Analyzing *the Mitchells vs. the Machines* (Rianda 2021) Through Cinema and Media Theories:

Toward a Media-Oriented Techno Literacy Framework

Lorenzo Denicolai (University of Turin)

In this study, I propose that Mike Rianda's *The Mitchells vs. The Machines* can serve as a model of a learning object that fosters a specific form of technological literacy. Within the current international educational landscape, institutional guidelines recognize the critical role of media in shaping citizenship, particularly in light of the growing prevalence of digital and visual phenomenological forms in everyday technological life. From this perspective, *The Mitchells vs. The Machines* is a valuable model for addressing various media-educational themes. However, its relevance extends beyond this: the film's content can also be interpreted as a representation of specific theoretical approaches within media studies –such as media archaeology, technological post-phenomenology, and the neuro-cognitive approach to cinema and audiovisual media– which currently rank among the most widely debated topics in the field. I propose that it is possible to metaphorically 'put one's hands into the film', 'touching' its components to understand the interactions among its various elements and acquire a set of pre-knowledge that may be helpful in other aspects of everyday life. To do so, my theoretical analysis establishes a concise dialogue between media archaeology, film studies, and neuroscience to support the hypothesis that *The Mitchells vs. The Machines* constitutes a prototype for technology literacy pathways.

Keywords
Human-Technology Interaction; Audiovisual Media; Media Archaeology; Neuro-Cognition And Cinema; Techno Literacy
DOI
https://doi.org/10.54103/2036-461X/23172

INTRODUCTION

In April 2021, Netflix released the animated family film *The Mitchells vs. The Machines* available on its platform. Directed by Mike Rianda and produced by Columbia Pictures and Sony Pictures Animation, the film follows the Mitchell family: Linda, an elementary school teacher; Rick, a well-intentioned yet technologically inept father; and their two children –Katie, a young student on the verge of enrolling in a prestigious film school in California, and Aaron, a shy boy with a deep passion for dinosaurs. The family is completed by their peculiar dog, Monchi, whose distinctive physical and behavioral traits play a crucial role in the resolution of the narrative. The plot centers on the family's journey to accompany Katie to her new school; however, along the way, they unexpectedly become humanity's last hope against a machine uprising. Led by the malevolent artificial intelligence and virtual assistant PAL, the machines rebel against

humans, posing an existential threat. Seeking revenge against its creator for attempting to replace it with humanoid robots, PAL hacks into their systems and transforms them into a personal army. Through ingenuity, resourcefulness, and their eccentricity, the Mitchells ultimately defeat PAL, restoring humanity's freedom.

As will be explored in the following sections, the characters' varying levels of technological proficiency –understood as their ability to use tools belonging to different technological epochs and ontological paradigms– serve as their primary means of countering PAL. Another central film theme is the dynamic relationships between family members and the strength of their familial bond. This aspect is influenced by the malfunctioning robots Eric and Deborah, who aspire to experience human emotions and, in doing so, integrate into the Mitchell family, which further emphasizes the relationship.

Mike Rianda's film offers a compelling representation of everyday life in the digital postmodern era, particularly concerning human interactions with technology. The *onlife* condition, theorized by Luciano Floridi (2014, 2015, 2021), serves as the broader framework within which the Mitchells' actions, experiences, and aspirations unfold. Each family member embodies a distinct mode of engaging with and accepting digital technology: Katie represents the digital native who envisions a future shaped by technology, particularly audiovisual media; Linda is the nurturing mother drawn to the idealized yet often misleading portrayals on social media; Aaron is the instinctive digital native who interacts seamlessly with media; and Rick is the digital immigrant who struggles with new technologies despite his best efforts.

Beyond its purely narrative aspects, *The Mitchells vs. The Machines* serves as a valuable tool for addressing a range of issues central to contemporary Media studies and supporting the hypothesis I introduce in this contribution. Rianda's film offers significant insights into a series of interrelated and complementary themes, which I will briefly outline, moving from the most explicit and evident to the more profound ones. The film proves helpful for: a) a media educational reflection, particularly concerning everyday interactions with media and the dynamics between different generations (such as parent-child relationships, etc.); b) a preliminary analysis of the human-technology relationship, specifically regarding the use of smart devices (including the aforementioned generational differences), as well as human-machine interaction (HMI) and human-robotics interaction (HRI), with their respective subcategories (such as communication with machines, identification with robots and vice versa, etc.)[1]; c) exploration of cinematic language, the film's meta-linguistic character, and its nature as a "media object" characterized by its specific complexity and materiality. Thus, we can consider *The Mitchells vs. The Machines* at least in two ways: a tool for analyzing media education and literacy frameworks (with particular attention to Remix Culture, the logic of mash-ups, and the concept of cultural remediation);

1 See Sandry (2015, 2017).

a medium to provide a methodological framework for investigating the technological stratifications –and their interrelations– that are simultaneously diegetic and extra-diegetic in the film while also reflecting contemporary techno-media everyday life.

THE MITCHELLS VS. THE MACHINES: THEMES, AND ITS ROLE IN THE HYPOTHESIS

In this study, I propose that Mike Rianda's *The Mitchells vs. The Machines* can serve as a model of a learning object that fosters a specific form of technological literacy. Within the current international educational landscape, institutional guidelines[2] recognize the critical role of media in shaping citizenship, particularly in light of the growing prevalence of digital and visual phenomenological forms in everyday technological life. Film and audiovisual media –conceived as products, objects, "things", and experiences– have increasingly been integrated as educational and didactic tools within this framework. Historically,[3] still and moving images have played a central role in theoretical and empirical research exploring their effectiveness –sometimes assumed, sometimes empirically supported– in knowledge transmission. The emergence and subsequent dissemination of theoretical models and diverse methodological approaches further underscore the significance of these research trajectories on a global scale. From this perspective, *The Mitchells vs. The Machines* is a valuable model for addressing various media-educational themes. However, its relevance extends beyond this: the film's content can also be interpreted as a

2 In the International educational landscape, although with varying approaches and speeds of change due to geographical and cultural inclinations and sensitivities (Reid, 2018), the digitalization of the 2000s has led to an increase in media-related activities, including the use of audiovisual materials in schools. In Italy, for instance, the Ministero dell'Istruzione e del Merito launched a *Piano Nazionale per l'educazione visuale a scuola* (2016) with the aim of "promoting the teaching of cinematic and audiovisual language in the classroom" to facilitate the acquisition of "tools and methods of analysis to understand the grammar of images and to develop awareness of their nature and specific functioning." This study primarily examines the Italian educational context, focusing on the *Indicazioni Nazionali* issued by the Ministry in 2012 and revised in 2018.

3 In the early 20th century, Thomas A. Edison, following the invention of the *Edison's Home Kinetoscope*, strongly advocated for the widespread introduction of moving images in American educational practices, emphasizing the powerful impact of visual (and narrative) materials on young learners' cognition (see Keeler, 2012; Saettler, 1990). Starting from the 1920s in the United States, *Visual education* emerged as a dynamic field of theoretical and empirical research (Brooker, 1947; Keeler, 2012; Paxton and Marcus, 2018). Today, various research strands related to this topic –such as *Film education* and *Film literacy* –fall within the broader domain of *Media education* and the multiple literacies that stem from and complement it. In recent years, discussions on *Film education* and *Film literacy* have gained increasing prominence in the policy guidelines of various national governments across the European Union "Burn and Reid 2012; Reid 2018".

representation of specific theoretical approaches within media studies –such as media archaeology, technological post-phenomenology, and the neuro-cognitive approach to cinema and audiovisual media– which currently rank among the most widely debated topics in the field.

The film can potentially cultivate a broader form of media (and visual) awareness than what is typically considered in school-based media education programs. These programs, despite strategic directives, often focus primarily on understanding how to use technological tools for strictly didactic purposes. In this sense, I refer to a form of technology literacy that aims to deepen knowledge of media theories and expand technological awareness beyond the strictly educational context and the instrumental use of digital tools.

The Mitchells vs. The Machines has been identified as a paradigmatic case study to support this objective. As a family-oriented film, it is designed to engage a wide age range, all interacting daily with digital technology. The film portrays these generational differences in technological engagement, mirroring real-world dynamics. Like other films with similar themes,[4] it is an animated production. This characteristic enhances its appeal and emotional resonance, particularly among the demographics most immersed in digital culture (children and young people).[5] However, unlike many other animated films, Rianda's work operates on a meta-linguistic and, more specifically, meta-cinematic level. The narrative directly engages with cinematic materiality (Katie is a filmmaker; various phases of video production are depicted throughout the film, etc.), establishing a more direct connection to theoretical research in cinema, and media studies. Moreover, the film can be an accessible introduction to artificial intelligence and its growing role in everyday life. It offers a compelling depiction of screens' ubiquity and the evolving human-technology relationship, making it a valuable tool for fostering critical engagement with contemporary media environments. All these themes contribute to positioning Rianda's *The Mitchells vs. The Machines* as a helpful tool for *Technology education* (Pappa et al. 2024a, 2024b) and *Technology literacy* (Williams 2009; Davies 2011; Cassinadri 2024). The film can serve both as an introduction to technological tools in school curricula and as a resource for developing effective teaching and learning methodologies using these tools –ranging from computers and mobile devices to educational robotics, AI-driven apps, and platforms.

However, as previously stated, this contribution adopts a theoretical orientation

4 Among the many animated productions, I cite *The Iron Giant* (Bird, 1999), *Robots* (Wedge and Saldanha, 2005), and *Ron's Gone Wrong* (Smith and Vine, 2021). Among live-action films, notable examples include *Bicentennial Man* (Columbus, 1999) and *A.I. – Artificial Intelligence* (Spielberg, 2001), alongside the broader genre of works exploring the relationship between humans and machines, such as the TV series *Westworld* (Nolan and Joy, 2016–2019). With the exception of Columbus's film, all these productions adopt a strongly dystopian perspective. Conversely, films like *Wall-E* (Stanton, 2008) focus on a more humanized form of robotics, though without portraying a genuine relationship between humans and machines. Regarding *Wall-E*, see Sobchack (2009).

5 See Chu et al. (2015).

grounded in cinema and media studies. The approach adopted here is thus grounded in media theories, incorporating insights from post-phenomenological (Ihde 1990; Verbeek 2005; Rosenberg and Verbeek 2015; Ihde and Malafouris 2019), phenomenological, and neuro-cognitive perspectives (Sobchack 1992, 2004; D'Aloia and Eugeni 2015, 2017; Parisi 2019; Fingerhut 2021). These perspectives suggest that the human-technology relationship should be examined through the lens of everyday life, considering the broad experiential spectrum that emerges from interactions with technological artifacts[6] and the reciprocal exchange between human and technological agents –while assuming the materiality of the technical object as a fundamental premise. Accordingly, this article aims to promote a form of *technology literacy* that aligns with Hansen's view of education as a means to "empower people to live life well and to positively influence their environment" (2003, 117) and with Williams' definition, which emphasizes "an awareness or appreciation of the relationships between technology, society, and the environment" (2009, 246). *The Mitchells vs. The Machines* effectively illustrates these dimensions. The notion of *technological thinking* –beyond using tools to perform specific actions– is repeatedly foregrounded throughout the film. Similarly, the film's meta-cinematic and meta-media nature offers a tangible engagement with the cinematic apparatus itself, allowing viewers to grasp the heterogeneity of components that shape and sustain the creation of a filmic product.

The theoretical analysis presented in the following sections establishes a concise dialogue between media archaeology, film studies, and neuroscience to support the hypothesis that *The Mitchells vs. The Machines* constitutes a prototype for technology literacy pathways.

THE "HANDS-ON" TENDENCY OF TECHNOLOGICAL EXPERIENCE: SOME THEORETICAL PRINCIPLES

The core of my hypothesis revolves around the possible pre-knowledge and practical competence effects that the user-viewer[7] may develop through watching Mike Rianda's *The Mitchells vs. The Machines* and engaging with the

6 In this regard, it is essential to consider, for example, studies on screens (Carbone, 2016; Carbone and Lingua, 2023), media apparatuses (Casetti, 2015; Eugeni, 2021), visual culture (Pinotti and Somaini, 2016; Wulf, 2022), as well as research in anthropology and cognitive aesthetics (Malafouris, 2013; Dissanayake, 2015), among others.

7 I define the viewer as a *user*, following the terminology adopted by Fickers and van den Oever (2018, 2022) in their analysis within the EMA framework. As these scholars emphasize, the term is intended to encompass both the *user* and the *use*, serving as a synonym for both meanings. Moreover, the concept of a *user*-viewer aligns with the idea that the viewer is active, engaging with and responding to what they see.

film's very 'body'. To support this proposal, I consider *The Mitchells vs. The Machines* as a media object endowed with concrete materiality and depth in a pretty literal sense. In this and the following sections, I propose that it is possible to metaphorically 'put one's hands into the film', 'touching' its components to understand the interactions among its various elements and acquire a set of pre-knowledge that may be helpful in other aspects of everyday life. To do so, I will establish a dialogue between different theoretical perspectives from media studies.

Andreas Fickers and Annie van den Oever (2014, 2018, 2019, 2022) offer a compelling approach to media archaeology with experimental media archaeology (EMA). The scholars argue for the value of "seeking a physical, sensual engagement with [...] historical artifacts" to "stimulate our imagination of the past" (2019, 46). This engagement allows researchers to "reflect critically on the hidden or non-verbalized, sensorial, corporal, and tacit knowledge that informs our engagement with media technologies" (ibid.). Their objective is thus to understand "how historical objects of media technology can be used as sources for a sensorial-focused history of technology and the media" (ibid.). Fickers and van den Oever's media-archaeological approach is rooted in *re-enactment*, a concept developed in historiography by Roger Collingwood (1946). According to Collingwood, historical knowledge consists of "the perpetuation of past acts in the present" (as quoted in Fickers and van den Oever 2019, 54). Historical actions –belonging to the past– can be reactivated through thought reproducing them. However, Fickers and van den Oever take this rational engagement further, transforming it into a practical and tangible experience. Their EMA is predominantly tactile, relying on real sensory engagement with media artifacts. In this regard, EMA resonates with *learning by doing* and constructivist approaches, aiming to be "a springboard for action". The scholars suggest that user interactions with technological devices emerge through activation, and activities such as handling old technological artifacts in media archaeology laboratories (an approach that fosters "hands-on" knowledge) can stimulate these interactions.

I would like to extend this argument further. The issue is that Fickers and van den Oever's activities require physical, genuine interaction with technological artifacts. As I have already emphasized, EMA is based on direct, bodily (and therefore sensory) engagement with the object of study. This approach opens up an additional line of inquiry: Could a similar kind of manipulation and discovery experience occur just through watching a film –by handling it with one's eyes[8]?

8 As will become evident in the following section, I employ this expression metaphorically, as vision is only one of the senses involved in the cinematic experience. In this regard, I align with Sobchack (2004, 64-65), who argues that "vision is not isolated from our other senses. Whatever its specific structure, capacities, and sensual discriminations, vision is only one modality of my lived body's access to the world and only one means of making the world of objects and others sensible –that is, meaningful– to me. Vision may be the sense most privileged in the culture and the cinema, with hearing a close second; nonetheless, I do not leave my capacity to touch or to smell or

Let us explore how this might unfold in *The Mitchells vs. The Machines*. The film's characters engage in various actions that involve manipulation and artistic-aesthetic construction through technology. As a result, the *user-viewer* may unconsciously acquire certain pre-knowledge and skills –or, at the very least, undergo a *techno-experience*– during the film's runtime. This aspect occurs through intersubjective positioning with the characters who use (or interact with) technological artifacts. In this light, *The Mitchells vs. The Machines* could be a visual-media environment where user-viewers can practice interacting with technology, guided and structured by the film's narrative. Much like a physical object or environment, the film may contain *affordances* (Gibson 1979; Carocci 2018; Ronzhyn et al. 2023) –that is, physical features that suggest possible actions to the user-viewer. In this way, the filmic product could become an experiential and educational tool that can be explored through experimental activities. Consequently, the film may serve as an actual media environment where viewers can act and engage in a series of indirect educational experiences. This concept aligns with the complex mechanisms of *embodied simulation* (Gallese 2007, 2015; Gallese and Guerra 2015), through which cognition can produce simulated experiences even when engaging with an aesthetic event.

To fully articulate this perspective, it is necessary to introduce, albeit briefly, some theoretical considerations on *embodied cognition* (Gallese 2007; Gallese and Guerra 2015) and its relationship with aesthetic and cinematic experience; the enactivist approach to human perception within environmental contexts (Noë and O'Regan 2001; Noë 2004); and relevant studies on the intersection of cinema, media, and cognition (Grodal 1997, 2009; Carocci 2018; Tikka 2008; Tikka et al. 2023).

According to Gallese (2007, 2015), the activation of so-called mirror neurons occurs both "when executing a motor act, such as grasping an object or making communicative gestures with the mouth, and when observing another individual performing a motor act" (Gallese and Guerra 2015, 57). Our brain can thus simulate an action simply by seeing it.[9] Gallese speaks of *embodied simulation*, referring to the cognitive ability to perceive through the body and simulate actions. Likewise, a similar process manifests when emotions and the capacity for empathy are involved: "[s]imilarly, it has been shown that experiencing an emotion or a sensation, observing it when experienced by others, and imagining it are underpinned by the activation of partly identical brain circuits" (Gallese 2007, 3). When we experience an aesthetic event (watching a film, reading, observing a painting, etc.), our simulative condition is enhanced, as our cognition is entirely directed and immersed in the fictional reality. In essence, being aware of the

to taste at the door [...]".

9 "To see an action means, perceptually speaking, *also* to simulate it within one's own motor system, through one's own motor system" (Gallese and Guerra 2015, 57, my translation, emphasis in original). It is important to specify that the activation of mirror neurons occurs only if the action –whether performed or observed– is goal-directed. See Caruana and Borghi (2016).

fictional nature of what we are witnessing allows us to experience it fully, with a maximum degree of immersion and identification. In a state resembling catharsis, we may experience extreme emotions (such as anger, terror, or pleasure) without actual risk, yet live that experience in a totalizing manner. Gallese defines this condition as *liberated embodied simulation* (ibid.; Wojciehowski and Gallese 2011; Gallese and Guerra 2015), referring to the process that enables strong empathic adherence to the character and the situation being experienced.

According to the enactivist approach of Alva Noë and Kevin O'Regan (2001), seeing involves inherently action, and the perceptual act enables interaction with both the object and the environment in which we find ourselves. As Carocci (2018) emphasizes, perception ensures a genuine exploration of the environment and that any interaction with it or with an object goes beyond understanding its form and morphology. Through perception, we already know how to use a particular object "since perception is perception of *affordance*, that is, [...] of what objects and the surrounding world *offer* us and invite us to do" (Caruana and Borghi 2016, 37, emphasis in original). Additionally, some interpretations of media theories and visual culture (Pinotti and Somaini 2016; Cometa 2020) suggest images themselves can constitute an environment rich in meanings: this refers to a space in which one can live, experience, and perform actions (for instance, in virtual reality spaces), and with which one can interact[10]. Thus, even a media space –a film being a functional representation of such[11]– can be an environment that facilitates "activations" and offers orientations toward action. Narration can also function similarly, providing cues for action: embedded within it are universal and general behavioral patterns of problem-solving (Grodal 2009; Gottschall 2012; Calabrese and Conti 2020; Tikka et al. 2023),[12] which thus ensure modes of learning (under conditions of pre-reflexivity) concerning the dynamics of everyday actions.

In conclusion, EMA is based on a "hands-on" approach to technology, allowing for manipulating a device to understand how to use it and, potentially, to generate new knowledge (Ellis and Williamson 2020). However, if we can, merely through sight (which is, in reality, the ability to "see" with the whole body), identify with a character by simulating their actions, empathizing with them, and co-experiencing their actions, then perhaps we can acquire pre-knowledge regarding the actions and use of objects and artifacts present in the narrative, through the viewing and paradoxical *simulated manipulation* of a film. Referring to the case of *The Mitchells vs. The Machines*, one might hypothesize that it facilitates pre-knowledge and initial competencies related to technological

10 For a deeper exploration of eco-media, see Fuller (2007), Parisi (2019), and Cometa (2024). From a different perspective, concerning so-called "media and technological environments" refer to Montani, Cecchi, and Feyles (2018), as well as Ciano et al. (2019).

11 Both as a "body" with which to establish a relationship (Sobchack 1992, 2004) and as a form of cognitive extension, see D'Aloia and Eugeni (2015, 2017); Carocci (2018).

12 Wolfgang Ernst (2005) argues that narration should also be considered as a technical element, and that it is essential to engage with it as a form of technology.

artifacts and human-technology relationships, thereby fostering a particular form of technology literacy that is more oriented toward media studies.

THE MANIPULATION OF THE MITCHELLS FAMILY: SOME EXPLORATORY EXAMPLES

The film offers potential 'hooks' for media literacy and audiovisual language from the first shots. The introductory screen presenting the Mitchell family features at least three types of graphic choices: in the lower part of the frame, the drawing is two-dimensional, used to depict the protagonists of the story in a comic book style; the typography of the phrase "Worst family of all time" resembles those commonly used in graphic art and comics; the three-dimensional rendering, typically found in cartoons created with computer graphics. Hand-painted textures further expanded the film's technical (and technological) scope, as confirmed by the production team and director Mike Rianda.[13] This stylistic blend recurs throughout the film, emphasizing key narrative moments while externalizing the protagonist's emotions, Katie.

Beyond its semiotic function, this layered style may be an initial mode of discovering audiovisual language and graphic techniques. It is as if, by metaphorically placing our hands 'inside' the film,[14] we can begin to grasp certain aspects of the discursive level of the cinematic product. In the opening scenes, Katie introduces her family members, employing different graphic levels and mash-up dynamics typical of *Remix Culture* (Lessig 2009; Manovich 2010; Sonvilla-Weiss 2010). For instance, Katie explicitly compares her father, Rick, to a screaming gibbon, a comparison made visually explicit in the film: her father's image is alternated with footage of the animal in a montage sequence (introducing yet another stylistic contamination –animation juxtaposed with live-action footage). Their faces are superimposed, placing the gibbon's screaming face onto Rick's animated body as a "montage of attractions". The film references the video-sharing platform YouTube and intertextual connections to blockbuster films, primarily within the disaster and dystopian genres. The presence of Remix Culture elements allows for initial consideration. These instances may be interpreted as examples of *re-enactment*, drawing on the concept proposed by Fickers and van den Oever. However, in contrast to the historical direction of Collingwood, from which the two scholars derive the idea, here the re-enactment serves to bring back into the present technological objects that played a significant role in the collective imagination of their original era, fully belonging to Pop culture (e.g., the 1990s Furby toy, which in the film becomes an

13 https://www.indiewire.com/features/general/the-mitchells-vs-the-machines-animation-netflix-1234633881/

14 Parikka (2012) emphasizes that one of the primary goals of Media Archaeology is to dig into the media to understand their functioning and the relationships that exist within and between them.

ally of the PAL operating system). This situation could be an act of remediation, not merely as a cognitive, pragmatic, and aesthetic reorganization of the media experience but rather as a resemanticization of the technological object in its materiality. Following EMA, I propose this as an initial form of re-enactment, not of thought (as in Collingwood's theory, later adopted by Fickers and van den Oever), but rather as an act of mnemonic reproduction or, more precisely, of excavation and rediscovery of a media object or practice. This act is followed by a subsequent reinvention of the action or technological object, functioning as a mechanism of appropriation (or re-appropriation) of its function and meaning, shaped by the action and interaction –whether actual or simulated– with the object itself. Ellis and Williamson specify that EMA "makes the historian a co-constructor of [...] multiple meanings, past and present" of technologies and that one must use "practice and experience as bases for producing new knowledge about old media" (2020, 2). In our case, the *user*-viewer watching the film would also assume the role of a media historian. A quick clarification is necessary here. Based on this initial consideration, the position of the *user*-viewer watching the film appears to align with the "*imagined* user" category. According to Fickers and van den Oever (2018, 2022), this pertains to an action derived from past experiences engaging with fiction materials (imagined, utopian, dystopian, etc.), which are then projected into the future. By contrast, as defined by these scholars, the "*re-enacted* user" is the only case in which re-enactment serves a media-archaeological research purpose, as it arises from direct, tangible, physical interaction with a technological device.

The hybrid approach of simulated manipulation that I am hypothesizing could effectively activate a process of re-enactment in the sense intended by these scholars.[15] In alignment with the enactivist perspective, I argue that recollection/reinvention corresponds to an (at least partially pre-rational) understanding of a given object, along with the associated sensorimotor activation that could lead to its hypothetical use in another context (a physical rather than exclusively symbolic-representational context, from which it originally derives). For example, in many scenes of the film, Rick frequently references his screwdriver and the various tasks he can accomplish with it. Katie's father is passionate about DIY projects and considers the screwdriver an essential tool always to have (in fact, all family members possess one). Observing how the protagonists use the screwdriver seems to allow the *user*-viewer to imagine its function –even though, in this case, it is a well-known tool– and, hypothetically, to comprehend it.[16] The potential acquisition of knowledge and competence could occur through embodied simulation, mainly since the screwdriver is a strategic medium in

15 Furthermore, Fickers and van den Oever aim to "make an interesting contribution to a media and technology historiography that draws inspiration from the *sensing* of the past" (2022, 33, emphasis in original).

16 In this situation, we could speak of an *imagined* user. However, if my hypothesis of a simulated manipulation makes sense, we might already be dealing with a *re-enacted* user.

narrative moments marked by emotional intensity. As we discussed in previous sections, these are instances in which viewers are more likely to be emotionally engaged in the action they are witnessing –an effect of intersubjectivity. In this sense, engaging with technology –even analog– could suggest modes of use in a broader context, potentially serving as a behavioral model for problem-solving in other situations. Katie shares her passion for cinema early in the film, showcasing the different stages of creating her stop-motion short films. These scenes offer a glimpse into and, to some extent, an assimilation of basic production techniques: puppet construction, animation, and filming, often carried out using a Handycam. Once again, each narrative sequence (diegetic and extra-diegetic) containing these elements may serve as a techno-cognitive affordance for learning procedural aspects through embodied simulation. In general, the entire narrative provides the opportunity to 'touch' the filmic medium –to 'dig' into the cinematic construct: it allows one to observe the mechanics of narrative and discursive structures (a common meta-linguistic reflection) and to explore potential technological approaches to creating visual and graphic objects. According to Fickers and van den Oever, since the objective of EMA is to offer "a full-bodied and sensory approach to media technology" (2018, 200, my translation), Rianda's film once again proves to be a valuable object for excavation and deconstruction, enabling "a better understanding of the 'constructivist nature' of media technology products (photographs, films, audio recordings, etc.) as historical sources (e.g., handling them as 'staged performances' rather than 'snapshot versions of life', that is, questioning the 'visual' or 'sonic' evidence of audiovisual sources)" (2014, 277).

However, as stated earlier, excavation is an act that primarily entails a media-archaeological and technological approach. In this sense, delving into and within the medium is an effective action for the hypothesis of a media-oriented *Technology literacy*, a process of technological knowledge and re-cognition based on the mixed approach of EMA and embodied simulation I am describing. The excavation and deconstruction (simulated yet paradoxically motor-driven) of the cinematic object should enable the learning of fundamental aspects of human-machine interaction and technology. Let us examine several key elements from *The Mitchells vs. The Machines* that may help illustrate this argument more effectively.

TOWARDS A MEDIA-ORIENTED TECHNOLOGY LITERACY

All the media and technologies depicted in the film provide insights into the historical period to which they belong and, most importantly, their specific uses. The existential journey of Katie, partially recounted through flashbacks, is a process of personal growth and self-awareness that unfolds in parallel with technological evolution. Throughout the film, we witness a gradual transition

from the Handycam, which young Katie used to create her first recordings, to the smartphone, which the college-aged Katie engages with and uses to produce videos as an adult. Simultaneously, the smartphone that her mother, Linda, uses to chat and post content on Instagram is juxtaposed with both the corded telephone and physical phonebook Aaron uses to connect with fellow dinosaur enthusiasts and, more significantly, with the near-total lack of digital proficiency exhibited by her father, Rich, who favors more analog tools, such as the screwdriver mentioned above or the crossbow he employs against the robots. The film's "archaeological" nature permeates the entire narrative, which ultimately revolves around a confrontation between humans and machines. The former are technologically less advanced than the latter, and various objects in the film emphasize this disparity. For instance, the Mitchells' old car is a metaphor for this technological backwardness, contrasting with the androids controlled by PAL. The USB drive that Katie attempts to use to upload the robot deactivation code, along with the screwdrivers that help the Mitchells escape from the prison spheres, stand in opposition to the futuristic spacecraft meant to launch humanity into space. Monchi the dog's crossed eyes also disrupt the robots' recognition systems, undermining PAL's technological singularity.

Despite these contrasts, the storyline emphasizes that the interplay between humans and technology is fundamental to resolving the central conflict. In this regard, the film aligns with certain principles of post-phenomenological theory concerning human-technology mediation[17] while engaging with cognitive archaeology elements.[18] These aspects contribute to developing the media-oriented technology literacy I aim to introduce. As previously noted, a key function of cinematic media is to enable potential actions and cognitive feedback loops for the viewer, cultivating an ecological relationship with the medium and its content. The two humanoid Pal Max robots, Eric and Deborah, initially hostile to the Mitchells, provide the clearest example of this human-machine relationship. Following a turbulent beginning, the robots develop an attachment to the family, ultimately siding with them against PAL and becoming integrated into the Mitchell household. Throughout the film, the two Pal Max robots attempt to simulate human emotional responses, for example, by painting facial expressions such as smiles or tears onto their screens[19].

Technology provides interpretative keys and intentional affordances throughout the narrative –suggesting actions that extend beyond the plot and reference

17 See Ihde (1990); Rosenberger and Verbeek (2015).

18 See Malafouris (2013, 2021); Ihde and Malafouris (2019).

19 Paul Dumouchel and Luisa Damiano (2016) provide an important contribution to the analysis of the increasingly close (and empathetic) relationship between humans and robots. In the final part of their essay, the authors discuss the latest studies in robotic epigenetics, whose goal should be to create machines capable of genuinely experiencing emotions, rather than merely simulating them. For this reason, the authors emphasize the importance of an enactivist approach, according to which machines and humans should interact within affective loops, allowing for a continuous and mutual intentional exchange. I also refer to Denicolai (2022) on this topic.

our post-media condition. The various levels of human-technology relationships Don Ihde (1990) identified in his post-phenomenological framework closely align with the film's narrative and contribute to articulating a form of technology literacy. Let us briefly examine the most salient aspects with reference to the film. Ihde distinguishes four types of relationships, each differing in the degree of awareness with which humans engage with technological objects. The broader context of the film represents our contemporary *onlife* condition, which, in line with Ihde, can be classified as an *embodiment relation*: the characters' actions result from radical mediation (Grusin 2015) and a continuous dialogue with technology. In this sense, their relationship with the world is entirely mediated. When the robots shut down Wi-Fi globally, widespread panic ensues: people willingly enter the prison spheres, drawn by the promise of connectivity and an unspecified yet enticing digital entertainment experience. However, a brief exchange between Rich and Katie provides an even more explicit illustration of this condition. At a dinosaur-themed rest stop, Rich reprimands his daughter for perceiving reality solely through the lens of her devices. Katie counters his remark, asserting that her relationship with technology is her way of experiencing the world. This exchange ultimately delineates two distinct human conditions: the analog (representing digital immigrants) and the digital (representing natives). Katie playfully superimposes a kitten filter over her father's face to punctuate her perspective in real-time.[20] This dialogue is particularly compelling for its implications within eco-media and enactivist perspectives[21] and this analysis of human-technology interactions. While the film primarily operates within an embodiment relation, we can also discern traces of an *alterity relation*. According to Ihde (1990), this mode of interaction requires a genuine dialogue between two entities. In the scene discussed above, however, this exchange remains 'silent' as it lacks a direct action-reaction dynamic. Yet, it remains tangible as it emerges through an assemblage –an *apparatus* formed between humans and machines (Denicolai, 2022). PAL's actions, in a dystopian manner, exemplify a *background relation*, meaning that they occur without continuous human awareness. In daily life, humanity is surrounded by machines that operate autonomously, often in ways that serve human well-being (e.g., air conditioners, refrigerators, etc.). Similarly, algorithms collect and process data, presenting users with personalized information. In this regard, Eugeni highlights the existence of *pseudo-organisms* –machine-prostheses that, in ecological interaction with

20 R: "You could experience things a whole lot better without that camera. Your eyes are nature's camera". K: "I am experiencing it. This is how I experience things". R: "I don't think you are. You're hiding behind that phone". In response to this statement, Katie frames her father with the smartphone and, in real-time, applies a ridiculous filter to his face. (tc: 00:25:27-00:25:45).

21 Noë (2015) focuses on the now common practice of experiencing live events through the lens of the camera, highlighting the need to share a performative moment and, consequently, live it not "with the naked eye" but already mediated by the smartphone's lens. In this way, a continuous relationship, also cognitive, of action and feedback becomes evident between the entities involved.

human agents (but often unbeknownst to them), "frequently perform certain organism-like functions with a high degree of automatism" (Eugeni 2021, 249, my translation). Lastly, the *hermeneutic relation* allows humans to interpret otherwise imperceptible data or phenomena. In the film, this is evident when the Pal Max humanoids visually represent their plans for conquest. However, this relation can also serve a metalinguistic and, consequently, an investigative function. From this perspective, I consider the presence of graphical elements that frequently enrich the film's frames and diegesis as a form of hermeneutic relation. The use of graphic overlays –ranging from varied artistic styles to slow-motion sequences and filters– enhances the emotional states of the characters, enabling the viewer to engage more deeply with the unfolding action.

Finally, I wish to touch upon a crucial issue embedded within the film –one whose awareness may be regarded as an initial step toward achieving this media-oriented technology literacy. The entire narrative revolves around humans and technology's active and reactive relationship. As the story progresses, the issue becomes increasingly evident: at first, post-media, digital, and immersive technology is present in the actions of all the Mitchells except for Rich. However, Rich is not inherently less technological than the others; the plot's resolution hinges on his analog media (the screwdriver, the crossbow) and his skills (DIY craftsmanship, tool usage, woodworking[22]). This situation suggests the coexistence of different levels of technology in terms of their material evolution (from the screwdriver to the USB drive, for instance) while reaffirming the necessity of continuous co-action between humanity and technology. Metaphorically and in everyday life, this relationship persistently and in real-time shapes both agents involved.[23] Indeed, Rich gradually embraces digital technology, just as Katie recognizes –or rather, rediscover, reimagine, *re-enact*– the analog. A form of technological thinking emerges, allowing the *user*-viewer to engage with these dynamics and internalize them through the simulated manipulation I have proposed.

CONCLUSIONS

In this paper, I have attempted to propose a heuristic mode of media investigation, with particular attention to the audiovisual and cinematic product, aiming to provide (but not exclusively) schools and younger generations with a methodology to 'enter' the media object and deepen their understanding both from a specific linguistic and stylistic perspective and, more importantly, from a media and technological standpoint. In this regard, I am introducing, in an entirely exploratory manner, the possibility of identifying a specific technology

22 The small wooden carved moose head, sculpted by Rich and given to Katie by the man, symbolizes a metaphorical passing of the baton of a series of knowledge, principles, desires, and techno-media awareness.

23 See Malafouris (2013, 2021); Parisi (2019).

literacy rooted in media studies as an approach to exploring and discovering the relationship between the human agent and the technological object. To this end, within media theories, I endeavored to create a dialogue between media archaeology lines and certain neurocognitive studies foundations as applied to aesthetic and cinematic experience.

The Fickers' and van den Oever EMA approach is advantageous, as it is based on the necessary manipulation of the technological object to establish a relationship with it and, consequently, to 'live' an experience, which may also be semantic, with it. My proposal is further developed by suggesting that such manipulation could also occur through embodied simulation (thanks to the neural mechanisms of our cognition), enabling the filmic object to be considered in its three-dimensionality –both as an object and as a 'box' into which we can look and experiment not only with sensations or emotions but also with modes of action. This simulated manipulation is still embryonic and requires further exploration and verification, including through potential experimentation and assessment in learning contexts.

To support this hypothesis, I considered the film *The Mitchells vs. The Machines* as a paradigmatic example of a media object and environment because it contains a series of inputs and affordances that could help elucidate my model. Consciously, I focused only on certain salient aspects of the film, highlighting those I considered most functional in supporting my starting hypothesis. I remain convinced that Rianda's film exemplifies a way of living with technology in our everyday lives and is a vibrant educational tool for media literacy activities.

REFERENCE LIST

Brooker, Floyde E. 1947. "Motion pictures as an aid to education." *The ANNALS of the American Academy of Political and Social Science*, 254(1): 103–09.

Burn, Andrew, and Mark Reid. 2012. "Screening literacy: Reflecting on models of film education in Europe". *Nordic Journal of Digital Literacy*, 7(4): 314–23. https://doi.org/10.18261/ISSN1891-943X-2012-04-07

Calabrese Stefano, and Valentina Conti. 2020. *Neuronarrazioni*. Milano: Bibliografica.

Carbone, Mauro. 2016. *Filosofia-schermi. Dal cinema alla rivoluzione digitale*. Milano: Cortina.

Carbone, Mauro and Graziano Lingua. 2023. *Toward an Anthropology of Screens. Showing and Hiding, Exposing and Protecting*. London: Springer.

Carocci, Enrico. 2018. *Il sistema schermo-mente. Cinema narrativo e coinvolgimento emozionale*. Roma: Bulzoni.

Caruana, Fausto, and Anna Borghi. *Il cervello in azione. Introduzione alle nuove scienze della mente*. Bologna: Il Mulino.

Casetti, Francesco. 2015. *Galassia Lumière. Sette parole chiave per il cinema che viene*. Milano: Bompiani.

Cassinadri, Guido. 2024. "ChatGPT and the technology-education tension: Applying contextual virtue epistemology to a cognitive artifact." *Philosophy & Technology*, 37(1): 14–28. https://doi.org/10.1007/s13347-024-00701-7.

Ciano, Aydin, Margoth González Woge, and Peter-Paul Verbeek. 2019. "Technological Environmentality: Conceptualizing Technology as a Mediating Milieu". In *Philosophy and Technology* 32(2): 321–38. https://doi.org/10.1007/s13347-018-0309-3.

Chu, Sharon Lynn, Francis Quek, and Kumar Sridharamurthy. 2015. "Augmenting Children's Creative Self-Efficacy and Performance through Enactment-Based Animated Storytelling". In *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction* (TEI '15): 209-14. New York: Association for Computing Machinery. https://doi.org/10.1145/2677199.2680602

Cometa, Michele. 2020. *Cultura visuale. Una genealogia*. Milano: Raffaello Cortina.

Cometa, Michele. 2024. *La svolta ecomediale: La mediazione come forma di vita*. Milano: Mimesis.

D'Aloia, Adriano, and Ruggero Eugeni, eds. 2015. "Neurofilmology. Audiovisual Studies and the Challenge of Neuroscience". *Cinéma & Cie*, 22/23.

D'Aloia, Adriano, and Ruggero Eugeni, eds. 2015. *Teorie del cinema. Il dibattito contemporaneo*. Milano: Cortina.

Davies, Randall S. 2011. "Understanding Technology Literacy: A Framework for Evaluating Educational Technology Integration". In *Tech Trends*, 55: 45–52. https://doi.org/10.1007/s11528-011-0527-3.

Denicolai, Lorenzo, ed. 2022. *Robotmedium: dispositivi, intelligenze, cinema*. Milano: Meltemi.

Dissanayake, Ellen. 2015. *Art and Intimacy. How the Arts Began*. Seattle: University of Washington Press.

Dumouchel, Paul, and Luisa Damiano. 2016. *Vivre avec les robots. Essai sur l'empathie artificielle*. Paris: Média Diffusion.

Ellis, Patrick, and Colin Williamson. 2020. "Object lessons, old and new: experimental media archaeology in the classroom." *Early Popular Visual Culture*, 18(1): 2–14. https://doi.org./10.1080/17460654.2020.1751434

Ernst, Wolfgang. 2005. "Let there be irony: Cultural history and media archaeology in parallel lines." In *Art History*, 28(5): 582–603. https://doi.org/10.1111/j.1467-8365.2005.00479.x

Eugeni, Ruggero. 2021. *Capitale algoritmico. Cinque dispositivi postmediali (più uno)*. Brescia: Scholé-Morcelliana.

Fickers, Andreas, and Annie van den Oever. 2014. "Experimental Media Archaeology: A Plea for New Directions". In *Technē/Technology: Researching Cinema and Media Technologies-Their Development, Use, and Impact*, edited by Annie van den Oever, 272-78. Amsterdam: Amsterdam University Press.

Fickers Andreas, and Annie van den Oever. 2018. "Per un'archeologia dei media sperimentale. Note epistemologiche e metodologiche sugli esperimenti con le tecnologie mediali del passato". In *Archeologia dei media: Temporalità, materia, tecnologia*, edited by Giuseppe Fidotta, and Andrea Mariani, 199–229. Milano: Meltemi.

Fickers, Andreas, and Annie van den Oever. 2019. "Doing experimental media archaeology. Epistemological and methodological reflections on experiments with historical objects of media technologies". In *New media archaeologies*, edited by Ben Gordon and Mark Goodall, 45-68. Amsterdam: Amsterdam University Press.

Fickers, Andreas, and Annie van den Oever. 2022. *Doing experimental media archaeology: Theory*. Berlin: De Gruyter.

Fingerhut, Joerg. 2021. "Enacting Media. An Embodied Account of Enculturation Between Neuromediality and New Cognitive Media Theory". *Frontiers in Psychology*, 12, 635993: 1–22. https://doi.org/10.3389/fpsyg.2021.635993

Floridi, Luciano. 2014. The Fourth Revolution: *How the Infosphere is Reshaping Human Reality*. Oxford: Oxford University Press.

Floridi, Luciano. Ed. 2015. *The Onlife Manifesto: Being Human in a Hyperconnected Era*. London: Springer.

Floridi, Luciano. 2021. "Digital Time. Latency, Real-Time, and the Onlife Experience of Everyday Time". *Philosophy and Technology*, 34: 407-21. https://doi.org/10.1007/s13347-021-00472-5.

Fuller, Matthew. 2005. *Media ecologies: Materialist energies in art and technoculture*. Cambridge: The MIT Press.

Gallese, Vittorio. 2017a. "Mirroring, a liberated embodied simulation and aesthetic experience". In *Mirror Images. Reflections in Art and Medicine*. Thun: Verlag für modern Kunst, 1–9.

Gallese, Vittorio. 2017b. "Visions of the body. Embodied simulation and aesthetic experience". *Aisthesis. Pratiche, linguaggi e saperi dell'estetico*, 10(1): 41–50. https://doi.org/10.13128/Aisthesis-20902.

Gallese, Vittorio, and Michele Guerra. 2015. *Lo schermo empatico. Cinema e neuroscienze*. Milano: Raffaello Cortina.

Gibson, James J. 1979/2014. "The theory of affordances". In *The people, place, and space reader*, edited by Jen Jack Gieseking, William Mangold, Cindi Katz, Setha Low, and Susan Saegert, 56–60. New York: Routledge.

Gottschall, Jonathan. 2012. *The storytelling animal: How stories make us human*. New York: Houghton Mifflin Harcourt.

Grodal, Torben. 1997. *Moving Pictures: A New Theory of Film Genres, Feelings, and Cognition*. Oxford: Oxford University Press.

Grodal, Torben. 2009. *Embodied Visions: Evolution, Emotion, Culture, and Film*. Oxford: Oxford University Press.

Grusin, Richard. 2015. "Radical mediation". *Critical Inquiry*, 42(1), 124–148.

Hansen, John W. 2003. "To Change Perceptions of Technology Education." *The Journal of Technology Studies*, 29(2): 116–19.

Ihde, Don. 1990. *Technology and the Lifeworld: From Garden to Earth*. Bloomington: Indiana University Press.

Ihde, Don, and Lambros Malafouris. 2019 "Homo faber revisited: Postphenomenology and material engagement theory." *Philosophy & Technology* 32: 195–214. https://doi.org/10.1007/s13347-018-0321-7

Jenkins, Henry. 2009. *Confronting the challenges of participatory culture: Media education for the 21st century.* Cambridge: The MIT Press.

Keeler, Amanda R. 2012. "John Collier, Thomas Edison and the Educational Promotion of Moving Pictures." *College of Communication Faculty Research and Publications*, 124: 1–17. Available on: https://epublications.marquette.edu/comm_fac/124

Lemish, Dafna. 2015. *Children and media: A global perspective*. Hoboken: John Wiley & Sons.

Malafouris, Lambros. 2013. *How things shape the mind*. Cambridge: The MIT Press.

Malafouris, Lambros. 2021. "How does thinking related to tool making?". In *Adaptive Behavior*, 29(2), 107–121. https://doi.org/10.1177/1059712320950539.

Montani, Pietro, Dario Cecchi, and Martino Feyles, eds. 2018. *Ambienti mediali*. Milano: Meltemi.

Noë, Alva, and Kevin O'Regan. 2001. "A sensorimotor account of vision and visual consciousness." *Behavioral and brain sciences*, 24(5), 939–973. doi:10.1017/S0140525X01000115

Noë, Alva. 2004. *Action in Perception*. Cambridge: The MIT Press.

Noë, Alva. 2015. *Strange tools: Art and human nature*. New York: Hill and Wang.

Pappa, Christina Ioanna, Despoina Georgiou, and Daniel Pittich. 2024a. "Technology education in primary schools: addressing teachers' perceptions, perceived barriers, and needs". In *International Journal of Technology and Design Education* 34: 485–503. https://doi.org/10.1007/s10798-023-09828-8.

Pappa, Christina Ioanna, Despoina Georgiou, and Daniel Pittich. 2024b. "Assessing the state of technology education in primary schools: a systematic review of the last 2 decades." *International Journal of Technology and Design Education* 34: 1003–1044. https://doi.org/10.1007/s10798-023-09851-9.

Parikka, Jussi. 2012. *What is media archaeology?* Cambridge: Polity Press.

Parisi, Francesco. 2019. *La tecnologia che siamo*. Torino: Codice.

Paxton, Richard J., and Alan S. Marcus. 2018. "Film media in history teaching and learning." *The Wiley International handbook of history teaching and learning*, 579–601.

Pinotti, Andrea, and Antonio Somaini. 2016. *Cultura visuale: immagini, sguardi, media, dispositivi*. Torino: Einaudi.

Reid, Mark. 2018. "Film education in Europe: National cultures or European identity?". In *Film Education Journal*, 1(1): 5–15. DOI https://doi.org/10.18546/FEJ.01.1.02

Ronzhyn, Alexander, Ana Sofia Cardenal, and Albert Batlle Rubio. 2023. "Defining affordances in social media research: A literature review." *New Media & Society*, 25(11): 3165-88. https://doi.org/10.1177/14614448221135187

Rosenberger, Robert, and Peter PCC Verbeek, eds. 2015. *Postphenomenological investigations: Essays on human-technology relations*. Lanham: Lexington Books.

Saettler, Paul. 1990/2004. *The Evolution of American Educational Technology*. Charlotte: Information Age Publishing.

Sandry, Eleanor. 2015. *Robot and Communications*. New York: Palgrave.

Sandry, Eleanor. 2017. "Creative Collaborations with Machines." *Philosophy & Technology*, 30: 305–17. https://doi.org/10.1007/s13347-016-0240-4.

Sobchack, Vivian. 1992. *The Address of the Eye: A Phenomenology of Film Experience*. Princeton: Princeton University Press.

Sobchack, Vivian. 2004. *Carnal Thoughts: Embodiment and Moving Image Culture*. Berkeley-Los Angeles: University of California Press.

Sobchack, Vivian. 2009. "Animation and automation, or, the incredible effortfulness of being." *Screens* 50(4): 375-91. https://doi.org/10.1093/screen/hjp032.

Sonvilla-Weiss, Stefan. Ed. 2010. *Mashup Culture*. London: Springer.

Tikka, Pia. 2008. *Enactive Cinema: Simulatorium Eisensteniense*. Jyvaskia: Gummerus Printing.

Tikka, Pia, Mauri Kaipainen, and Juha Salmi. 2023. "Narrative simulation of social experiences in naturalistic context – A neurocinematic approach." *Neuropsychologia*, 188, 108654: 1–11. https://doi.org/10.1016/j.neuropsychologia.2023.108654.

Verbeek, Peter-Paul. 2005. *What things do: Philosophical reflections on technology, agency, and design*. University Park: The Pennsylvania State University Press.

Wagner, Robert W. 1972. "Thomas Edison to Protean People." *Journal of the University Film Association*, 24, 4: 92–100. https://www.jstor.org/stable/20687183

Williams, John A. 2009. "Technological literacy: a multiliteracies approach for democracy." *International Journal of Technology, and Design Education*, 19: 237–54. https://doi.org/10.1007/s10798-007-9046-0.

Wojciehowski, Hannah, and Vittorio Gallese. 2011. "How Stories Make Us Feel: Toward an Embodied Narratology." *California Italian Studies*, 2(1). http://dx.doi.org/10.5070/C321008974.

Wulf, Christoph. 2022. *Human beings and their images. Imagination, Mimesis, Imaginary*. London: Bloomsbury.