be shown rather than worn, digital fashion displays the functional liberty characteristic of an aesthetic commodity. The philosopher Gernot Böhme proposes that capitalism has entered a new phase: under the "aesthetic economy,"[3] the value of commodities extends beyond their physical utility or monetary worth. Aesthetic economics restructures the dichotomy of the "use value" and "exchange value," triangulating them in service of an independent utility metric: the "stage value."[4] Under this metric, the aesthetic properties of a product no longer exist in *addition* to its ability to satisfy primary needs, but function towards "the staging, the dressing up and enhancement of life."[5] Observing that the outward presentation of commodities is emancipated from their material function,[6] Böhme refers to the study of atmospheres as engaging in "poetic phenomenology" – the study of how appearances come to be.[7] Böhme's phenomenological investment in the operation of aesthetic commodities aligns convincingly with Shapovalova's experiential framing of digital fashion.

For Böhme, the stage value of an aesthetic commodity arises from its *atmosphere*. Understood as the "something more" arising from aesthetic encounters, atmospheres are by definition "intangible" and "indeterminant."[8] As elusive as atmospheres are, they can nevertheless be theorized at the sites of their production: aesthetic laborers have long engaged in the skillful manipulation of materiality – the outward appearance of matter – to create and intensify the atmospheric presence of aesthetic commodities.

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3   G. Böhme, *Critique of Aesthetic Capitalism*, trans. E. Jephcott (Milan: Mimesis International, 2017): 20.
4   Ibid.
5   Ibid.
6   G. Böhme, *The Aesthetics of Atmospheres*, ed. J.P. Thibaud (Oxon: Routledge, 2017): 144.
7   Ibid.: 33.
8   Ibid.: 29; 30.

While "pure aesthetic materials assume we won't handle or touch them,"[9] they nevertheless touch and move us emotionally.[10] Bohme's formulation of atmosphere complicates the reading of digital fashion as a testament to the dematerializing effect of the capitalist economy on material relations and social life.[11] When all that is solid melts into air, the air becomes charged with affective presence and sensory impressions – it becomes an atmosphere.

Given the nonphysical nature of virtual garments, how exactly does digital fashion engage in the production of atmospheres? Scholarships in new media studies and affect theory converge on their emphasis on embodiment as central to the study of aesthetic mediums. Informed by theories of embodied perception stemming from philosophers such as Bergson and Merleau-Ponty, new media scholars have challenged the "immaterial" ontology of virtual technologies.[12] Similarly, affect theorists foreground the porous boundaries between sensory modalities and gestures toward the primacy of hapticity in visual encounters.[13] Together, these studies provide additional methodological tools to investigate the materiality of virtual garments.

This essay traces digital fashion's atmospheric production across three sites of its exhibition: the e-commerce website, social media, and the runway show. In the first section, I examine the proliferation of elements – specific forms of materiality such as water – in digital garment designs. Drawing from Giuliana Bruno's work, I introduce the concept of "elemental surface" as a representational technique utilized by virtual garments to enhance their

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9   Ibid.: 146.
10   Ibid.: 97.
11   G. Simmel, *The Philosophy of Money*, ed. D. Frisby (London - New York: Routledge, 2004): 150.
12   B. Brown, "Materiality," in W.J.T. Mitchell, M.B.N. Hansen, eds., *Critical Terms for Media Studies* (Chicago - London: The University of Chicago Press, 2010): 49-63; W. Bao, *Fiery Cinema: The Emergence of an Affective Medium in China, 1915-1945* (Minneapolis: University of Minnesota Press 2015).
13   E. Kosofsky Sedgwick, *Touching Feeling: Affect, Pedagogy, Performativity* (Durham: Duke University Press, 2006).

environmental presence. In the second section, I explore how the digital imposition of virtual garments alters the background-foreground relationship of existing photographs, from which the elemental surface emerges as an index for the sensation of vitality and liveliness. The operation of hapticity and vitality collides in the third section. By analyzing digital garments as they appear in an animated advertisement, I contend that elemental surface mobilizes contemporary anxieties surrounding the "natural" environment in service of its construction of an affective milieu.

In the seminal essay, "The work of art in the age of mechanical reproduction," Walter Benjamin attributes the demise of aura to the rise of technologies of reproduction, such as photography and film.[14] Made available for mass distribution and consumption, the artwork is cut off from the ritualistic contexts of its exhibition and dispossessed of its unique presence. Benjamin's prophetic insight into the elevated importance of an artwork's public presentability directly anticipates the domination of "staging value" mandated by aesthetic capitalism. Yet, for Böhme, the mass circulation of aesthetic productions is accompanied by the manipulation and intensification of their presence rather than their depreciation and demise. How might we approach this generative tension? Digital fashion, by demonstrating the logic and operation of stage value to its extreme, is a good place to begin.

The web interface: atmosphere and hapticity

Digital fashion design is not contingent upon the market availability of raw materials, nor is it constrained by the physical attributes of specific fabrics. With the recent

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14   W. Benjamin, "The work of art in the age of mechanical reproduction," trans. H. Zohn, in H. Arendt, ed., *Illuminations: Essays and Reflections* (New York: Schocken Books, 1969): 217-251.

integration of Adobe Substance to CLO Virtual Fashion,[15] designers can manipulate the material properties of existing virtual fabric available in online databases, or create a virtual surface entirely from scratch. Roei Derhi, a Berlin-based digital fashion designer, describes the fabric selection for digital garments as "limitless."[16]

Despite the wide range of fabric selections made possible by digital simulation software, digital fashion designers have demonstrated a particular affinity to the elemental. The classical Greek elements – earth, water, fire, air – have been cited as the inspiration for a great number of digital fashion collections, such as that of James Mack and 2WB.[17] Simply entering the keyword "water" yields over 200 searches among the 2000 articles of clothing in the DRESSX database, with results ranging from digital tops, dresses, and earrings.[18] Elements, according to the media scholar Nicole Starosielski, are "defined by their roles in composition."[19] Understanding elements as constituting parts extends their scope to encompass other specific forms of materiality, such as electricity, botanics, and metal – images similarly popular for digital fashion designers. Given that the elemental orientation of digital garments does not correspond to trends in the physical fashion industry, its medium specificity serves as a generative avenue to begin our inquiry into the materiality of digital fashion.

"Neon Pillow" (Fig. 1) is a garment designed by May Ka. Consisting of a padded jacket worn over a

15   "CLO Virtual Fashion Welcomes Substance by Adobe, Jeanologia, and ColorDigital Integrations to CLO 6.0," *Businesswire* (November 11, 2020), https://www.businesswire.com/news/home/20201111005772/en/CLO-Virtual-Fashion-Welcomes-Substance-by-Adobe-Jeanologia-and-ColorDigital-Integrations-to-CLO-6.0, accessed January 10, 2023.
16   R. Derhi. Interviewed by the author. November 2021.
17   "James Mack: TERRA MOTUS," DRESSX, https://dressx.com/products/james-mack-terra-motus?_pos=1&_sid=2fb6573d9&_ss=r, accessed December 10, 2022; "2WB Artemis," DRESSX, https://dressx.com/products/2wb-003?_pos=6&_sid=ca632080c&_ss=r, accessed December 10, 2022.
18   "DRESSX search for 'water'," DRESSX, https://dressx.com/search?q=water, accessed January 15, 2022.
19   N. Starosielski, "The elements of media studies," *Media+Environment* 1, no. 1 (2019) https://doi.org/10.1525/001c.10780.

knee-length dress, the garment is rendered in a single hue of sea glass blue. Its pliable, creased underlayer contrasts texturally with the smooth voluminous shoulder panels. Yet, the airy silhouette is softened by the drapery's crinkled tips and deflated hemlines. A thin sheet of puffer insulator folds into a skirt with a simple side slit. The fabric combines the plasticity of polyester with the reflective glare of satin. Not only does the digital textile resemble existing fabric, the specific details of its seams and patchwork are also meticulously rendered.

Fig. 1. *The Neon Pillow*, May Ka, https://dressx.com/collections/may-ka/products/total-neon-pillow, accessed January 15, 2022.

Prior to the popularization of digital garments, the fashion industry has already become increasingly dependent on *haptic technologies* – "computational systems and applications aiming to artificially reproduce the sense of touch."[20] With the rise of online fashion retailing, clothes were made available for purchase on e-commerce websites

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20   L. Cantoni, M. Ornati, "Fashiontouch in e-commerce: an exploratory study of surface haptic interaction experiences," in F.H. Nah, K. Siau, eds., *HCI in Business, Government and Organizations,* vol. 12204 (Cham: Springer, 2020): 493-503, 494 https://doi.org/10.1007/978-3-030-50341-3_37.

and social media; the physical constraints placed by the COVID-19 epidemic lockdowns further encouraged fashion stores to migrate to online platforms.[21] While devices such as the touch screen and the mouse enabled the simulation of physical touch, the two-dimensional affordances of mobile and laptop screens generated the need to simulate tactility through visualization technologies. "You can wear fire, you can wear lightning, those things are done with the same sense of fashion – what kind of fire? Wings or glitter?" asks Derhi,[22] gesturing to the importance of textural details in the rendering of digital garments. The "limitless" potential of fabric selection does not translate to their freedom from perceptual constraints.

In addition to the employment of visualization technologies, digital fashion designers have turned to representational and narrative techniques to enhance the hapticity of digital garments. Freed from the need to resemble existing fabric yet striving to visually simulate tactile surfaces, digital garments self-knowingly plunge into the elemental. On the website of DRESSX, the first and biggest retailer of digital fashion clothing, each garment is accompanied by a designer's statement. May Ka's description of her design reads as follows:

This bubble put May Ka to sleep. She felt her feet were going to– wards something new, but her footsteps were inaudible. Falling into the deep water. Will she be able to breathe? The water is not transparent, but she have never seen so clear until now [sic].[23]

Ka describes the inspiration behind her piece as the pillow that accompanies her to sleep, whereupon the act of dreaming resembles "falling into deep water." When viewed

21   Ibid.
22   R. Derhi, Interviewed by the author. November 2021.
23   "Ma Ka: Abstract Rose," DRESSX, https://dressx.com/products/abstract-rose?_pos=57&_sid=ac38fecdf&_ss=r, accessed January 10, 2021.

with the imagery of water in mind, the materiality of the digital garment takes on a new dimension. The reflective fabric evokes the placid surface of a lake on a sunny day. The softness of the underlayer now takes on the fluidity characteristic of liquid as a state of matter. The sagging form of the drapery gestures towards the downward haul of gravity as one sinks into the water, just as the airy silhouette connotes a state of buoyancy–an opposing movement that casts the body in a state of suspension. As an existing substance, water brings to mind a particular combination of physical attributes. When Ka evokes the element of water to describe the experience of wearing the dress, specific visual details of the garment converse with each other, take on additional meaning, and cohere into a tangible surface. After all, what can evoke material presence better than the constituting units of matter itself?

The technology of clothes simulation has centered around the visualization of "surfaces," a word that permeates the field of textile engineering.[24] Rather than describing the materiality of digital fashion as made up of elemental images, it is more suitable to understand its composition as an "elemental surface." The phrase might appear oxymoronic at first sight. Whereas elements are by nature fundamental and deep-seated, "surface" are merely skin-deep. The media scholar Giuliana Bruno challenges dismissive readings of surface as ornamental and superficial, turning instead to surface as a generative conceptual framework to engage with the materiality of images: "Surface matters in the fabrics of the visual, for it is on the surface that textures come alive and the 'feel' of an aesthetic encounter can develop."[25] The phrase "'feel' of aesthetic encounter" dovetails with Böhme's formulation of atmosphere as the defining characteristic of aesthetic production. It is at the interface of surfaces that the atmosphere becomes sensible. Viewed in this light,

24   P. Volino, N. Magnenat-Thalmann, *Virtual Clothing: Theory and Practice* (Cham: Springer, 2000).
25   G. Bruno, "Surface encounters: materiality and empathy," in D. Martin, ed., *Mirror-Touch Synesthesia* (Oxford: Oxford University Press, 2017): 107-125, 118.

the invocation of elements emerges as a representational – or, in Böhme's words, "presentational" technique through which virtual garments mobilize our prior conceptions of matter to generate a greater sense of environmental presence.

To attend to surfaces is to engage with media as environments. In her study of early Chinese cinema, the media scholar Bao Weihong describes *affect* as the "platform/interface of experience produced by media technology and media aesthetic in interaction with the perceptual subjects."[26] In this sense, affect does not designate any singular medium or sensory modality, but instead constitute a condition of mediation that envelops individuals and machines and redraws their intimate boundaries. In Ka's description, water envelops the dreamer just as the digital garment encloses the wearer. Water becomes an intermediary substance through which the dreamer confronts her "fears and anxieties" and sees the world with heightened lucidity. Surfaces "hold affect in its fabric" and enable "the passage of empathy," writes Bruno.[27] When beckoned to interact with the body and its surroundings, the environmentalizing tendency of the elemental surface is further dramatized. In the next section, I situate Ka's garment in the context of its intended function: to be worn and displayed by the human body.

The DF image: atmosphere and vitality

Digital garments are sold digitally and dressed digitally. To wear a digital garment is to superimpose its form onto an existing photograph with the help of graphic engineering technologies. This procedure is accomplished through the use of "collision detection,"[28] a computation technique that simulates the points of contact between the virtual fabric and

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26   W. Bao, *Fiery Cinema: The Emergence of an Affective Medium in China, 1915-1945*: 12.
27   G. Bruno, "Surface tension, screen space," in S. Saether, S. Bull, eds., *Screen Space Reconfigured*, (Amsterdam: Amsterdam University Press, 2020): 35-55, 28.
28   P. Volino, N. Magnenat-Thalmann, *Virtual Clothing*: 6.

the surrounding objects. Despite having little effect on the appearance of the virtual garment as an independent entity, the importance of collision detection becomes readily apparent when we examine the entirety of the digital fashion image (hereon referred to as the DF image).

In Fig. 2, shadows enable a dialogue between the wearer's body and the virtual garment. The bottom rim of the dress projects its silhouette on the thighs of its wearer, asserting itself as a material surface that receives the light in place of the wearer's skin. Shadows project an entity's image upon a foreign surface. By insisting on its ability to rechannel the light, the dress appears under the same sunlight as the body. In the lower right corner of the image, the shape of the body's shadow takes on the silhouette of the garment. Not only does the garment envelope the wearer, it environmentalizes the body to converse with the soft, chilly grass on a winter morning.

Fig. 2. The Neon Pillow purchased from DRESSX, Cambridge, December 2022 (photographed by the author). January 15, 2022.

The digital reflects light just as it displaces light. Under the piercing sun, the dress' monochromatic surface takes on a new life. No longer enveloped by solid hues of gentle blue, the garment now radiates in a purple glow marked by overexposed highlights. Hints of green make their way to the outer edges of the garment, gradually intensifying as they approach the lawn and foliage in the background.

Through the skillful manipulation of shadows and reflection, the DF image is no longer a replica of the original photograph with the addition of the digital garment. Rather, it strives toward the overarching reality of the indexical and causally affirms the existence of the constellation it depicts.

Given that the staging of the digital garment implicates the entire photographic image, digital fashion's concern with visual congruency manifests prior to the creation of the DF image. Clicking into the tab "How to Wear" on the DRESSX website, an alternative title immediately appears: "Choose the right picture: recommendation for receiving the best photo looks." The requirements for the photo fall under four groups: natural light, fitted clothes, high quality (photograph), and uncovered parts. While the expectation for compact clothing pertains to the appearance of the body, the demand for natural lighting concerns the environmental setup.[29] In an earlier version of the webpage, the list also asked the buyer to locate themselves relatively close to the camera to ensure "less background."[30] Digital fashion demands from the wearer not only a body but a context, where the physical environment becomes an integral part of the process of "wearing" the clothes.

Clothing is external to the body yet an extension of the body. It is at once the interface upon which the body and the external world come into contact, but also

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29   "How to wear DRESSX and digital fashion," DRESSX, https://dressx.com/pages/help, accessed January 15, 2021.
30   Ibid.

the veil that separates the body from its immediate surrounding. This dynamic is perfectly captured by Emanuele Coccia, "[The dress] does not act directly upon our own anatomical body or the media that surround it, but rather it incorporates extraneous fragments of the world, foreign bodies through which our self is made to appear."[31] Alexander Knight, a London-based digital fashion designer, affirms this statement through his description of pockets:

It brings me joy to see something crazy and then see the details. Like when you see a Versace evening gown with a pocket, and the model walking down the runway with their hands in the pocket. I guess it gives it life. Digital garments can have a cold, static, and unlivable quality to them. Giving it these details gives it life.[32]

Knight does not employ the rhetoric of realism, describing the ideal of digital garments instead as a state of aliveness. Serving as a container for not only the body but also parts of an external world, the pocket signifies a garment's potential to enter into relationships with others. Having a pocket allows digital garments to make a promise of everyday companionship: the wearer's hand, keys and wallet, a bus ticket, a crumpled piece of candy wrapper. In doing so, pockets endow the garment with "life." To simulate the experience of wearing physical clothes entails more than appearing unedited; it demands no less than to situate garments alongside the living so that they in turn take on a life of their own.

Read this way, the DF image reaches beyond the synthetic towards the additive. The color of the garment is more vibrant than the skin of the wearer, and its form more dynamic than the posture of the body it adorns. The difference in luminosity and animacy is not only one of

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31 E. Coccia, *Sensible Life: A Micro-Ontology of the Image*, trans. S.A. Stuart (New York: Fordham University Press, 2016): 28.
32 A. Knight. Interviewed by the author. November 2021.

quantity but quality: the resolution of the dress is decidedly higher than that of the original photo. The virtual garment creates a unique region of clarity, ushering forth a sense of saliency impossible to be captured by a digital camera from the same distance away. The elemental surface steps forward in an outward radiance, endowing an otherworldly vitality to the concrete and ordinary. The seamless photographic overlay creates an image of pictorial rupture – not from a sense of visual incongruity but, quite to the contrary, the hypersensitivity between the figure and ground. Similar to the pocket, the digital garment's ability to respond to the body and the environment not only serves to conjure a realistic image, but one that feels convincingly and dramatically alive.

The language of life and liveliness permeates Böhme's theorization surrounding aesthetic commodities. Describing the perceptual effect of atmospheres, Böhme writes, "the establishment of a world of images on the surface of reality, or even independently of it, may well serve the intensification of life."[33] The function of aesthetic commodities is "made of their attractiveness, their glow, their atmosphere: they themselves contribute to the staging, the dressing up, and the enhancement of life."[34] The perceptual pattern and affective construction of digital garments relocate Böhme's invocation of "life" from the general condition of living to the immediate *sensation* of vitality. The elemental surface of digital fashion is not only elemental because it evokes hapticity through the portrayal of specific forms of materiality, but also because it endows a fundamental feeling of liveliness to the body it claims to envelop.

The reciprocity between hapticity and vitality has been evoked by Bruno when she describes the surface as the site in which "textures come alive."[35] In the

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33   G. Böhme, *The Aesthetics of Atmospheres*: 199.
34   G. Böhme, *Critique of Aesthetic Capitalism*: 21.
35   G. Bruno, "Surface encounters: materiality and empathy:" 118.

next section, I examine digital garments as they appear in a virtual runway animation in order to further excavate the mode of embodiment enacted by the elemental surface of digital fashion.

The virtual runway: atmosphere and embodiment

A silver parka comes to life within the first three seconds. An orange thread slithers into the right-hand sleeve, followed by the contraction of the backside padding. As the full parka comes into view, additional strands fly into the frame, endowing form to an otherwise slackened figure. With its arms outstretched, the parka inhales for the first time with the simultaneous compression of its seam lines – rapidly yet unfalteringly assembled almost as if by its own will. A single decisive zip renders the garment upright, and a hood pops into place. The resurrection is complete.

Such was the opening sequence to a commercial on digital fashion.[36] The creative team, not so subtly named "ITSALIVE," offers us a glimpse into the worldbuilding of industry. As the virtual garment appears increasingly alive, the body and its surroundings take on an inert and lifeless quality. This perceptual pattern, already evident in the DF image, is further dramatized by the advertisements and runway shows released by the digital fashion industry.

As the animation progresses, flame emanates from the parka just as the music picks up, unleashing dynamic dashes of green and silver light that illuminates the dark background. Just as the parka begins to dance, a satin jumpsuit walks up to the parka and unveils its head mask. A moment of revelation follows: there was nothing

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36   "Digital Clothes Production | Virtual Wear Development | Digital Fashion," ITSALIVE, YouTube video, 0:58, 2022, https://www.youtube.com/watch?v=zDAsRGOqx0o, accessed January 10, 2023.

underneath. What we had assumed to be a mannequin has been a hollow void all along.

In a sense, physical runway shows have become "digital" decades before the rise of digital fashion. With the rise of Instagram and other forms of digital media platforms, the clothing commodity is staged with its afterlife as a photograph or short video in mind.[37] One of the most notable impacts on fashion photography, as noted by Silvano Mendes, was the elevated importance of runway scenography. A runway show constitutes an intermedial event, and its success depends on the close collaboration between fashion designers, stage designers, architects, and photographers.[38] On the other hand, just as digital garments are made from pixels rather than textiles, digital fashion shows prefer computer animation over live-action footage. Rather than employing specific staging technologies such as fog machines or lighting equipment, digital fashion commercials employ 3D animation to portray the product, its wearer, and the surrounding. In doing so, the aforementioned revelation becomes especially jolting and unsettling, as the body's absence renders it virtually indistinguishable from the background.

For the philosopher Hans Jonas, the human embodiment is characterized by the simultaneous experience of the body as a subject for self-invention and an object for self-scrutiny.[39] While the dynamic interplay between this dual perspective has enacted highly divergent modes of embodiment across temporal and cultural geographies, inherent to the human experience is this generative tension between the first- and third-person perspective. Joanne Entwistle, drawing from Merleau-Ponty's

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37   S. Mendes, "The instagrammability of the runway: architecture, scenography, and the spatial turn in fashion communications," *Fashion Theory* 25, no. 3 (2019): 311-338, https://doi.org/10.1080/1362704X.2019.1629758.
38   Ibid.
39   H. Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (New York: A Delta Book, 1966): 186-187.

phenomenological approach to embodiment, explores how this dual perspective of the body is evidenced and enacted by the act of dressing: "the experience of dress is a subjective act of attending to one's body and making the body an object of consciousness and is also an act of attention *with* the body."[40] The existence of clothing, especially in its ornamental context, is not only a product of but the active site upon which the body functions, according to Bernadette Wegenstein, as the "medium for experience itself."[41]

Digital garments relocate the site of our dual perception from the body to its representation by the digital image –already when the body has become an object of its own perception, whether in a mental image of ourselves posing in front of the camera, or in the photomontage prepared for social media. "Contemporary technoscience is in a unique position to exploit this phenomenological convergence of first- and third-person perspectives," writes Wegenstein.[42] The word "exploit"– connoting the intentional instrumentalization and manipulation of fashion – precisely gets at the power of digital fashion: the digital garment separates and redistributes the dual perspectives along a temporal axis – our attention *with* our body is fated to precede our attunement *to* our body.

And so, we watch the two headless figures dance to their own rhythm. When the jacket slips off from the satin jumpsuit, light directly passes through the regions uncovered by the garment, leaving a disembodied arm that nevertheless propels the dancer into the air. As the body fades into the dark space of projection, what remains is the outward radiance of the elemental surface. Our frisson of unease is reframed as an experience of wonder and

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40   J. Entwistle, *The Fashioned Body* (Cambridge: Polity Press, 2015): 118.
41   B. Wegenstein, M.B.N. Hansen, "Body," in W.J.T. Mitchell, M.B.N. Hansen, eds., *Critical Terms for Media Studies* (Chicago-London: The University of Chicago Press, 2010): 21.
42   Ibid.

enchantment by the closing message: "We are the future. Wear the future."[43]

Characterized by seasonal change and stylistic variation, the fashion industry actively mobilizes future-oriented rhetoric. Yet, digital fashion offers a specific image of the future. In the final acts of the animation, the satin jumpsuit leaps and twirls amidst the fleeting background: the sunrise over a desert, snow-capped mountains, a blossoming flower, great waves of the ocean, thunder, clouds, the atmosphere of the earth seen from space. Marketing products made of code instead of cotton, the digital fashion industry brands itself as a sustainable solution to the perils of climate catastrophe. Rather than interrogating the patterns of consumption that underlie over-extraction and waste, the digital fashion industry consistently evokes images of nature in celebration of the triumph of life.

"The eternity of art becomes a metaphor for the eternity of the soul, the vitality of trees and flowers become a metonymy of the vitality of the body…"[44] Umberto Eco's description of sculptural replicas in California graveyards possesses strange resonances with the internal logic of digital fashion. Referring back to Starosielski's definition, elements are specific materialities that constitute our ecological conditions. In the animation, it was precisely a flame emanating from the parka that transformed the background from an empty cosmos to a colorful creation myth. The sense of vitality afforded by the hapticity of the elemental surface is tasked to mediate the premonition of future catastrophe and to offer a promise of humanity's continuous livelihood.

Asserting that the aura of "historical objects" may be illustrated "with reference to the aura of natural

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43   "Digital Clothes Production | Virtual Wear Development | Digital Fashion," ITSALIVE, 2022, YouTube video, 0:58, https://www.youtube.com/watch?v=zDAsRGOqx0o, accessed January 10, 2023.
44   U. Eco, *Travels in Hyperreality*, trans. W. Weaver (San Diego: Harcourt, 1986): 96.

ones,"[45] Benjamin depicts a meditative encounter with nature:

If, while resting on a summer afternoon, you follow with your eyes a mountain range on the horizon or a branch which casts its shadow over you, you experience the aura of those mountains, of that branch.[46]

Comparing the view of the distant mountain offered by Benjamin with the virtual projection of the landscape in the digital fashion concept video, digital garments indeed appear to testify to the demise of aura in our age of digital reproduction. And yet, digital fashion is similarly invested in the interplay between the natural and affective environment. To situate the phenomenal structure of "atmosphere" in dialogue with that of "aura" is to foreground the primacy of environmental perception in the history of technological mediation. By expanding the constitution of media from communicative forms to ecological conditions, elemental surfaces provide an analytic framework for ecocritique beyond the study of "nature," focusing instead on the perceptual patterns and representational techniques through which physical and affective environments are felt, performed, and lived.

Coda

We are familiar with the fairy tale of an emperor without clothes; now it seems as though our clothes have lost their emperors. "What we need is the digital body to be for people to wear our clothing,"[47] says Kerry Murphy, the

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45   W. Benjamin, "The work of art in the age of mechanical reproduction:" 5.
46   Ibid.
47   "FASHION MADE: The Future of Digital Fashion with Kerry Murphy, The Fabricant," Product Innovation, YouTube video, 38:2, 2019, https://www.youtube.com/watch?v=Up8B9WUoKg4, accessed January 10, 2023.

founder of the pioneering digital fashion brand Fabricant. For Murphy, as for many others in the industry, the current coupling of digital garments and physical bodies is only a transitory phase in the field's progression toward complete virtuality. Before that day comes, holding our love and fear in its fabric, preserving the contours of our hollow form, the digital garment dances in a world without us.

As new materialisms have argued for the inherent vitality vested in all matter, Mel Y. Chen reminds us that animacy is political–the assignment of liveliness to bodies is viscerally bound to the technologies and discourse of biopower.[48] In the same way, as media scholars have increasingly expanded the notion of hapticity beyond physical tactility, our experience of materiality is nevertheless structured by nonneutral social relations. What is endowed with the vitality to "touch us emotionally,"[49] and whose life gets to be touched, staged, and enhanced? The elemental surface of digital garments reminds us that the questions of vitality and hapticity are tightly intertwined and invites us to interrogate their intersecting histories. More concretely, elemental surfaces beckon us to approach the history of elements—from its classical inception to its post-classical legacy—with an eye towards the sensationalization and environmentalization of life. It is from this vantage point that digital fashion's danger emerges alongside its allure, and our critical intervention emerges alongside constructive possibilities.

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48   M.Y. Chen, *Animacies: Biopolitics, Racial Mattering, and Queer Affect* (Durham: Duke University Press, 2012).
49   Böhme, *The Aesthetics of Atmospheres*: 97.
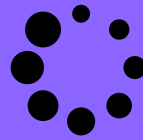
PERMANENT CALL: OPERATIONAL AN-ICONS

A landscape painting hanging in a gallery represents reality; the image of a landscape offered by a drone monitoring a military area is an image that does something on reality. Since the tradition of the imagines agentes, up to the «operational images» described by Harun Farocki, scholars have sought to highlight in different ways the powers of images, their capacity to affect reality and to influence human reactions, but also to stare back at us and even to perform acts, in a word to single out the agency of images. An-icons are, as such, particularly well-suited to be operational, as they are actively engaged in operations that are meant to impact on and change reality.

Virtual reality in particular affords the possibility to generate compelling, quasi-real, yet allegedly safe spaces in which to experiment with actual reality, and with subjects inhabiting it. Therefore, it proves of considerable practical advantage in those professional fields in which simulating reality constitutes a preliminary step towards modifying it. In addition to reproducing real environments, virtual reality allows as well to create new ones. Hence, it is valuable in those contexts in which actual reality has to be suspended and replaced by inhabitable virtual worlds.

Technologies of virtual, augmented, and mixed reality have today multiple applications in several fields: design, architecture, and urban planning, where different solutions can be tested before being implemented; medicine, where surgical procedures can be designed and rehearsed on virtual patients; psychology and psychiatry, where individuals can learn how to overcome their disturbances by practicing coping strategies in virtual situations, or temporarily find relief in substitutive worlds; as well as education, marketing, training, the military field, the porn industry, and so on.

As they become increasingly widespread, the practical usage of virtual environments and an-icons more broadly raise multiple and urgent questions. How are simulations or brand-new realities precisely built? To what degree and under which conditions do we find them persuasive? What does it mean to be exposed to virtual situations that nonetheless are conceived to impact on our actual self? What perceptual and cognitive processes do we undergo as we experience operational an-icons? And what ethical and/or political issues do an-icons pose in their operational life?

This section of AN-ICON. Studies in Environmental Images solicits contributions that monitor and critically reflect upon the applications and practical usage of an-icons as a new and sui generis kind of operational images. Methodological variety is key to this section. Therefore, in addition to theoretical works, we welcome empirical works that adopt the standpoint and research tools of empirical aesthetics and phenomenology, cognitive sciences, cognitive psychology, neurosciences, as well as sociology and ethnography.

In this perspective, Operational An-Icons encourages proposals related to the following frameworks:

→ State-of-the-art scholarship and further directions in the practical usage of an-icons.
→ The technical mechanisms underlying the practical usage of an-icons.
→ The experiential mechanisms elicited by the practical usage of an-icons.
→ The social, ethical, and political impact of the practical usage of an-icons.

Phenomenology of space and virtual reality. An experimental course for students in architecture

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Abstract   The paper presents the theoretical assumptions and the way of conducting an experimental course on the Phenomenology of Space designed for architects and interior designers. The course made use of virtual reality to allow students to directly experience the perceptive and cognitive effects induced by the forms of space, colour, the texture of materials, and light. Virtual reality was also the medium that made it possible to translate certain philosophical concepts related to the phenomenology of space into an experiential and applicative field close to the sensitivity and spatial culture of the designers. The themes addressed gave rise to a progressive development that allowed students to develop an increasingly complex project and experiment with increasingly complex issues. The course began with the phenomenology of thresholds, and continued with the analysis of field and synesthesia, the phenomenology of atmospheres, and the analysis of orientation and mind maps. In each of these areas of research and experimentation, the common thread remained the relationship between the body and space. The article also presents the exercises proposed to the students and an overall assessment of the teaching experience.

Keywords   Phenomenology   Virtual reality   Achitecture

Philosophy   Education

Presentation of the course

Virtual reality (VR) holds educational potential of great interest for all disciplines that deal with spatiality, and even more for those, like architecture, that have a privileged relationship with lived space, that is to say with the interaction between the body and its environment. I attempted to demonstrate this thesis through the conception and development of a course on Phenomenology of space that makes use of virtual reality to study the perceptual effects of architectural design.

The course began as a research project funded by an internal call for proposals in the Department of environments, construction, and design of the University of Applied Sciences and Arts of Southern Switzerland (SUPSI-DACD, Mendrisio, Switzerland) dedicated to digitization. From the outset, its implementation required the formation of a small interdisciplinary research team. It included, alongside myself, philosopher and professor of spatial theory Pietro Vitali (architect and professor of the degree course in interior architecture), Matteo Moriani (architect and assistant for the course developed by this project), and Marco Lurati (interaction designer and lecturer). In contrast to what often occurs, the collaboration between different areas of expertise in our case had a material character. The task of taking care of the content and educational aims of the course fell to me, as philosopher, while that of dealing with questions related to more strictly architectural aspects fell to the designers, who then guided the students in their design work. The interaction designer, finally, had the task not only of making the course possible through the development of the technology and the necessary programming, but also of teaching students how to carry out design in VR and the relevant programs (Twinmotion in particular). As is clear, no member of the working group could have proceeded without the aid of the others. The final goal was to create a course in phenomenology applied to architecture with the help of Oculus Quest 2 headsets. In other words, rather than just learning theories, the students would need to sharpen their

spatial sensibility by experimenting with these theories in a virtual environment. The challenge was thus double: on one hand to offer a course on applied philosophy, and on the other to introduce virtual reality into a theoretical course, making it the tool for the application of theory.

In addition to this, in an almost unconscious, seemingly instrumental way, the students would need to learn sophisticated programming languages, a skill that is also useful from a professional standpoint.

Background

Virtual Reality has recently emerged in architecture and the arts as novel means for visualizing different design solutions and for building up the design model and its virtual environment.

Similar to these applications, VR is commonly used in architectural education in the design process, as it provides the designer with an image to create the spatial and topological relationships of a project. Although the use of VR for teaching purposes is not yet widespread in architecture faculties (in Europe at least), its pedagogical effectiveness has been clearly documented.[1] Several studies on the pedagogical function of VR in architectural studies have shown that the use of VR increases the awareness of designer during designing in terms of the structural properties and component assembly of a structural system,[2] helps students' way of thinking, critical thinking, and problem-solving activities,[3] creates the possibility to "feel like being in the place,"[4] strengthens the memory and awareness of the

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1 F. Kharvari, L.E. Kaiser, "Impact of extended reality on architectural education and the design process," *Automation in Construction* 141 (2022): 1-19, https://doi.org/10.1016/j.autcon.2022.104393.
2 W.A. Abdelhameed, "Virtual reality in architectural design studios: a case of studying structure and construction," *Procedia Computer Science* 25 (2013): 220-230, https://doi.org/10.1016/j.procs.2013.11.027.
3 F. Kharvari, L.E. Kaiser, "Impact of extended reality on architectural education and the design process."
4 T. Chandrasekera, K. Fernando, L. Puig, "Effect of degrees of freedom on the sense of presence generated by virtual reality (VR) head-mounted display systems: a case study on the use of VR in early design studios," *Journal of Educational Technology Systems* 47, no.4 (2019): 513-522.

spatial configuration,[5] augments "spatial abilities" in students,[6] trains the capacity to switch naturally from a planar representation of space to a 3D representation of the same space.[7] To cite a concrete experience, Johan Bettum, professor of architecture at the Städelschule, has used virtual reality in the master degree studio Architecture and Aesthetic Practice at Städelschule Architecture Class (Frankfurt) as a laboratory for spatial inquiries in relation to subjective experience, the construction of reality and the role of images in regimes of representation. These experiments consisted in designing immersive environments where architecture has been explored through the computerized representation of forms and spaces. According to the intentions of the course, this digitally produced realm of images supplemented and often supplanted the traditional role of drawing in the contemporary design process.[8] A second research experiment on the integration of VR in the curriculum at architecture schools, took place at the College of Architecture and Planning (CAP) of Ball State University. For three years in a row, the CAP created a design virtual environment for 2nd year students, making use of an HMD (Head Mounted Display). The CAP VR Environment aimed to support the actual architectural design process, therefore aiding the process of learning how to design, rather than limiting its use as a visualization tool. In the practical terms, the immersive simulation of an actual design project (the lobby of a small hotel) was intended to enable students to recreate the architectural characteristics of the space, eliciting an appraisal of their architectural spatial experience. According to the author, the ability to navigate through

5 A. Angulo, "Rediscovering virtual reality in the education of architectural design: the immersive simulation of spatial experience," *Ambiences. Environment Sensible, Architecture et Espace Urbain* 1 (2015): 1-23, https://doi.org/10.4000/ambiances.594.
6 T. Chandrasekera, S.Y. Yoon, "Adopting augmented reality in design communication: focusing on improving spatial abilities," *The International Journal of Architectonics, Spatial and Environmental Design* 9, no.1 (2015): 1-14, http://dx.doi.org/10.18848/2325-1662/CGP/v09i01/38384; M. Schnabel, T. Kvan, E. Kruijff, D. Donath, "The irst virtual environment design studio," *19th eCAADe Conference Proceedings. Helsinki* (2001): 394-400.
7 J. Milovanovic, G. Moreau, D. Siret, F. Miguet, "Virtual and augmented reality in architectural design and education. An immersive multimodal platform to support architectural pedagogy," 17th International Conference, CAAD Futures 2017, Istanbul, Turkey.
8 J. Bettum, *Architecture, Futurability and the Untimely* (Bielefeld: transcript Verlag, 2022).

the simulated lobbies turned out to be key to capture the architectural spatial experience and perceive the aesthetic emotion and/or symbolic meaning embedded in the projects.[9]

A further type of studies attempted to demonstrate, through an experimental design that also involved students from a design class at the Milan Polytechnic, the possibility of recreating complex spatial qualities through VR, for example investigating how multisensoriality (scent in particular) affects the realism of the experience contributing to increase the users' sense of presence in the virtual environment.[10]

Although in some ways apparently akin to the case studies cited, it must be borne in mind that the course we experimented with differs first and foremost from them for the basic reason that it does not fall within the scope of architecture, but of philosophy applied to space (a philosophy with a phenomenological orientation). The aim of the pedagogical experiments conducted is therefore not related to design, but to the understanding of the body-space relationship, with a specific focus on the modalities of sensory perception. In other words, thanks to virtual reality, the students were able to experiment in various ways, according to a number of controlled possibilities, how the manipulation of certain variables (positions of openings, colors, scales, relationships between objects in space, artificial lights, sequences of spaces) impact the spatial experience on a perceptive and cognitive level. The aim was not to obtain a realistic representation of space, nor was it to learn about and visualize certain spaces and construction processes through VR. The aim was rather to verify with one's own (virtual) body the perceptual effects induced by

9 A. Angulo, "Rediscovering virtual reality in the education of architectural design: the immersive simulation of spatial experience."
10 M. Carulli, M. Bordegoni, U. Cugini, "Integrating scents simulation in virtual reality multisensory environment for industrial products evaluation," *Computer-Aided Design & Applications* 13, no. 3 (2016): 320-328, https://doi.org/10.1080/16864360.2015.1114390.

certain design choices, and to develop a method to derive generalizable knowledge from experience.

Although the aforementioned studies have provided the course with useful information and a set of important examples regarding the didactic use of VR in architecture, there is - to the best of my knowledge - no previous use of VR in phenomenology of space.

Theoretical framework

Phenomenology is undoubtedly the theoretical orientation most closely related to the intelligence of architects, who are accustomed to thinking about space "live," so to speak. Among the characteristic abilities of the architect are the capacity to consider the relationship between spaces and bodies, to imagine the atmosphere of environments and the way in which shape, color, and spatial scale influence our experience of them, and to organize solids and voids, exteriors and interiors, the visible and the invisible, light and shadow, volumes and matter, as though they were elements of an aesthetically expressed spatial language. It is precisely this sort of sensibility that the course sought to thematically develop, strengthening students' awareness of and ability to design perceptual (i.e., not only spatial) environments imbued with cognitive and emotional meanings. To best realize the desired encounter between philosophy and architecture in this pre-categorical level of spatial experience, I found it useful to refer to phenomenology broadly defined, broadly enough to include Gestalt psychology and some elements of behaviorist psychology. Before giving a synopsis of the thematic contents of the course, it will be necessary to evaluate the contribution that virtual reality can offer to the encounter between phenomenology and architecture, mediating between their languages. VR's potential consists in its particular qualities as an immersive medium, or more specifically in its

capacity to insert perception into an immaterial, interactive, and programmable *Umwelt*.

The first aspect is perhaps the most important. If there is a single quality that the spatial intelligence of the architect must necessarily develop during the course of study, it lies in the capacity to move from an understanding of space based on plans—made up of lines, symbols, numbers, and so on—to a subjective understanding, ideally placed in the space that those signs represent abstractly. The passage from an objective and external gaze (the one that reads the plan) to an internal, embodied one, capable of bringing the signs to life in a volumetric space and corporealizing them, is normally entrusted to the imagination. But given the complexity of this mental operation, it is always necessary to turn to a plurality of media: sketches, models, photographs of the models taken from the inside, rendering, etc.

None of these tools, however, is capable of physically including the subject, who thus continues to have a distanced and disembodied understanding of space. Given the importance of the role that the body plays in spatial experience, it is clear that the value of virtual reality lies in the possibility of transferring the subject inside of the space of representation, in such a way that allows them to have a direct, aesthetic, and even synesthetic experience. Thanks to VR, the architect can jump in and out of the representation: he or she can "enter the plan," making it into an immersive experience, and then exit, modify the design on the basis of this experience, and finally return to the virtual space to check the outcome of the operation. This movement in and out of the space of representation provides the intelligence of the architect with a new medium; this is not, however, virtual reality, but rather his or her own body as an "analogical" tool, one that provides an analog to embodied sensory experience. On the one hand, virtual space replicates the intentional structure that the world presents to us: space moves with me, shows itself and hides itself in relation to my gaze, and declares its secondary qualities (for example, showing itself to be narrow and oppressive,

or disorienting —all qualities that are related to a certain kind of subjective experience.). On the other hand, even if they are "embedded" in a virtual environment, the subjects still maintain an interior distance, a remainder of objectivity; they know that they are in a representation, just like at every moment they know that their own body is only an analogon of the sentient one, which allows them to have a mediated, self-observed experience, and to register its effects. If virtual space is a distant relative of the sketchpad, the body that explores virtual space is a distant relative of the pencil that draws in the sketchpad, or more precisely of the manual intelligence involved in that experience.

The risk of virtual reality causing the architect to lose an authentic relationship to space, or to "authentic space," is, when taken from this point of view, less serious than one might fear—and all the more so due to the fact that VR does not by any means claim to substitute itself for the traditional forms of mediation, translation, and representation of space, but rather to integrate them into its own capabilities. Furthermore, VR remediates within itself many media to which we have long been accustomed, from the drawing pad to the cinema; from this perspective, rather than eliminating all mediation, it entails a deep and layered media culture. This is also confirmed by the educational usage of VR, given that in order to adequately use it, the students will necessarily continue to move through the representational languages of different media (from manual design to CAD, as well as the photos and films that can be made within virtual reality). They can also share their visual experience externally, since what they see within the virtual environment can be simultaneously projected on a screen connected to a projector. This, if we consider it closely, is no small thing. Two separate and autonomous (although co-present) environments—two different parallel *Umwelten*—can be connected in real time. Making it possible to show the outside what one sees as one sees it, VR makes ocular experience shareable, albeit through two different media (on one hand the projected film and on the other the immersive reality.) The VR viewer transforms vision

into a full-fledged medium: it transmits, communicates to the outside, shows, and makes what it manifests public in real time. The virtual experience is, in effect, "replicant" by nature. In it, technological reproducibility has now caught up with the perceptual experience linked with one's own body: today sight, tomorrow touch, and then who knows.

The alienation of one's own body, if we can call it such, may have slightly disturbing aspects for those who want to project it into dystopian future scenarios, but within the context of more modest educational ambitions, it holds enormous potential, given that it makes the lived experiences of others shareable and evaluable. As will by now be clear, the course was nothing like a normal design workshop, nor did it aspire to be. It was more like a virtual gymnasium where, through a series of guided experiments, the perceptual and psychological dimensions of space were exercised; a gymnasium that allowed for the easy modification of space and the experimental verification of its effects.

Aims of the program

To be concise, the use of virtual reality in the architectural context can be summarized in four points. These, as we will see, were developed in the course through a series of exercises.

1)   *VR allows for the modification of space at will, and for the verification of its effects on perceptual, emotional, and cognitive levels (depending on what one is interested in determining) in an immersive environment.*

For example, the height of a ceiling is, from one point of view, objective and mathematical, identical in any space. It is what it is, regardless of other spatial variables like color and depth. Within the perceptual dimension, however, things proceed very differently, since all of these variables intertwine and influence one another in a manner so clear that to define it as subjective would be misleading. The depth of space modifies the perception of

height in direct proportion to its increase. This can easily be experienced in virtual reality precisely because it only applies to a sentient body, which on paper does not exist. Experiments of this type can examine the relationship between color and spatial perception, the modification of an environment through light (or shadows) depending on the hour of the day or the season, the perception of one's center of balance in space, the relationship between different scales, the relationship between different volumes and shapes, synesthesia, and many other analogous situations.

VR offers the opportunity to examine all of these aspects not only through vision, but also from a practical point of view, that is to say, through the study of the behavior of the users that interact with the organization of a given space: how they move, what they understand, what they remember, and how they describe a certain environment. All of this provides a way to test design solutions (whether realistic or experimental), or to verify theories developed in the existing literature.

2)   *VR allows for the implementation of phenomenological variations and the experiencing of their effects on different levels: aesthetic, psychological, ontological.*

The use of phenomenological variation within the context of the project meant the possibility of varying one or two special elements, altering in a controlled way their position, breadth, depth, and other characteristics. One can, for example, modify the perception and geometry of an entire environment by changing where the entryway is located, thus deforming the environment in relation to the observer's center. Depending on the breadth or depth of the entry, the experience of entering, and of the relationship between outside and inside, is modified. Depending where the two entries in a room are located—given that these establish between themselves, on a perceptual level, a reciprocal connection, a sort of invisible corridor—space will be "sliced" by that connection in different ways, redistributing

internal space and generating areas (compartments) of variable shapes and dimensions.

This method requires experimenting with a limited and controlled number of variations, and that the results be recorded from a perceptual and even ontological point of view. The dimensions of a window can be varied in such a way as to produce significant aesthetic discontinuities, but beyond a certain threshold of size the window changes in nature, becoming, for example, a glass door (if it alludes to the possibility of transit, taking on the potentiality of an opening-threshold), or a glass wall, where wall and window meet, each giving up one of its intrinsic potentialities (in the case of the wall, the possibility of visually separating spaces, and in the case of the window, that of connecting an inside to an outside atmosphere). The exercise of variation can take on many forms, all useful for testing a wide range of spatial effects with aesthetic, symbolic, or even ontological significance. To give a final example, which highlights the possibilities of VR, we might think of the effect of all of the possible variations applied to the height of a small room, from the minimum or even insufficient measurement to a generous one, say of 3 meters, up to a decidedly out of scale measurement of 10 or 20 meters. This modification allows for the discovery through intuitive evidence of the discontinuous relationship between stimulus and perception, or of the differential thresholds that punctuate the qualitative passage from one psychophysical condition to another (claustrophobic, comfortable, roomy, oppressive, etc.). The qualitative thresholds can also cause a change in the sense of space itself. For instance, a space in which the ceiling is too low will not be perceived as inhabitable. Habitability is a spatial quality that requires a certain minimum height, even if it is still a claustrophobic one. But if one exceeds this measurement greatly, one enters into a new context of meaning, for example that of an artistic installation, and space takes on a poetic significance that it did not have before. But this is not all. The exercise of phenomenological variation calls for the capacity to describe, or better, to verbalize lived experience, developing

an appropriate (specific), effective (figurative), and meaningful (persuasive) language. From perception to expression: a continuous two-way transit that helps students develop a degree of spatial awareness that they do not normally possess. Naturally, the exercise becomes progressively more complex depending on the number of variables one chooses to introduce. The preceding case, for example, could be made much more complex simply with the introduction of one further variable, such as materials (say, concrete or word) or the presence of a light source (for example, an opening onto a natural light source from above).

3)   *VR allows for the firsthand study of relationships between form and meaning.*
        Here, I turn to the field of Gestalt psychology, and more particularly to the possibility of simulating and studying phenomena of orientation and mental maps (at the base of which lie the tools of the psychology of shapes). To once again in this case offer some examples, one might think of virtual space as a site in which to experiment with different strategies for functionally dividing up space, for grouping families of objects on the basis of the principles of "figural unification," for generating rhythms, for anticipating the sense of space (directions and meanings), and for inducing motor responses. Within this field of experimentation also lies the possibility of giving symbolic significance to a certain element of the environment (for example, the main entrance, the most important painting, the state room, etc.) as well as that of articulating in various modes the relationship between voids and solids, distances, or objects with different shapes and sizes.

4)   *VR allows for experimentation with the constitutive factors of atmospheres.*
        This fourth point is the result of the interaction between all of the preceding spatial components and their relative interactions, and thus cannot but appear last. Experimentation with the constitutive factors of the atmosphere becomes explicit when attention is shifted to the

holistic aspects of the environment, the emotional impact that the space has on us, and the moment of encounter with an atmosphere and the way it can be an object of design. The usefulness of virtual reality in respect to the phenomenological analysis of atmospheres is clear: precisely because an atmosphere is in itself an immersive and synesthetic phenomenon, it can only be observed through bodily presence. One is always *inside* an atmosphere, to the point that the very presence of a certain atmospheric connotation defines, when perceived, the confines of an interior (the interior of a work of architecture, of a certain city or neighborhood, or of a particular culture, etc.). VR thus shows itself to be extremely effective as a tool for the analysis of the psychological aspects of atmosphere, facilitating an applied atmospherology. The various aspects that comprise the atmosphere of a place, that is to say its social and emotional characteristics, can become the object of critical analysis and can be used for the revision of designs. Within this field of experimentation there is also the possibility of observing space from any desired perspective and of moving, even if in a limited way, in a manner that unites visual and synesthetic experience.

In addition, VR offers the possibility of introducing natural sounds, background noises (for example, chatter, whose intensity depends on the number of people that we decide to put into the space), sounds of footsteps (which change depending on the surface being tread upon), and music (which can be diffused into space from a preselected source). It is not yet possible, however, to introduce tactile experiences, while olfactory ones are difficult to manage and a bit artificial.

Structure of the course and workflow

The course took place during the first semester of the 2022 academic year, and was divided into 12 lessons, each lasting an entire day.
Excluding the first introductory lesson and the last one, dedicated to the presentation of final exercises,

five units were offered to the students, each one comprising two lessons. Each unit dealt with a different theme, but always built on the themes discussed in the preceding units. The course thus followed a gradual development through units. The typical organization of the units followed this order: a theoretical lecture (Matteo Vegetti); presentation of the exercise; discussion; presentation of programing tools and the use of Twinmotion for the given exercise (Marco Lurati); design work by students under the guidance of the course assistant (the architect Matteo Moriani, with the invaluable volunteer contribution of the interior architect Victoria Pham). Each unit was concluded the afternoon of the second lesson with a group review of the exercises. Since these were carried out by students in pairs, the presentations took place as follows: one student explained the design choices and the outcomes of the experimentation, while the other, from within the virtual space, showed the spaces in question (thanks to a projector connected to the Oculus, or rather to the computer supporting it). Each pair of students worked on a space of a different scale (2.5x2.5; 5x5; 10x10; 20x20; 2.5x5; 5x10; 10x20). In this manner, the phenomenologically significant issue of scale was indirectly present throughout the course, presenting numerous opportunities for reflection. Given that the same exact exercise presented difficulties of different types depending on the scale, each group of students necessarily had to offer a different design solution. The differences between scales were of course also evident in the exercises based on variations.

In what follows I offer a descriptive brief of the subjects dealt with in each unit and in the corresponding exercises. The latter held a fundamental importance in the overall economy of the course, given that they connected theory with practice and formed an educational pathway that began from a few basic elements and then became progressively richer and more complex.

"I ask a young student: how would you make a door? With what dimensions? Where would you place it? In which corner of the room would you have it open? Do you understand that these different solutions are the are the very basis of architecture? Depending on the way that one enters into an apartment, on where doors are located in the walls, you feel very different sensations, and the wall that you that you drill likewise takes on very different charac- teristics. You then feel that this is architecture."[11]

The first introductory lesson of the course dealt with the relationship between body and space, bringing to light some of the fundamental issues in Merleau-Ponty and Heidegger's phenomenological approaches.[12] Through the definition of these concepts and the relationship between them (space as correlate of the activity of a living body, as environment, as site, as a felt, perceived, lived space, in- vested with meanings), the course established a theoretical basis sufficient for understanding its aims.

Then, a first approach to virtual reality, and a first intuitive test of the ideas learned, was carried out through the use of the Gravity Sketch program, which of- fers its users the possibility of creating space through the movements of their hands, and to choose from a vast rep- ertoire of creative resources (lines, shapes, surfaces, colors, materials, transparencies, etc.). Each pair of students ran- domly selected an aesthetic/perceptual theme (unknown to the others) to give form to. Once a pair of students created theirs in VR, the rest of the class was invited to visit it and provide a brief description of it. Based on the comments received, it was easy to tell if the students had succeeded

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11 Le Corbusier, *Precisions on the Present State of Architecture and City Planning* (1930) (Cambridge MA: The MIT Press, 2015).
12 M. Heidegger, M. *Corpo e spazio* (1964), trans. F. Bolino (Genova: Il Melangolo, 2000); M. Merleau-Ponty, *Phenomenology of Perception* (1945), trans. D. Landes (Abingdon-New York: Routledge, 2012).

in conveying the theme that they were tasked with interpreting spatially.

In a small way, this first contact with virtual reality reproduced the characteristic transposition of theoretical themes into an "applied" dimension that would characterize the course as a whole. Most importantly, Gravity Sketch is an effective tool for becoming familiar with VR, and more particularly with the possible functions offered by the Oculus.

UNIT 1 - Phenomenology of thresholds

The first unit was dedicated to the theme of thresholds, or rather to the diverse configurations of the divide between interior and exterior that make the experience of space as a place possible (the possibility of "entering" or accessing that only the crossing of a threshold allows). Experimenting with the different thresholds that comprise space and mastering their rhetorical significance means knowing how to articulate space like a complex text, full of caesuras, connections, leaps, transitions, and transformations. Each threshold represents a critical point in space because it is called upon not only to manage the different practical and symbolic functions of the environment, but also the relationship between seemingly irreconcilable opposites: interior and exterior, public and private, the familiar and the foreign, the inside and the outside. The phenomenology of thresholds thus aimed to show through numerous examples how the threshold could be designed and conceived of in different ways depending on goals and intentions (aesthetic, symbolic, practical).

The lesson took its impetus from an anthropological reflection on the significance of the threshold/door,[13] to then move towards more philosophical[14] and phenomenological[15] questions. Here, as elsewhere, Ching's im-

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13 J. Rykwert, *The Idea of a Town* (Cambridge MA: The MIT Press, 1988).
14 G. Simmel, "Bridge and door," *Theory, Culture & Society* 11 (1994): 5-10.
15 P. V. Meiss, *De la forme au lieu* (Lausanne: Presses polytechinques et universitaires, 1986);
A. Moles, E. Rohmer, *Psychologie de l'espace* (Paris: Casterman, 1998).

ages and insightful observations were very useful in accompanying the discussion.[16]

The lesson was also the occasion to thematize the threshold between "front" and "back," between "stage" and "backstage," or rather between the public and private dimension, through a series of different frames. Here, I use the language of Erving Goffman to allude to the importance of the frame in defining, on the basis of its specific material or formal qualities, the type of situated social situation that one wishes to obtain: the degree of visibility, of separation, of privacy (or of porosity, contamination, or transparency) that one wants to establish between the respective domains of "front" and "back" in order to strengthen or weaken the public valence of the place and the relationships that take place there.[17]

Expected outcomes:

■ Understanding the symbolic value of the entering a space and the way in which the threshold manages the relationship between interior and exterior.
■ Experimenting with the perceptual effects generated by the different positioning of a door-opening in the same identical space.
■ Experimenting with the connection that is created between two door-openings within the same space, and the modification of spatial relationships that this connection brings about.
■ Understanding the significance of the center as what organizes space and its distortions.
■ Understanding the language of the window-opening through different typologies.
■ Experimenting with the concept of "frame."
■ Analyzing the way in which an object (in this case, a work of art) reacts to space based on its position, size, relationship to light, and to its own "aura."

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16 F.D.K. Ching, *Architecture: Form, Space, and Order* (Hoboken: John Wiley & Sons, 2015).
17 E. Goffman, *Behavior in Public Places* (New York: Free Press, 1966); and *Interaction Ritual* (New York: Pantheon, 1982)
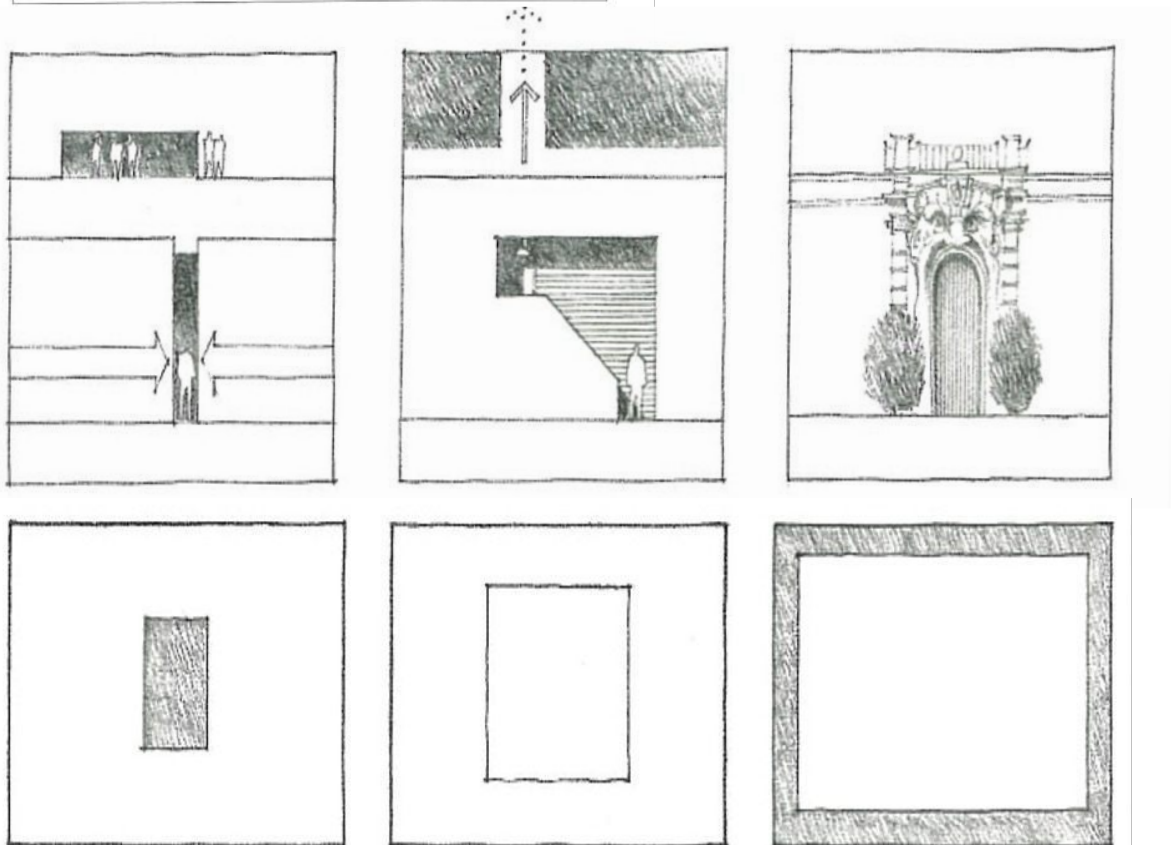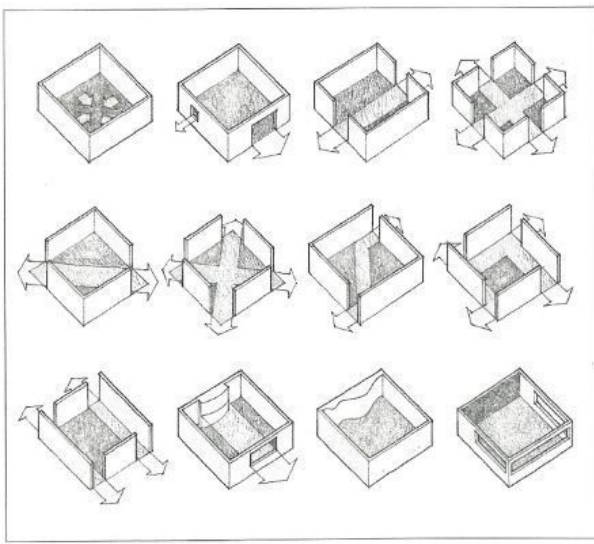
Fig. 1. Beyond a certain limit, an opening ceases to be an enclosed area and becomes a dominating element: a transparent plane bordered by a frame. From F.D.K. Ching, *Architecture: Form, Space, and Order* (Hoboken: Wiley, 2015).
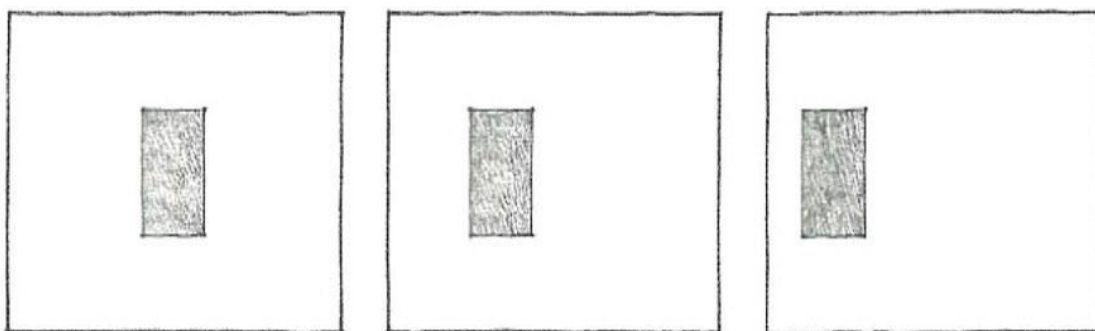

Fig. 2. An opening situated on the plane of a wall will appear to be a luminous form against a contrasting background. If it is centered on the plane, the opening will appear stable and will visually organize the surface around it. If it is decentered, it will create a level of visual tension with the sides of the plane towards which it has been moved. From F.D.K. Ching, *Architecture: Form, Space, and Order*.

Exercise

Each pair of students works on a space of different scale, with a square or rectangular base (2.5x2.5; 5x5; 10x10; 20x20; 2.5x5; 5x10; 10x20).

A) Create three spaces with equal dimensions. In one of these spaces, place a door-opening in three different positions, and note how the space changes perceptually, writing a description of it from within the virtual space.

B) For each of the three spaces, create two door-openings placed in different ways (but on the same wall). Describe the result: how is space modified? Where is the center?

C) Place a rug of shape, dimension, and material of your choice in each space.

D) Place a window-opening in each space. The openings must be central, zenithal, and angular (size and shape are up to you).

E) Modify the dimensions and shape of the window-openings, increasing their width or height freely. Describe the result.

F) Place into one single space a combination of four of the entry-doors or windows created earlier (4 total: this could be 2 doors and 2 windows or 3 doors and 1 window, etc.) Describe the result.

G) Connect in a sequence four of the spaces created earlier. Give these environments a hierarchy and connect them with a path that joins the entrance and the exit. Design the main entrance into the space from a rhetorical standpoint. Try to convey the hierarchy between different environments through the use of different kinds of thresholds. The thresholds must anticipate the sense of the space being entered, and must convey the relationship between the spaces that they connect (you can use frames, stairs, boxes, ramps, partitions, false ceilings, different thicknesses for the walls, and the form and dimensions of the thresholds can be modified. In this phase, the

threshold can become a volume). You may not, however, use any elements of décor.

        H) Place a sculpture in one of the environments in such a way as to enhance the latter.

        I) Design a threshold/separation (a frame) that creates a private space within one of the rooms that you have already made.

        J) Make a 30-second VR film of these environments and describe the created space (2000 words). The description should be written subjectively ("I advance and see on my right…;" "the light from the window is illuminating the threshold that I am about to cross…")

        K) Take 3 photos of the interior that illustrate the design choices (that is, representative views of the interior space generated through experimental solutions.)

UNIT 2 - The power of the field

"By emphasizing the generated field in addition to the architectural object, one raises once more the problem of space, but in different terms by giving the concept a different value. In traditional criticism space is a homogeneous structure, a kind of counterform to the mural envelope, indifferent to the lighting conditions and to its position in relation to the buildings, whereas the notion of field stresses the continuous variability of what surrounds the architectural structures."[18]

        The second unit, which clarified some of the theoretical elements already present in the first, analyzed the principles of field theory, or better, an ensemble of theories based on the shared presupposition that a space occupied by volumes does not coincide with their physical

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18 P.P. Portoghesi, cited in R. Arnheim, *The Dynamics of Architectural Form* (1977) (Berkeley: University of California Press, 2009).

space, but extends beyond it, without however being independent of the originating form.[19]

The field thus coincides not with the borders within which everything is enclosed, but with a certain arrangement of forces and vectors acting in space. Space thus becomes an active and reactive environment: a field of psycho/physical forces. Every volume present in the field, by virtue of its mass and its shape(s), changes the field's appearance. The field generated through design deeply affects our perceptual schemas through the play of forces that act within it. But within the concept of field, the concept of center, already encountered in the previous unit, plays a fundamental role. While geometrically a center is simply a point, perceptually it extends as far as the conditions of stability that it is based on will permit. Of course, the center may or may not be indicated. In architecture, it can be indicated (or suggested) by a ceiling lamp, a mobile, a decoration, or a mosaic. Or, it can be an empty space at the center of two diagonals or of the geometry dictated by the positions of the thresholds. Normally, however, there are multiple centers at work in each field, each of which attempts to prevail over the others. The lesson thus brought attention to the problem of the interaction between fields of different shapes and strengths, suggesting the possibility of making corrections to one's designs by working on the centers, the directions of the volumes that generate the field, or their distance from one another.

This illustrates the concept, well known to phenomenology and cognitive psychology, that space is born as the relationship between objects. On the basis of this idea, shifting attention from the shapes of objects and their interaction to the void that separates them, the lesson then also discussed the concept of "interspace," and along with it the fundamental law of attraction-repulsion: "Objects that look 'too close' to each other display mutual repulsion: they want to be moved apart. At a somewhat greater distance

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19 R. Arnheim, *The Dynamics of Architectural Form*; P.P. Portoghesi, V.G. Gigliotti, "Ricerche sulla centralità. Progetti dello studio di Porta Pinciana," *Controspazio* 6 (1971); A. Marcolli, *Teoria del campo* (Firenze: Sansoni, 1971) and *Teoria del campo 2* (Firenze: Sansoni, 1978).

the interval may look just right or the objects may seem to attract each other."[20]

The final theme concerned the typical fields of basic shapes such as the circle, triangle, and square. This discussion was then applied to bidimensionally-perceived spatial forms, such as the shape of the window in respect to the wall in which it is placed.

Finally, it bears noting in relation to point "C" of this unit's exercise that VR does not exclude interaction with physical objects. Virtual and material reality can in fact overlap, generating a significant enhancement of spatial experience. In the present case, it was sufficient to place a real table where the virtual table designed by the students was, in order to allow a group of four people to share the same situation from different perspectives. The members of the group sat around the same virtual table (sharing the same design simultaneously in multiple Oculus viewers), but could at the same time establish a tactile relationship with the table around which they were seated in real space.

The lesson made wide use of examples taken from architecture as well as city planning in order to explain how field theory adapts to each scale.

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20 R. Arnheim, *The Dynamics of Architectural Form*.

Expected outcomes:

■ Understanding and experimenting with the influence of the center and the relationship between centers.

■ Perceptually experimenting with the field in terms of scope and shape of irradiation, as well as the relationship between fields in terms of interference, conflict, or harmony.

■ Perceiving the language of voids in relation to solids in terms of visual balance and variable density (compression and decompression of the spaces between elements).

■ Testing the symbolic/perceptual power of fire (that of a fireplace) in establishing a center and a space.

■ Observing the dynamics of the field together with the other students, developing a suitable language.

■ Putting the dynamics of the fields into the form of a graphic representation.
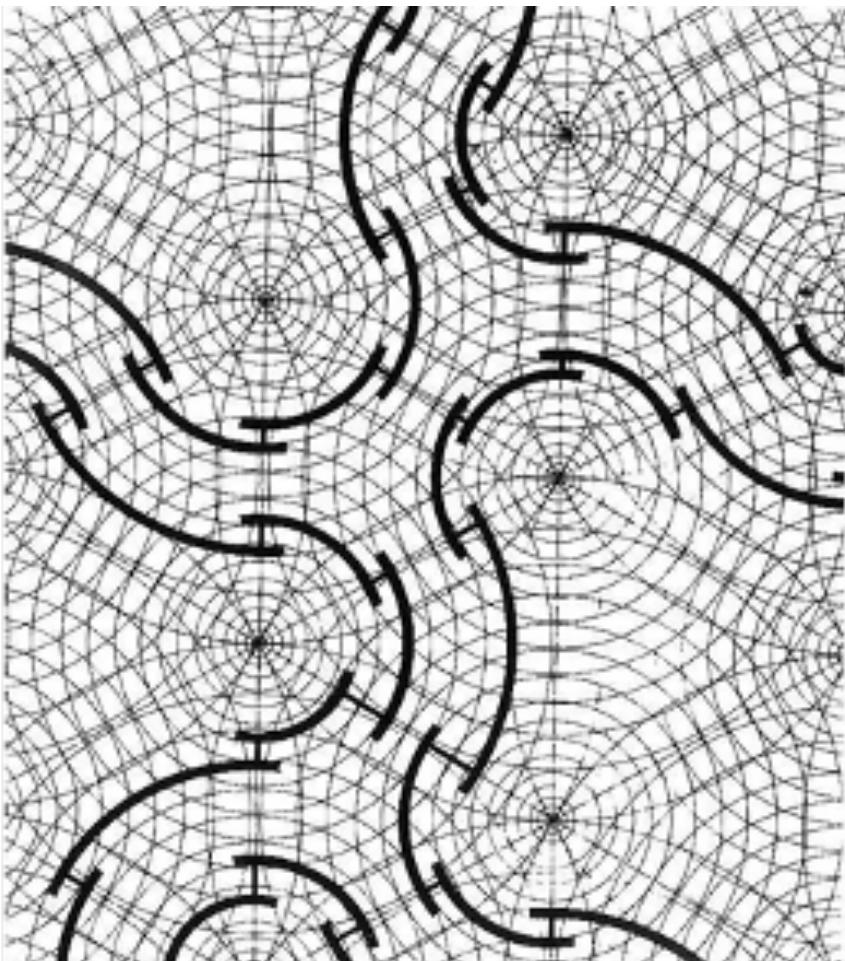
P. Portoghesi, *Field Theory. Space as a system of places*, 1974.
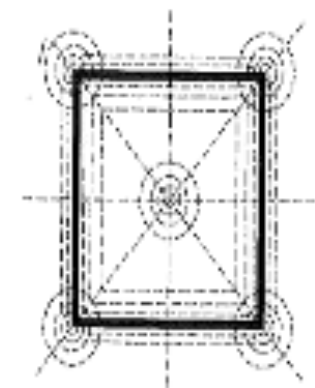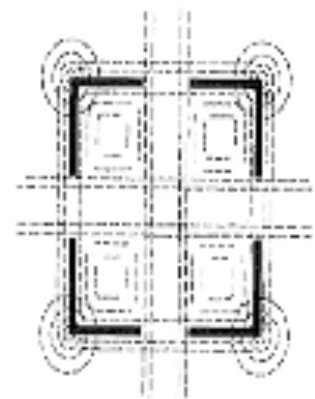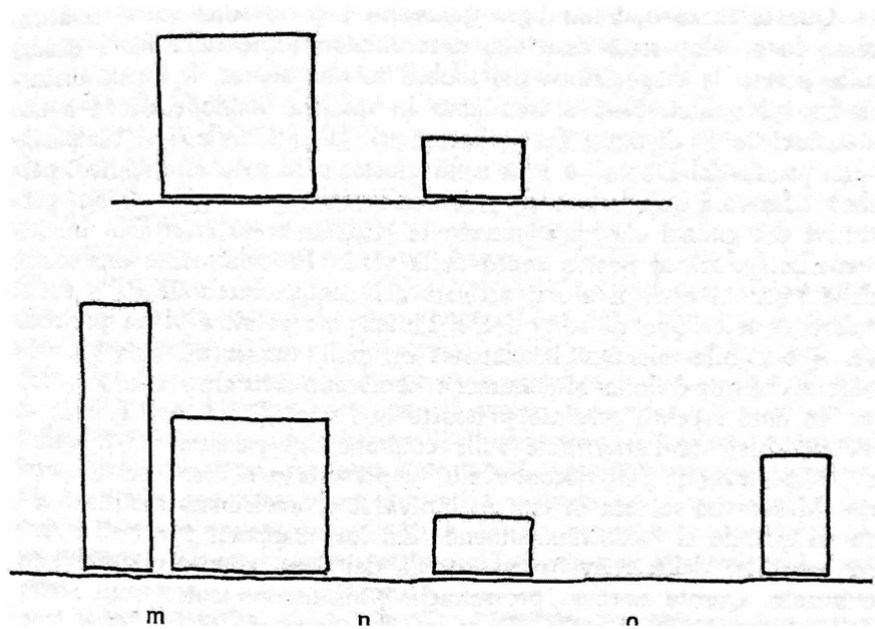
Fig. 4. Modification of forces internal to a rectangular field based on the positioning of the door-openings. From P. V. Meiss, *De la forme au lieu* (Lausanne: Presses polytechinques et universitaires, 1986).
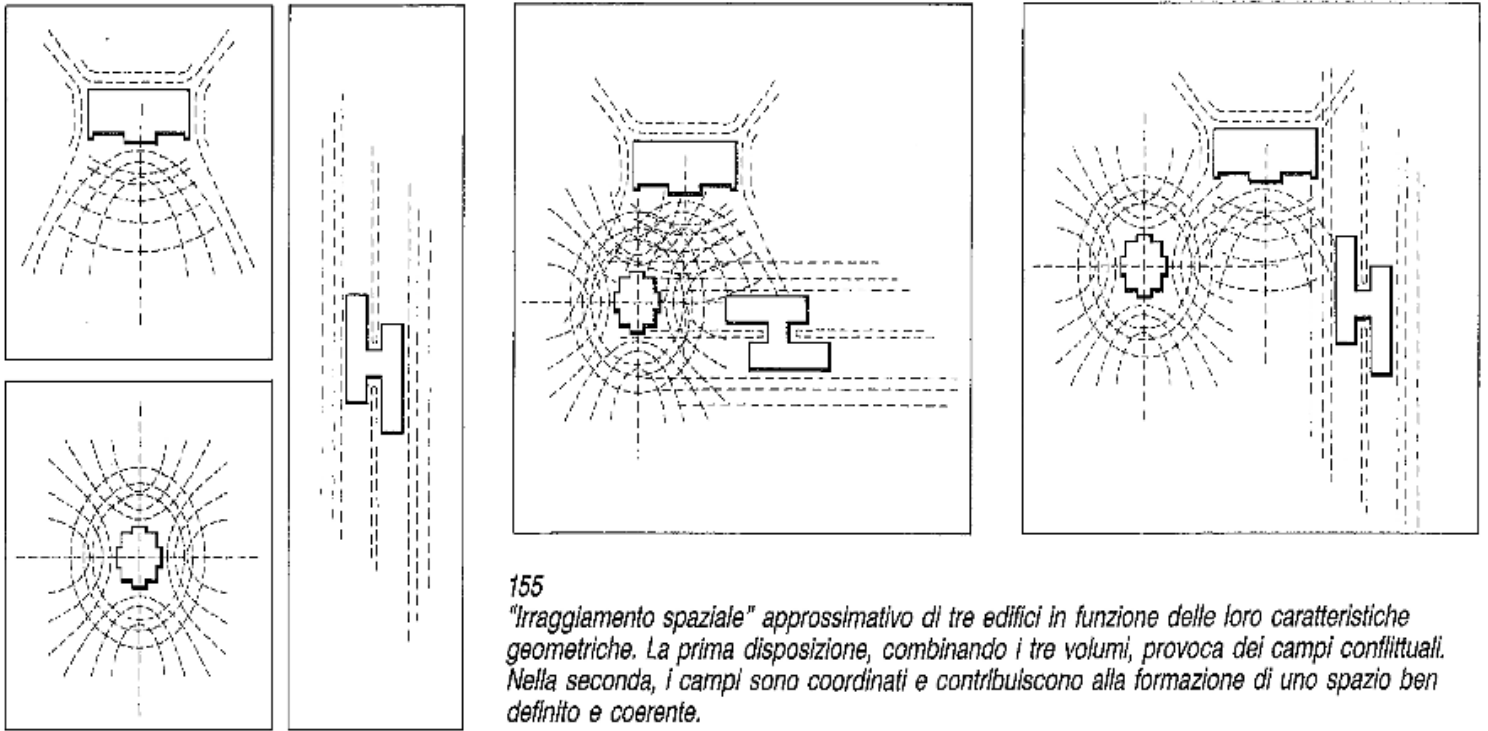
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"Irraggiamento spaziale" approssimativo di tre edifici in funzione delle loro caratteristiche geometriche. La prima disposizione, combinando i tre volumi, provoca dei campi conflittuali. Nella seconda, i campi sono coordinati e contribuiscono alla formazione di uno spazio ben definito e coerente.

Fig. 5. "Irraggiamento spaziale."

Exercise

Beginning from the final state of the work undertaken in the previous exercises, inserting objects and volumes in space, we will analyze the force fields that these create.

A) Begin the exercise by observing and analyzing the space already created on the basis of field theory.

B) Among the four volumes from the previous exercise, we have one that already contains the sculpture. In the three remaining, place:

a) A fireplace and a table for 4 people

b) 5 monochrome volumes (1 cylindrical, 1 cubic of 1x1, 2 parallelepipeds of 1x1x2, and a column): create a harmonious field out of these volumes, which may not touch the wall (the volumes can be sized in respect to

the space that hosts them). Describe the fields that you think you have generated.

c) In the third room, place a painting and a mirror on one of the walls.

C) Sit in a group of four at the table, and together analyze the space with the fireplace from inside of the simulation. Improve the previous solutions by changing the placement of the volumes, or try an alternative solution.

D) Now, enter the space with the geometrical volumes and analyze the field/fields generated. Improve the previous solutions by changing the position of the volumes, or try an alternative solution.

E) Analyze how the spaces change at different hours of the day due to natural light and shadows. Create a film of 30 seconds, based on a narrative strategy, that shows how the fields are modified by natural light at different times of the day. Walk through the entire space, back and forth, at three different times of day: morning, afternoon, and twilight.

F) Now, enter into the space with the geometrical volumes and analyze the field/fields generated. Improve the previous solutions by changing the position of the volumes, or try an alternative solution.

G) From inside the space, take three photographs representative of the perceptual/visual experience of the field.

H) Extract the building plan from Archicad (1/100) and draw the fields, centers, and vectors that you think you have generated within the space.

UNIT 3 - Multisensoriality and synesthesia

"...every architectural setting has its auditive, haptic, olfactory, and even hidden gustatory qualities, and those properties give the visual percept its sense of fullness and life. Regardless of the immediate character of visual perception, paradoxically we have already unconsciously touched a surface before we become aware

of its visual characteristics; we understand its texture, hardness, temperature, moisture instantaneously." [21]

The third unit was carried out in collaboration with Dr. Fabrizia Bandi, researcher in the "AN-ICON" group led by Andrea Pinotti, who was a guest of the course thanks to the SEMP international exchange program. The aim of the unit was to guide students to the discovery of the universe of synesthetic effects attributable to sight and hearing.

Fabrizia Bandi, an expert in the thought of Mikel Dufrenne, introduced the students to elements relating to synesthesia in the phenomenology of Merleau-Ponty, Pallasmaa, and Dufrenne.[22] The lesson insisted on the importance of understanding the multisensorial character of perception since, whether one likes it or not, space communicates with bodies in this way, through the intertwining of different perceptual faculties.

Synaesthetic perception is the rule, and we are unaware of it only because scientific knowledge shifts the center of gravity of experience, so that we have unlearned how to see, hear, and generally speaking, feel, in order to deduce, from our bodily organization and the world as the physicist conceives it, what we are to see, hear and feel ... The senses intercommunicate by opening on to the structure of the thing. One sees the hardness and brittleness of glass, and when, with a tinkling sound, it breaks, this sound is conveyed by the visible glass. One sees the springiness of steel, the ductility of red–hot steel, the hardness of a plane blade, the softness of shavings.[23]

By relativizing the predominance of sight in the structure of perception, the theorists of synesthesia invite us to discover the persistence of "unauthorized" sensory registers (like sound and temperature in colors, or touch in something perceived visually), which condition experience

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21 J. Pallasmaa, *The Embodied Image* (Hoboken: Wiley and Sons, 2012): 51-52.
22 M. Merleau-Ponty, *Phenomenology of Perception*; J. Pallasmaa, *The Embodied Image*; M. Dufrenne, *L'oeil et l'oreille* (1987) (Paris: Nouvelles Éditions Place, 2020).
23 M. Merleau-Ponty, *Phenomenology of Perception*: 266-267.

in mostly unconscious and unconditioned ways. The many examples referring to the field of architecture had the aim of leading the students to a decisive point: given the original complicity between body and space, to design means, perhaps before anything else, to organize a complex perceptual environment in which each element not only has multisensory potential in itself but also inevitably relates with that of the others. By experimentally testing the synesthetic effects of the designed space in virtual reality, intertwining their own bodies with it, the students had a way to determine the results of their choices on multiple perceptual levels. These could work towards creating syntonic or dystonic effects, or could play with the composition of different synesthetic qualities within the same element, for example, combining a given material with a color that contrasts with it in temperature, or background music of a certain kind, for example, soft and enveloping, with an environment imbued with the opposite synesthetic characteristics (cold, sharp, shrill). The general goal was to create a perceptually rich and coherent environment. Here, it is important to note that it is possible to import images of any material, including photographs of existing surfaces, into the Oculus.

This unit also allowed for the development of a discourse straddling the border between the phenomenological aspects of multisensory experience and the findings of the neurosciences.[24]

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24 For example N. Bruno, F., Pavani, M., Zampini, *La percezione multisensoriale* (Bologna: il Mulino, 2010).

Expected outcomes:

■   Cultivating sensitivity to the multisensory aspects of material and texture.

■   Developing a language capable of translating synesthetic experience and allowing it to be shared with others.

■   Studying the possibilities of using multisensoriality to design and compose different perceptual environments in logical sequences.

■   Experimenting with the encounter between the synesthetic aspects of music and those of the designed environments.

■   Verifying the efficacy of the desired perceptual effects through a questionnaire.

Exercise

Beginning with the previously-created space, generate four different perceptual environments, working with materials, colors, and sounds. The environments must create an ordered sequence, a perceptual-synesthetic path imbued with meaning.

A) Work with tactile perception: use textures on different parts of the environment (floor, ceiling, objects present in the room, etc.) while also modulating the qualities of the materials (transparency, opacity, reflectiveness, etc.) to create an effect that induces a multisensorial/synesthetic sensation.

B) Use materials and colors to elicit a specific sensation (hot/cold; rough/smooth; sharp/soft; enveloping/repelling; lightness/oppression, etc.)

C) Work with sound: test the impact of the sound of footsteps, introducing different numbers of people into the space based on its size as follows:

- 2.5x2.5: 1 person, 5 people, 20 people
- 5x5: 1 person, 10 people, 40 people
- 10x10: 1 person, 20 people, 80 people
- 20x20: 1 person, 40 people, 400 people
- 2.5x5: 1 person, 10 people, 40 people
- 5x10: 1 person, 20 people, 80 people
- 10x20: 1 person, 40 people, 400 people

Once the highest number of people within the space has been reached, add voices. Finally, walk through the space and test the sounds of your footsteps in different environments.

D) In an environment of your choice, introduce a sound effect (natural or artificial) or music that reinforces the synesthetic character of the space.

E) The environments must create a perceptual itinerary. Through the characteristics that you give the environments, try to construct a pathway that will make a hierarchy apparent, with the clearest possible succession.

F) Describe in writing the synesthetic effect that you think you have generated in each of the fourenvironments (without sharing the responses with the rest of the class);

a)   How can the environments that you have created be defined as multisensory?

b)   What type of sensation did you want to make emerge from the different spaces?

c)   What is the relationship between the choice of materials/sound and the sensation that you wanted to transmit to those within the space?

d)   How did the choice of sound relate to the choice of materials and colors?

G) Take one photo in each environment.

H) Shoot a video of the four environments, lasting 24 hours (with all natural light). Compress it into a film of 2-3 minutes.

I) During the morning of the second day, each group will visit the rooms created by the others and respond in writing to some questions aimed at verifying the effect produced by the space on its users:

a) How do the spaces visited constitute an example of multisensoriality? Which factors contribute most?

b) What sort of sensation emerges from the different spaces. Try to describe which elements caused this sensation.

c) Was the sound particularly significant in your experience of the space? Why?

UNIT 4 - Light and color: phenomenology of atmosphere

The fourth didactic unit was dedicated exclusively to the topic of light and color. The reason for this choice resided primarily in the importance of these two factors for spatial perception (in various ways: from colored light to the relationship between natural light and materials that reflect it). Furthermore, light and color play a decisive role in the connotations of atmospheres. In dialogue with various others, from Goethe[25] to Conrad-Martius,[26] from Sedlmayr[27] to James Turrel,[28] the lesson highlighted both aspects: the perceptual dimension and what Conrad Martius calls "the character" of light, or rather the way in which a given property of light is intermittently given expression. Light is undoubtedly a special atmospheric agent, since temperature and color can give space a very clear emotional timbre. But it can be used—as in the phenomenological art of James Turrel and Robert Irwin—to change the form of space, up to the point of distorting it and erasing its borders.

VR is a unique instrument for testing how light reacts to surfaces, their textures, and their colors in the widest range of different conditions (for example, depending on the time of day, and also by adding natural light to artificial light sources).

It is also useful, though, to create spaces and spatial languages linked to the psychology of shapes. Five possible functions of light capable of perceptually altering space in respect to different design aims: illumination, indication, division/unification, connection, creation of rhythm. Of course, each of these functions raises specific questions

25 J.W. Goethe, *Theory of Colours* (1810) (Cambridge MA: The MIT Press, 1970).
26 H. Conrad-Martius, "Realontologie," *Jahrbüch für Philosophie und phänomenologische Forschung* 6 (1923): 159-333; H. Conrad-Martius, "Farben. Ein Kapitel aus der Realontologie," *Festschrift Edmund Husserl zum 70. Geburstag gewidmet* (*Jahrbüch für Philosophie und phänomenologische Forschung*) 10 (1929): 339-370.
27 H. Sedlmayr, *La luce nelle sue manifestazioni artistiche*, ed. A. Pinotti (Palermo: Aesthetica, 2009).
28 J. Turrell, *Extraordinary Ideas-Realized* (Berlin: Hatje Cantz Verlag, 2018). See also M. Govan, C.Y. Kim, eds., *James Turrell: A Retrospective* (Los Angeles: Los Angeles County Museum of Art, 2013).

(the type of light source and its temperature, the shape and position of the light sources, the relationship between light and darkness, background and foreground, etc.), but in a theoretical sense, the exercise aimed above all to demonstrate the potential applications of a complex theoretical framework like the one mentioned above.

Finally, the discussion turned to the phenomenological theme of atmospheres, a field that, as already noted, could only appear last, once the basic elements for an analytic understanding of the body-space relationship had been acquired. With few exceptions, "atmosphere" is a concept used in a very intuitive way by architects, yet is central to their specific form of spatial intelligence. It is here that VR perhaps offers its greatest contribution: it is one thing to introduce students to the thought of the usual authors on the subject, such as Böhme,[29] Norberg-Schulz,[30] Schmitz,[31] Ströker[32] or Zumthor,[33] and quite another for them to have the chance to analyze atmospheres from within, to study their perceptual effects, and to modify their factors in the desired (often experimental) way. Describing the extraordinary power of atmospheres to influence our mood is much simpler and more effective when one has the possibility of interacting with a virtual environment. From within these environments, variation in light can be understood atmospherically in all of its significance. The capacity to design an/the entrance as a tool to understand, expand, or focus an encounter with a given atmosphere can be carried out in all possible ways, giving life to the theoretical hypotheses learned through the creativity of the designed. The symbolic and potential connotations of an atmosphere—which are often an involuntary outcome, but

29 G. Böhme, "Atmosphere as the subject matter of architecture," in P. Ursprung, ed., *Herzog and de Meuron: Natural History* (Montreal: Lars Müller and Canadian Centre for Architecture, 2002) and *Atmosfere, estasi, messe in scena. L'estetica come teoria generale della percezione*, trans. T. Griffero (Milano: Christian Marinotti, 2010).
30 C. Norberg-Schulz, Genius Loci: *Towards a Phenomenology of Architecture* (New York: Rizzoli, 1991).
31 H. Schmitz, "Atmosphärische Räume," in *Atmosphäre(n) II. Interdisziplinäre Annäherungen an einen unscharfen Begriff* (München: Kopaed, 2012).
32 E. Ströker, *Investigations in Philosophy of Space* (Athens: Ohio University Press, 1987).
33 P. Zumthor, *Atmospheres: Architectural Environments, Surrounding Objects* (Basel: Birkhäuser Verlag, 2006).

nonetheless entirely controllable, through the composition and interaction of the conditions present in a given space, and at times even a result produced by a "heterogenesis of ends"—can finally become the objects of direct experience, which would otherwise be impossible. I think these examples are sufficient to illustrate a field of research that goes far beyond virtual reality's capacity to change one floor into another, in order to find which one best suit the environment.

For architectural professionals, though, this aspect should truly not be underestimated. VR offers them a precious medium of communication with their clients, who often lack the ability to imagine the design solutions being proposed, or to read plans and "visualize" them in three dimensions. But even if bridging the gap between the spatial competencies of architect and client may sooner or later prove to be the main use of virtual reality, it is not, however, the most important for, nor does it lie within the specific aims of the course.

Expected outcomes:

- Experimenting with environmental effects of lighting.
- Experimenting with the semiotic and Gestaltic use of light.
- Testing the atmospheric effects relating to light and color.

Exercise

A) Use artificial light to strengthen the synesthetic connotations of the environment in an atmospheric way.

B) Use light to unify a part of the space and the objects within it.

C) Use light to generate a threshold.

D) Generate variations in the temperature, intensity, and type of artificial light, and observe how the colors of surfaces and the texture of materials change.

E) Analyze how the spaces change under the different variations of artificial light.

F) Modify the color of the materials through the effects of variations of artificial light.

G) Using a narrative strategy, make an atmospheric film of 30 seconds that shows how the spaces are modified by different types of artificial light. If necessary, you can animate the space with the movement of a virtual character.

UNIT 5 - Orientation and legibility of space

The final didactic unit dealt with the theme of spatial orientation on the basis of the line of research opened up by the work of Kevin Lynch.[34] At the basis of this choice are two assumptions. The first is that Lynch has given us a scalable methodology, which can also be effective when applied to interior spaces. The second is

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34 K. Lynch, *The Image of the City* (Cambridge MA: The MIT Press, 1960). See also L. Letenyei, J. Dobák, eds., *Mental Mapping* (Passau: Schenk Verlag, 2019).

that such a methodology, based on psychology of shapes and on a study of mental maps that we might say are akin to phenomenology, places itself in continuity or in dialogue with the content already explored in the preceding units of the course. The formation of mental maps takes place in the interaction between subject and environment. On a cognitive level, for Lynch the maps reveal the constant presence of five elements, which we can also define as structures, in the sense that they structure the experience of (urban) space by connecting it back to a universal mental schema. Such irreducible elements, even if they are not necessarily always co-present, are the path, the edge, the district, the node, and the landmark. A space's degree of comprehensibility, or rather our own capacity to orient ourselves in space and to have a clear mental image of it, depends on the form, character, and composition of these structures. The capacity of design to give spaces identity, structure, figurability, and meaning is fundamental in fostering a positive interaction between subject and environment, or even to induce emotional well-being. This gives us the capacity to anticipate how space will be understood, to support our spatial awareness (and hence our confidence in the space), and to develop a positive identification with spaces.

All of this holds for any interior space, even if it is clearest on a large scale (for example that of a museum).

Each interior indeed presents us with paths, both introverted and extroverted nodes, helpful or disorienting edges (like walls, partitions, or anything that divides space), landmarks (prominent aesthetic elements), and even districts, since the term designates first and foremost for Lynch whatever distinguishes the characteristic atmosphere of a place.

To demonstrate and test this hypothesis, the students had to empty out the spaces they had created up to this point, multiply them by four, and connect them in a freely-chosen sequence. Using only the spatial language of the five fundamental elements and working in syntony with the principles of the psychology of shapes that make space recognizable and possible to remember (uniqueness,

formal simplicity, continuity, preeminence, clarity of connection, directional differentiation, visual field, awareness of movement, rhythm) the students were asked to give their design a high cognitive value for the users. In order to test the result obtained, each student visited the design created by the others in virtual reality, and at the end of the visit drew a mental map for each.

The study of the maps, finally, allowed several problems linked to the understanding of space to be brought into the discussion: errors in the reconstruction of the shape of the space, missing places, unclear dimensions and hierarchies, and incongruencies and hesitations of various types. The critical evaluation of the most problematic spaces (and, on the other hand, of those that almost always elicited a clear representation) allowed the students to rethink their design, seeking effective solutions. VR is a very useful tool for studying phenomena of orientation and environmental image. Its usage, however, can be extended to other psychological aspects related to the design of the environment, as for example to the concept of affordance, which in Gibson's language refers to the physical qualities of objects that suggest to a subject the appropriate actions for manipulating them.[35] The greater the affordance, the more the use of the tool becomes automatic and intuitive (a passage to cross, a door to open in a given direction, a switch to turn or press, etc.). Another possible use of a virtual space with "public" dimensions, like the one created in the last unit, is the study of the rules of proxemics.[36] This can be accomplished through the possibility of inserting a number of virtual people, who move according to established or casual paths, interacting in various ways, into the scene.

35 J.J. Gibson, *The Ecological Approach to Visual Perception* (1979) (New York: Psychology Press, 2015).
36 T.E. Hall, *The Hidden Dimension* (New York: Anchor Books, 1990).

Expected outcomes:

■ Experimenting with the principles of Lynch's theory from the perspective of design and develop a sensitivity to the cognitive structure of space.

■ Learning the method of mental maps.

Exercise

A) Return to the basic space in its starting condition, taking away all of the elements aside from the openings (doors and windows). Multiply the space you created before by four times. Then generate a sequence of twelve connected environments.

Four spatial elements must be present in the design: pathways, edges, introverted nodes, extroverted nodes, and landmarks. Design the entrance and exit of the building. The goal is to create a fluid and figurable space. To achieve this goal, plasterboard walls can be taken away or added (also to change the shape of the space); or you can redesign them in such a way as to weaking or strengthen the frame (the edges) to create visual and auditory connections, light effects, or transparencies.

Each room can have a landmark (painting, statue, mirror, geometric volumes).

In order to orient the user on the path and to support the figurability of the space you can use: colors, materials, lights, sounds, and frames.

You may not, however, use symbols or signs.

B) Make a film of the space.

C) Once it has been designed, the space will be visited by other groups for a set period of time. These visitors will then be asked to draw a map of the space as they remember it. On the basis of these mental maps, try to understand the strong and weak points of the designed space through a synthetic map.

The project will be evaluated in respect to the following categories: uniqueness/originality, formal simplicity,

hierarchical continuity, clarity of connections, directional differentiation, scope of vision, awareness of movement.

The maps will be collectively discussed. We will try to understand why certain spatial elements were forgotten, misunderstood, and memorized with difficulty.

D) Change the space in order to modify it on the basis of the suggestions that emerged from the discussion.

Technical specifications

There are dozens of 3D and VR software programs specialized in various types of applications. The criteria that guided our choice were the following: possibly free software, so that the students could continue to use it as professionals, simplicity of the interface and usage, simplified workflow, and the capacity to model in 3D and have VR visualization and navigation functions.

Based on these criteria, we chose Twinmotion (https://www.unrealengine.com/en-US/twinmotion), a software specifically designed for architecture and interior architecture based on the Unreal motor; the VR experience is native "out-of-the box," with features allowing for the real-time modifications of materials, time of day, etc.
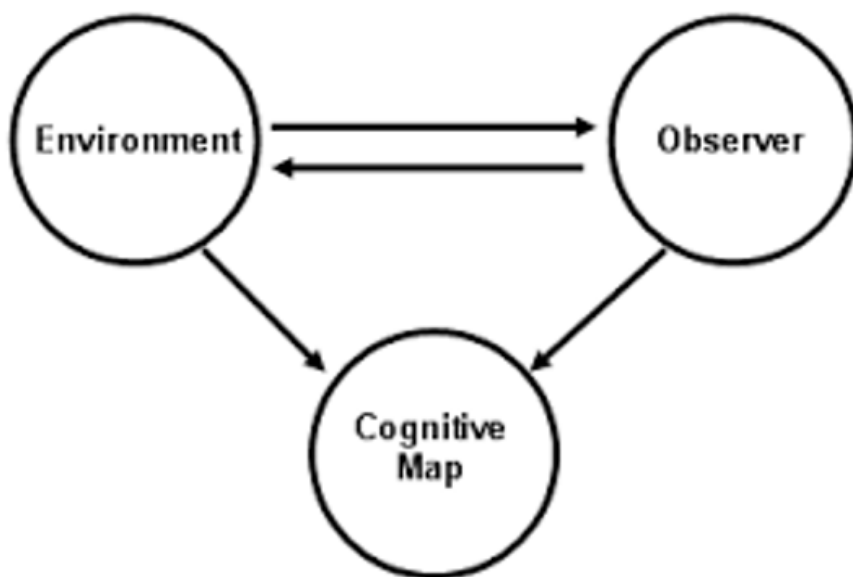
Fig. 6.

The interface is very simple, but on a deeper level allows for all of the necessary modifications of

parameters. It can also simulate sounds in the space when one moves through the VR scene.

Twinmotion has an internal library of 3D models (animated and otherwise) that can be added to the scene one is working on in a very intuitive way, but does not allow for the creation of new 3D models from within.

The solution to this problem was to use the Twinmotion plugin, which allows for the importation from various 3D modelling programs such as Rhinoceros, ArchiCAD, or 3DS Max, of 3D objects with a simple transfer.

This solution was ideal insofar as the students were able to use ArchiCAD for 3D modeling and then to synchronize it with Twinmotion for VR and rendering.

Also, the main design remained in ArchiCAD, where various sections and plans were designed as usual.

The VR viewer market has developed in interesting ways in the past few years, moving from solutions with fixed stations (with the viewer connected to the computer by cable and external sensors to map the area of the game) to mobile ones, with integrated sensors that function independently, without a cable and the need for an external computer to function.

The main need of the project was to have a quick working process with the fewest possible number of intermediate steps. The product chose was the Oculus Quest 2 (https://www.oculus.com/quest-2), a "standalone" viewer with an integrated graphics processor, which can also function as an external viewer for a computer when connected via cable. The price and the image quality were important factors in the final selection.

The possibility of using the students' own laptop computers was quickly rejected, due to the issue of the computing power of graphics cards, different operating systems, and the installation of necessary programs that use a large amount of disc space (at least 30 GB).

To solve these problems, Windows laptops with the latest video cards (Nvidia RTX 3070), with all of the necessary programs installed (ArchiCAD, Oculus, Twinmotion) were acquired.

Discussion and recommendations

The structure of the course proved to be effective and engaging, and gained very positive evaluations from the students, confirming in its own way the positive effects on VR learning already cited.[37] The strongest point was the integration of theory and practice, two dimensions that normally are clearly separated and, despite good intentions, mutually indifferent.

This also signaled a danger and a difficulty: unfortunately, the results of the course could not be measured by looking at the end outcomes —as would take place in a design workshop— because the design, in our case, was the means and not the end.

Furthermore, some of the starting conditions (for example, the position of the door-openings) can seem absurd from an architectural point of view, and are incomprehensible if one is not aware of the specific educational goals of the course.

The attention dedicated by the students to certain environmental, spatial, compositional, formal, perceptual, and atmospheric factors definitely produced surprising results, which were also appreciated by our architect colleagues, but in order to avoid misunderstandings it was always necessary to strongly reiterate the theoretical/philosophical specificity of the course and its objectives. From this point of view, even the spaces that were seemingly less successful from an architectural standpoint could have a positive significance in regard to what interested us: the essential was not in fact in the results in themselves, but in the process that led to them, in the experimental intentions of those who made them, and in the documentary traces that recorded and commented on the experience on a theoretical and critical level. The essential, in short, was the degree of awareness developed by students in each phase of the course and their level of understanding

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37 F. Kharvari, L.E. Kaiser, "Impact of extended reality on architectural education and the design process."

regarding the ways in which certain spatial factors impact our relationship with space on conscious and unconscious, and cognitive and perceptual levels.

However, in view of the Academic Year 2022-2023, in order to better distinguish the intentions of the course from those of the project work, we decided to modify the course.

In particular, we have attempted to simplify the exercises and standardise them so that the results are comparable. In addition, we placed emphasis on experimenting with spatial variants of an element (e.g. the threshold/door) to allow students to test the most significant perceptual changes between the choices made. Finally, we required the students to present the experiments they had tried, a selection of the most interesting results, and written descriptions of their experiences in a common layout. Redefined in these terms, the first point of the new exercise relating to the first unit asks the students to place a gap-threshold in the starting space, to experiment with different solutions capable of generating a meaningful spatial experience; to describe in writing the criterion used, the most paradigmatic solutions, and the quality of space determined by these solutions. The same method, based on the study of variations, was applied to the composition of the rooms, the shape of the threshold/windows, the position of the sculpture, etc. Overall, the course has become much more analytical than before, and somewhat more phenomenological.
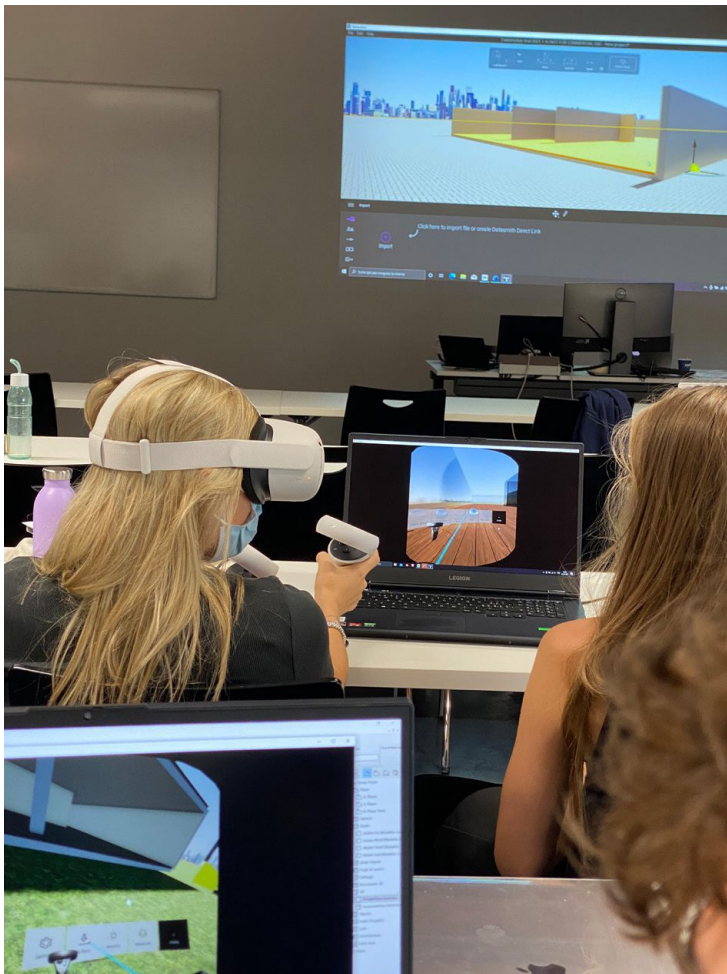
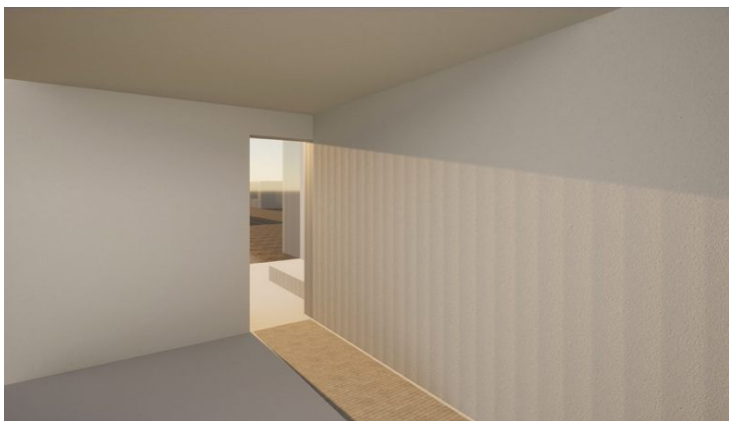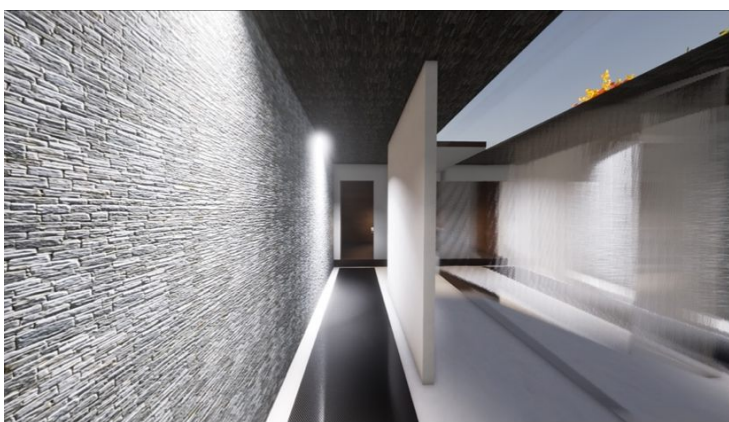Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Figg. 9-12. Four pictures related to the exercise on the thresholds: projects of Elmira Rabbani and Gabriele Luciani, Giada Pettenati and Michelle Rosato, Giorgio Ghielmetti e Mattia Buttinoni. Bachelor of Interior Architecture, SUPSI, DACD.
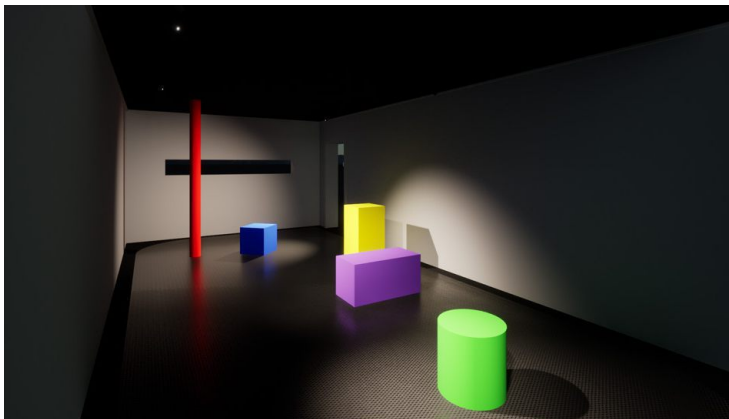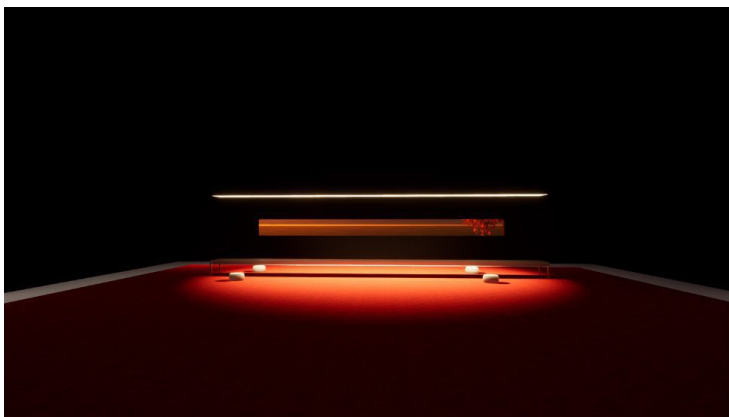
Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Figg. 13-16: Four pictures related to the exercise on light and colour. Projects of Sandra Burn and Asia Camoia, Elmira Rabbani and Gabriele Luciani, Jessica Corti and Silvia Zehnder. Bachelor of Interior Architecture, SUPSI, DACD.

spazio analizzato: 3 x 4.5 x 2.5m

Dal momento che il nostro parallelepipedo è di base rettangolare abbiamo iniziato ad analizzare le sperimentazioni in cuiNun varco viene posto sulla facciata più lunga, ossia 4,5 m. Abbiamo sperimentato varie possibilità di soglie utilizzando i seguenti criteri: locazione, altezza e larghezza. Inizialmente abbiamo posto la soglia al centro della facciata e abbiamo osservato come variava la percezione cambiando l'altezza (1.60m, 2.10m, 2.50m) del varco e in seguito cambiando la larghezza (0.50m, 0.70m, 1m, 1.50m, 2m, 2.50m). Successivamente abbiamo decentrato la soglia, ed infine abbiamo fatto lo stesso procedimento anche per la facciata più corta, ossia 3m. Dopo aver sviluppato queste svariate possibilità ne abbiamo selezionate alcune che secondo noi sono più significative:

1.1:
- Apertura minima
- Si fa quasi fatica a passare
- Non si è invogliati a varcare la soglia
- Luogo molto riservato
1.2:
- Le senzazioni elencate precedentemente vengono accentuate decentrando la soglia
1.3
- Forte collegamento interno-esterno
- Luogo arioso
1.4:
- Le senzazioni elencate precedentemente diminuiscono decentrando la soglia
V1.5:
- Sorge la domanda se si tratta ancora di una soglia
1.7:
- Non è vivibile
- Quasi non ci si rende conto che si tratta di una vera e propria soglia
1.8:
- Altezza standard
- In correlazione con i cambiamenti di larghezza sperimentati non influisce granché
1.9:
- Direzionalità: dona verticalità allo spazio

Zoe Togni e Silvia Pedeferri   Fig. 17.

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spazio analizzato: 3 x 4.5 x 2.5m

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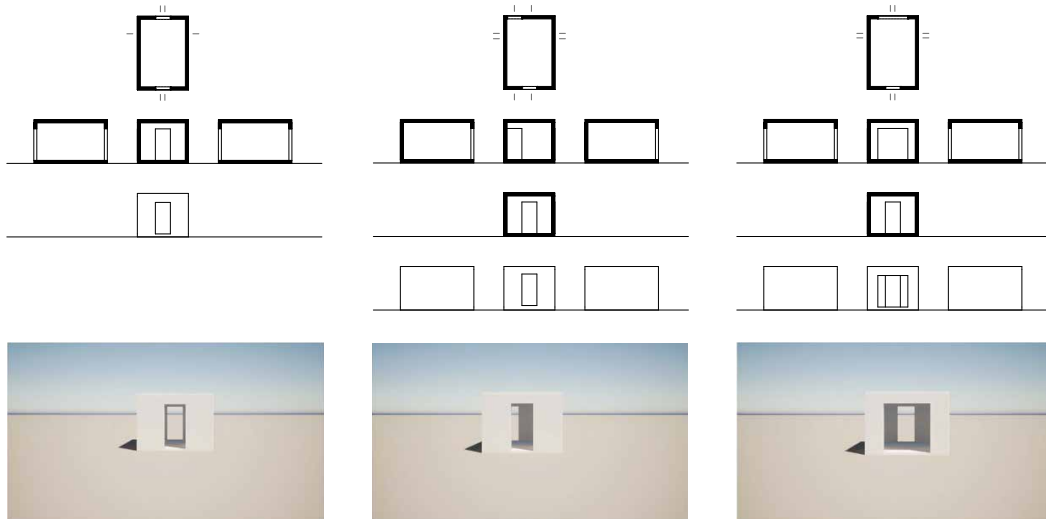

Zoe Togni e Silvia Pedeferri   Fig. 18.

Figg. 17-18. Examples of the layout used in the course 2022-2023 (first point of the Unit 1 exercise). Students: Zoe Togni and Silvia Pedeferri.

obiettivi | Il nostro obiettivo è di creare un'atmosfera che metta in contrapposizione una sensazione di apertura e leggerezza con una sensazione di chiusura e pesantezza, tramite l'utilizzo di texture, coliri e materiali che possano aiutare ad enfatizzare tali emozioni.

scelte | Ci siamo focalizzate principalmente sull'utilizzo di un materiale base, quale il calcestruzzo, che abbiamo adoperato in primo luogo, su tutti i pavimenti, e successivamente sule pareti tre stanze.
La prima stanza è caratterizzata da un pavimento chiaro, con tonalità azzurrastre e pareti in alluminio riflettente per creare un effetto sinestetico che ricordasse il freddo e la leggerezza, qualità innate del metallo.
La seconda stanza, invece, è valorizzata da una colorazione, sempre sulle tonalità dell'azzurro, ma più calde, con tutte le pareti in clacestruzzo, ma questa volta laccate, in modo da dare ancora l'effetto della leggerezza e del freddo, ma creando un climax con la prima stanza.
La terza stanza, caratterizzata da pareti in calcestruzzo grezzo, invece, ha come colorazioni un grigio scuro, che introducono un effetto sinestetico di pesantezza ed oppressione.
L'ultima stanza, invece, è caratterizzata da un pavimento blu scuro, notte, e da pareti e soffitto rivestite da pietra nera.
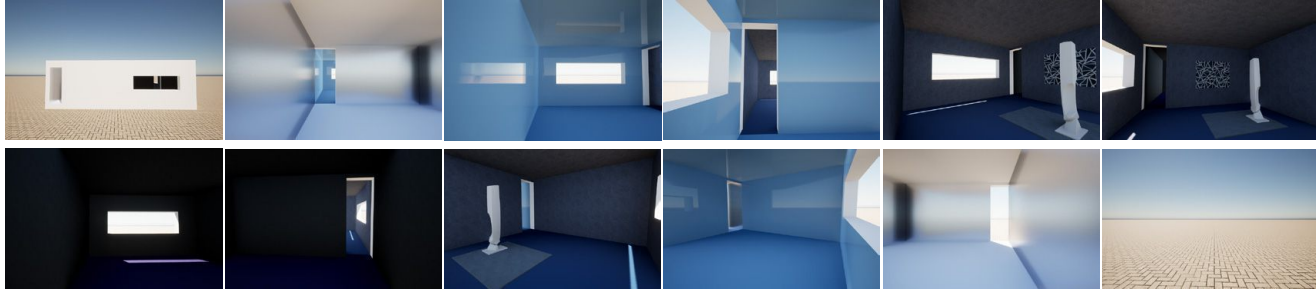
riscontri | Attraverso l'utilizzo del visore abbiamo constatato come le le nostre iniziali ipotesi non fossero del tutto errate.
Nella prima stanza, ci si trova in uno spazio freddo, quasi fantascientifico e irreale, ma a differenza di come pensavamo, si ha una sensazione di maggiore chiusura rispetto alla seconda stanza.
Proseguendo la stanza successiva ci trasporta in una relatà anch'essa fredda, nella quale si crea un gioco di colori che nasconde il fatto che sia stato utilizzato lo stesso colore su tutte le pareti.
La terza stanza è particolarmente tangibile e concreta. Crea un netto contrasto con la stanza precedente, trasportandoci in un'atmosfera pesante e reale. La sensazione che si prova è quasi di calma e tranquillità.
Il contrasto con le due stanze precedente viene inoltre accentutato dall'ultima stanza che è buia, opprimente e quasi soffocante, da non riuscire a stare al suo interno per troppo tempo.

Anna Bolla e Camilla Tosi

Fig. 19.

Fig. 19. Examples of the layout used in the course 2022-2023 (Unit 3, synoptic view of tested variants). Students: Anna Bolla e Camilla Tosi.

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