

Ghost in the Machine: Daily Interaction with Ephemeral Computing

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Abstract

The aim of this paper is to examine the phenomenon of the progressive spectralisation of the physical world, which involves a growing habit of contactless interaction. Indeed, the computerisation of domestic and social environments is almost complete. To realise this project of ubiquitous “spatial computing”, technology companies are converging on the development of wearable tools, mostly augmented reality (AR) glasses. While wearing them, users manipulate responsive but intangible objects that they “evoke” and that can appear ghostly from a distance. The interactive images of smart glasses are not concrete: they are digital entities that appear on the user’s lenses and respond to their voice commands and movements thanks to pattern recognition algorithms. Characterised by an unprecedented level of responsiveness, AR is a form of “total cinema” made up of 3D images that inhabit physical contexts. I will therefore refer to AR as a contemporary example of a portable phantasmagoric dispositif, a technology that involves the coexistence of people and images in the same space in real time. Finally, I will argue that, while the physical dimension is undergoing a progressive “ghostification”, it is not being replaced: in order to function, wearable technologies must be innervated in a human body, integrating eyes, hands, feet and emitted sounds as essential components for their operation. The current trend in technology, then, is to replace the touch revolution with a deeper performative turn that involves the user from head to toe.

Keywords: phantasmagoria; spatial computing; augmented reality; cinematic ghosts; bioaesthetics.

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1 Ghostly Technologies

At what point in history did ghosts first appear? Susan Owens has found written documentary evidence illustrating their occurrence dating back to the eighth century (2019: 9); Tom Gunning recalls the case of Emperor Charles IV, who lived between 1316 and 1368 and who claimed that one terrifying night he heard over and over again a phantom prowling about his castle (2007: 102). However, if by ghosts we mean something that oscillates between “visibility and invisibility, presence and absence, materiality and immateriality, often using transparency or some other manipulation of visual appearance to express this paradoxical ontological status” (ibid.: 99), then it is likely that they have always been with us: they are at least as old as ombromanie, the pre-cinematic art of projecting hand shadows onto a flat surface, which is widespread in different cultures and for which all we need is a source of light and the body we are endowed with. In short, ghosts originate with the production of moving images, starting with the shadows that necessarily follow us, and therefore haunt us, to tell us a story.¹

It is not surprising that the obsession with the appearance of ephemeral creatures has grown in relatively recent times, precisely because of the development and diversification of tools for producing moving images. Walter Benjamin’s observation that “The world dominated by its phantasmagorias [...] is ‘modernity’” (Benjamin 2002: 26) remains apt. Phantasmagorias spread almost simultaneously with the French Revolution, which is conventionally regarded as the key event in the birth of the contemporary era. Although the physicist Christiaan Huygens was the first to use convex lenses and a lamp to project images of skeletons for personal entertainment in around 1659 (Hankins and Silverman: 44), it was another physicist, Étienne-Gaspard Robert, also known as Robertson, who developed a veritable horror show. Robertson’s phantasmagoria, patented in 1799, consisted of a mode of staging the supernatural that was hyper-technological for its time (Gunning 2019: 49). Indeed, his device gave the audience the impression of being in the presence of ghosts capable of movement (Carels 2006): it consisted of a magic lantern on wheels, which ran on rails concealed by a screen invisible to the audience, in total darkness. In this way, the frightening apparitions seemed to be attacking the spectators, who yielded to the impulse of reacting accordingly (Grossi 2021: 29). Robespierre, Marat and Danton were among the characters who appeared on stage (ibid: 30), demonstrating that the link between phantasmagorias and the Revolution (and politics in general) is by no means accidental. In *The Communist Manifesto* (1848), Marx and Engels too chose to describe communism as a spectre haunting Europe, perhaps wishing for their political project the same fate as the occult phenomena at the time: in the mid-nineteenth century, ghosts were more or less everywhere, in theatres, in the latest research of scientists, and certainly in private living rooms, where they proved to be the undisputed protagonists of a “self-managed domestic liturgy” (Cigliana 2018: 25).²

Benjamin’s proposition has proved particularly powerful and far-seeing over time. Most contemporary technologies seem to have been invented to allow contact with the supernatural, even when they are not true phantasmagorias: pre-cinema is a hotbed of ghosts and apparitions; cinema itself can be considered a “machine à fantômes” (Berton 2021: 182), which, not coincidentally, counts the famous magician Georges Méliès among its early enthusiasts (Bazin 2002). The same can be said of photography, which was already widely used in the late nineteenth century to produce strikingly realistic portraits with the deceased (Natale 2016: 135-169), in which one could experience, for the last time and forever, the joy of sharing one’s own space with that of the dearly departed. Wireless technologies have then certainly heightened the sense of dealing with supernatural entities inhabiting the machine: think of the telegraph, the radio, the telephone, the television, and then the Internet, “haunted” technologies that have literally filled human spaces with sounds and images from another space, from somewhere beyond (Sconce 2000). Even today, technologies’ ghostly and more broadly supernatural character is a classic theme central to media archaeology (Andriopoulos 2013) and screen studies (Ng 2021).

As a result of the ubiquitous presence of audiovisual interfaces embedded in most human activities, the phantasmagoria in particular should no longer be considered as a specific, occult, and historically situated phenomenon. Indeed, Benjamin refers to it as the general mode of experience of industrial capitalism, when the

1. On the relationship between cinema and gesture, see Grespi 2017.

2. Translation by the author.

whole city becomes a phantasmagoria that enchants and seduces, as the chimaeras of commodities materialise within it (Marchesoni 2018: 56-57). Therefore, one can speak of a broader “phantasmagoric dispositif” that encompasses all those technologies determining the encounter of human beings and images in the same space in real time (Elcott 2016). In this sense, such a dispositif includes ombromanie, the nineteenth-century phantasmagoria, and 3D cinema. And more. We are surrounded by digital ghosts, even at present, most of them are not intended to frighten us: many of today’s cinematic ghosts have abandoned their scary character while retaining a distinct phantasmagorical quality.

This last point is not without importance. As we shall see, the consequences of the proliferation of cinematic ghosts are still relevant, both aesthetically and politically, for at least two basic reasons. Firstly, phantasmagoric devices have begun encroaching upon the daily lives of many of the world’s population, maintaining a stable foothold in living rooms and, more generally, in private spaces, at home and at work. Secondly, interaction with these devices, primarily when mediated by digital, portable and/or wearable technologies, consistently stimulates users’ bodily movements and, ultimately, their behaviour. I will therefore examine the case of one technology, augmented reality, which I consider to be paradigmatic in this phenomenon.

2 Digital Phantasmagorias

In 2017, like an echo of the apparitions that entertained audiences in post-revolutionary France, the hologram double of Jean-Luc Mélenchon appeared in Paris when the French politician, in the flesh, was addressing a rally in Lyon.³ Like him, many other celebrities are taking to the stage without actually stepping onto it, thanks to sophisticated projection forms (Cross 2022). Holographic fans, capable of producing ephemeral moving images thanks to rotating LED blades, and anamorphic screens, both widely used in advertising, transmit images that seem to break through the frame to enter our world (Pirandello 2023).

There are also augmented reality (AR) entities among the many digital ghosts currently in circulation. Initially developed in 1992 to assist aircraft assembly technicians in their work, AR was designed to enlarge the amount of information and objects available in an environment while reducing the time and effort required to find them (Caudell and Mizell 1992). Digital augmentation thus involves increasing the operational possibilities within a physical space (Wellner et al. 1993). Initially conceived as wearable technology, AR is now available through smart headsets and glasses and is also widely accessible via portable solutions such as smartphones and tablets. AR entities therefore range from a list of instructions to the avatar of a distant but real person to the fictional characters of a video game. Digital additions can be static or moving images, sounds, written text, or all of these, appearing on the surface of the lenses or screen of the device, and designed to be integrated with physical objects in the framed space. We can say that AR finds its place in the realm of “haunted” technologies, capable of making present what is not there.

Albeit with varying degrees of interactivity depending on the case in question, AR interfaces assume the guise of an autonomous other that engages with us. Sometimes, they take the form a veritable 4.0 phantasmagoria in which we are invited to participate. This is the case, for example, with *Noire. La storia sconosciuta di Claudette Colvin* (*Noire. The Unknown Story of Claudette Colvin*, 2023), a thirty-minute augmented reality installation directed by Stéphane Foenkinos and Pierre-Alain Giraud.⁴ An experience at the intersection of art exhibition, cinema and storytelling, *Noire* tells the story, set in 1950s Alabama, of a 15-year-old black girl, Claudette Colvin, who refused to give up her seat on a bus to a white passenger and was arrested. When I took part in the experience installed at the MEET Centre in Milan (2 February-10 March 2024), visitors entered the room, ten at a time, equipped with Microsoft HoloLens 2 AR glasses that allowed them to follow the story alongside Claudette and the other characters, who appeared as flickering spectres alongside them (fig. 1). The environment, a 250 square-meter set with furniture and props (fig. 2), let users sit next to the girl on the bus where it all began, look into her eyes as she is taken away, keep her company as she is locked behind bars, and watch part of the trial that followed.

3. <https://www.youtube.com/watch?v=EyB-NHspN-E> (last accessed 15-06-2025).

4. <https://www.youtube.com/watch?v=dSgmAzC8L-E> (last accessed 15-06-2025).

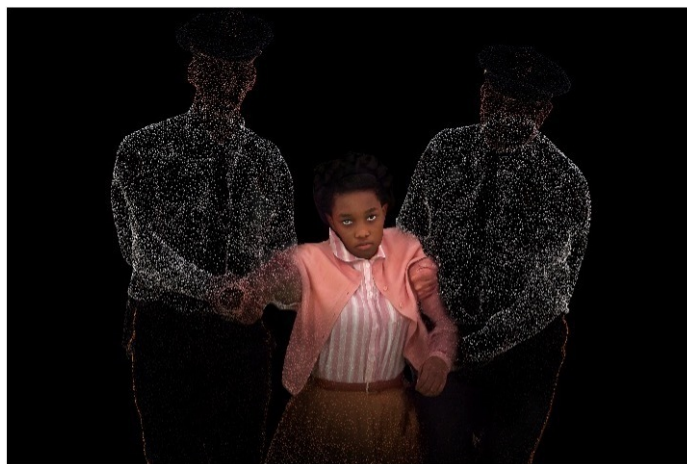


Fig.1 – Noire. La storia sconosciuta di Claudette Colvin ©Courtesy of MEET Digital Culture Center, Milano.



Fig.2 – Noire. La storia sconosciuta di Claudette Colvin ©Courtesy of MEET Digital Culture Center, Milano.

As early as 1944, René Barjavel noted that the ultimate goal cinema has always sought to reach is the possibility of escaping the two-dimensionality of film to gain freedom of movement and, ultimately, to produce what he calls “virtual” images (1944: 59) which can materialise without a screen, or at least thanks to an invisible one. The phantasmagoric three-dimensional image is thus both the origin and the destiny of cinema. As Barjavel himself adds, cinema will truly fulfill its role when it transforms solid reality into fleeting phantoms, when it makes the products of the imagination take shape before our eyes, drawing the spectator into the scene and inviting them to start exploring (ibid: 60). Indeed, one of the defining aspects of the phantasmagoric *dispositif* in general is the performativity it imposes on those who participate in it: people who attended Robertson’s shows knew perfectly well that the images before them were not supernatural emanations, yet they reacted by gasping, screaming, shielding their eyes, in the same way that today’s viewers of a 3D film or *Noire* respond physically to what they see.

In this sense, AR entities can be considered a kind of expanded cinema, of total cinema (according to the French author, perhaps even of ultimate cinema). Certainly, *Noire*, which was awarded “Best Immersive Work” at the 2024 Cannes Film Festival, can be considered a prime example of the staging of the contemporary phantasmagoric *dispositif*: stripped of the earlier horror-like aspects, those of *Noire* are images with which we share an environment, in real time.

Although it is close to other forms of phantasmagoria, AR has some specific features that make it particularly interesting for the present. Firstly, as the case of *Noire* shows very clearly, it is a portable/wearable phantasmagoria that can be activated all around users, rather than just in front of them.

On the other hand, it can be turned on practically anywhere, especially in its simpler versions, which do not require complex scaffolding, such as the one created for the experience dedicated to Claudette Colvin: for instance, the objective of the multi-user AR video game *Pokémon Go* is to locate and capture as many Pokémon as possible, with which one can compete in individual or team battles, geolocated around the world and visible thanks to the mobile phone camera. The smartphone screen, although not hidden by the darkness, like that of the eighteenth century, is still presented as a transparent surface which reveals Pokémon in the surroundings. Indeed, this type of game integrates the concrete world into its narrative, altering the meanings and functions of specific places, which leads players to modify their behaviour in urban spaces, occasionally resulting in consequences that impact the experience of non-players (as when they become caught up in traffic accidents caused by people who are busy capturing a Pokémon in the middle of the road) (Liberati 2018: 227). Finally, in most cases, these are phantasmagorias capable of “haunting” those who participate in them. Art in general and cinema in particular are not the only targets of this technology, nor perhaps the most sought after. Augmented reality, through smart glasses or mobile technologies, is now being used in the army to protect soldiers and increase their killing power; in hospitals to plan complex operations; in factories for inspection tasks and on assembly lines; in many everyday activities, such as playing games or trying out products before buying them and experimenting with augmented filters. AR transforms all these experiences into activities involving moving images, in this sense, everyday phantasmagorias. However, in most cases, we are not simply asked to watch a show. Now, what is the fundamental function of phantasmagoria in augmented reality? What role does the user play within this context?

3 The Virtual as a Ghost

Convinced that the human body is made up of a series of “layers of ghost-like images”, the author Honoré de Balzac refrained from being photographed due to his firm belief that each photograph would result in the loss of some of these layers, along with the “very essence of life” (Gunning 2007: 110).

Although based on an irrational belief, Balzac’s idea highlights the intersection of ghostly presences, the human body, and technology, which existed long before the advent of digital devices. In this respect, Arnold Gehlen wrote that every movement we make “is carried out in an aura of expectations; it is enveloped in images of its execution and the expected result”, which he called motor phantasms⁵ or “virtual movements” (Gehlen 1988: 170-171). Essentially, it is an intuition of what is perceived as potentially present in the environment.

5. The expression, which does not appear in the English translation, is present in the original German text.

The virtual, not to be confused with the digital, constitutes the everyday fabric of experience, the set of its affordances (Cavaletti 2022: 252-253), “vital expressions” bodily synthesised in our “gestural forms” (Grespi 2017: 64). The human body, and the hand in particular, performs dynamic “imagistic gestures”, a veritable process of reasoning in action, by which one remembers, interprets and plans at the same time (Grespi 2019: 350). There has always been a phantasmal element in our experience of the world, something that is there and cannot be seen, a virtuality that we explore every day with our gestures.

Technologies producing digital phantasmagorias focus precisely on these movements. AR is, in fact, part of the broader process of computerisation of domestic and social environments (now almost complete), which consists of increasing the operational possibilities of a physical space by empowering the human individual. To fulfil this project of ubiquitous “spatial computing”, most technology companies are concentrating on the development of wearable tools, such as the aforementioned Microsoft HoloLens 2 or the more recent Frame by Brilliant Labs; some others, such as Apple, are even experimenting with furnishing accessories which can project responsive digital ghosts into our homes (Verplaetse et al. 2023). In any case, the common goal is to design devices that allow the so-called “naturalisation” of the technological experience: that is, they must provide an interface with which we can interact by sight, voice and gesture, as we would with any concrete object in the world (Williams et al. 2020).

Therefore, although the physical dimension is undergoing a progressive “ghostification” (Conte 2023: 280), it is not being replaced. Indeed, users’ bodily interaction is indispensable for the digital phantasmagoria to take place. By taking advantage of the algorithmic gesture-tracking systems embedded in the devices,⁶ AR converts the imagistic gestures with which we usually limit ourselves to reasoning about reality into more tangible operational actions. For instance, consider a visor such as HoloLens 2: to operate effectively, the device must be installed on the users’ head and follow their movements accordingly. The left hand, including the inside of the wrist, must be raised in front of the face to bring up the home screen, which then literally appears in the user’s space. To click on applications, you have to mimic the gesture you would make if you were actually touching something with your fingers. In some cases, it is as simple as shifting your gaze or uttering a few voice commands.

For this reason, when talking about ghosts in relation to phantasmagoria in AR, the term refers to two different elements. On the one hand, it indicates the entities in AR themselves, which belong to the realm of cinematic phantoms, “quasi-living” interfaces (Cimatti and Maiello 2024), which do not really allow themselves to be grasped, which can be seen but are paradoxically present while being absent. On the other hand, it describes the gestures we make to interact with them: for the machine to respond to us, it must be able to detect and follow the human body’s movements. The phantasmal traces of the user’s gestures are then carefully archived to improve the devices’ future interface, promoting the smoothest possible continuity between the human and the machine body.⁷ AR functioning is therefore linked to a “ghost”, also in the sense of something discarded and removed, as the “other” that is present in the peculiar mode of lack (Derrida 1994: XVIII). Indeed, augmented ghosts can engage with us satisfactorily by working on a highly stratified sample of data, the entirety of which constitutes a space of latency (Somaini 2023: 93), a corpus of visual and cultural debris from which they draw to evoke synthesised patterns inherent to the very corpus from which they originate. Each of them thus constitutes the enactment of the loss of something that in its entirety we could never possess anyway, as Giorgio Agamben wrote referring to the loss of a beloved object (Agamben 1993: 20); an encounter with the past, reminiscent of that prefigured by Benjamin in his *Theses on the Philosophy of History* (Montani 2014: 61).

AR ghosts thus realize that peculiar “visor effect” (Derrida 1994: 6) addressed by Jacques Derrida, whereby the spectre observes invisibly, it is what observes us “even before and beyond any look on our part” (ibid: 6). AR ghosts carry a message (in this case, information and digital objects), but they also acquire one. They have been created with the explicit objective of revealing to the user certain potentialities of the environment that we typically explore independently. Simultaneously, they teach a new way of interacting with the environment,

6. For example, below are the technical datasheets of two of the most popular AR glasses: <https://www.microsoft.com/it-it/d/hololens-2/91pnzzznwcp?activetab=pivot:specificfichetecnichetab> (last accessed 15-06-2025); <https://www.apple.com/apple-vision-pro/specs/> (last accessed 15-06-2025).

7. For instance: <https://learn.microsoft.com/it-it/windows/mixed-reality/develop/unity/hand-eye-in-unity> (last accessed 15-06-2025).

often without physical contact. Once put on, indeed, the device guides the user through a training session in which objects appear in the user's field of vision and can be followed and manipulated with actions performed at a distance, either with the eyes, voice or hands, or by uttering certain verbal commands.

Although smart glasses are not yet widely used, partly due to their cost, they are already being employed for practical purposes: the US Army has signed multi-million dollar contracts with companies such as Microsoft and Red 6 AR for the supply of headsets specifically designed for the infantry and the air force;⁸ in Italy alone, since 2021, successful surgical procedures have been carried out with the help of smart glasses, which also allow different teams to work together at a distance.⁹ AR phantoms are already being used to train medical staff, allowing them to practise without the need for complex instruments or real patients.¹⁰

The reason they are so highly valued in such diverse contexts is that they fit into the physical exchanges that humans engage in with the world, reorienting, accelerating, and simplifying these interactions. They take advantage of the learning-by-doing method to increase the efficiency of their users, boosting their performance while saving time and money. Consequently, the effects of frequent use of phantom interfaces are increasingly evident, both psychologically and gesturally, with transformative effects on attention spans and the artistry of professionals such as surgeons: AR improves their efficiency to the extent that, in some cases, it can yield paradoxical outcomes, such as hindering the recognition of the unexpected (Dixon et al. 2013). From the famous experiments in chronophotography of Étienne-Jules Marey and Eadweard Muybridge to current visualisation techniques, examining the body has long been central to image technologies. It seems Balzac was right, considering that photography is at the heart of current tracking techniques. Moreover, many of the tools at our disposal today, even thermal cameras, work precisely by reducing bodies to their vital expression, reading them not as a group of individuals but as a mass of spectres, indistinct and anonymous (Donghi 2024: 82). AR participates fully in this history: by using AI algorithms to detect, understand and archive gestures, it assists in the construction of huge data archives, derived from the extraction of the motor ghosts of a population as extensive as that of its users.

4 Conclusion: The Spectral Turn

Digital ghosts no longer attack humans as they used to in the late eighteenth century: they have found a better way to capture them. They are not only haunted technologies; they are also haunting. Thanks to tools of this kind, a phenomenon of progressive spectralisation of the physical world is taking place, which is unfolding in two directions: on the one hand, towards the reification of the absent, since what cannot be close, because it is distant in space or time, appears in our surroundings with an ephemeral character, accessible for exchange; on the other hand, towards the dematerialisation of the animated or inanimate elements of the world, with which, as happens in ghost stories, we deal without physical immediacy. The much-discussed touch turn could thus expand into a deeper performative turn, algorithmically driven (and therefore spectral), in order to improve the efficiency of bodily thinking: it is enough for us to move for the machine to “see” us and begin to read our intentions, to put them into practice.

If ghosts remain so fascinating, it is because they engage us in an interplay that simulates peer interaction, capable of constructing specific bodily habits and simplifying gestures without recourse to bookish knowledge. In this sense, and in full accordance with Benjamin's insight, the political implications of the proliferation of phantasmagorical AR interfaces are best understood from a bioaesthetic perspective, since they are based on the analysis and storage of user behaviour and, ultimately, on the manipulation of human sensibility (Montani 2007).

8. News of these collaborations can be found on the official websites of the devices manufacturers: <https://news.microsoft.com/source/features/digital-transformation/u-s-army-to-use-hololens-technology-in-high-tech-headsets-for-soldiers/> (last accessed 15-06-2025); <https://red6ar.com/> (last accessed 15-06-2025).

9. As was the case with the software Artikor from the Italian startup Artiness.: <https://www.vodafone.it/nw/vodafone-italia/content/comunicati-stampa/2021/211108.html> (last accessed 15-06-2025).

10. The US company GigXR is already using digital ghosts to train medical professionals: <https://www.gigxr.com/> (last accessed 15-06-2025).

In the philosophical literature on ghosts, there is a tendency to distinguish between “simulacrum” and “spectre”, the former being what pretends to be something that does not actually exist, pure appearance, while the latter is conceived as the return of something that has been forgotten (Cigliana 2018: 37-38). The widespread use of technologies such as AR complicates this classical distinction. Indeed, AR ghosts are both: they are the plastic manifestation of the latest version of the commodity (the simulacrum *par excellence*, from Marx to Benjamin to Baudrillard), and *also* the condensed bodily thinking of users, synthesised into a series of ideal movements, of standard actions.

Augmented Reality (AR) technologies are not only ghostly in the sense that we suspect them of possessing an autonomous and artificial existence (Micali 2018: 212). Their interfaces serve as striking representations of something distant: the archive constituted by “layers of ghost-like movements” of users, we might say, who continue to haunt us in a machine-processed form.

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