Imagining the thinking machine: Technological myths and the rise of artificial intelligence

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Abstract:

This article discusses the role of technological myths in the development of Artificial Intelligence (AI) technologies from 1950s to the early 1970s. It shows how the rise of AI was accompanied by the construction of a powerful cultural myth: the creation of a thinking machine, which would be able to perfectly simulate the cognitive faculties of the human mind. Based on a content analysis of articles on Artificial Intelligence published in two magazines, the Scientific American and the New Scientist, which were aimed at a broad readership of scientists, engineers, and technologists, three dominant patterns in the construction of the AI myth are identified: (1) the recurrence of analogies and discursive shifts, by which ideas and concepts from other fields were employed to describe the functioning of AI technologies; (2) a rhetorical use of the future, imagining that present shortcomings and limitations will shortly be overcome; (3) the relevance of controversies around the claims of AI, which we argue should be considered as an integral part of the discourse surrounding the AI myth.

Introduction

As historians of media and technology have shown, a new technology is always a field onto which a broad range of hopes and fears are projected (Corn, 1986; Sturken et al., 2004; Natale and Balbi, 2014). With the emergence of new media studies as a field of enquiry, scholars addressed the cultural discourses surrounding digital technologies in terms of "*imaginaire*" (Flichy, 2007) or "modern myths" (Mosco, 2004). As happened with previous communication technologies, the public discourse on digital media such as personal computers, e-readers, smartphones, and the Internet, is strongly informed by speculations, fantasies, and references to the future (Boddy, 2004; Ballatore, 2014).

What we call "new media," however, have a long history, whose study is necessary to understand today's digital culture (Park et al., 2011). This article aims to contribute to this endeavour by illuminating the emergence of a crucial component of the digital imaginary: the speculations and fantasies about Artificial Intelligence (AI), which characterized the development of computing technologies during its early inception. It focuses on the emergence from the 1950s to the early 1970s of the AI myth, broadly defined as the ensemble of beliefs about digital computer as thinking machines, as a key moment in which to study the patterns characterizing the construction of technological myths and the digital imaginary. Based on a content analysis of articles on Artificial Intelligence published in two magazines, the *Scientific American* and the *New Scientist*, we identified three dominant patterns in the construction of the AI myth: (1) the recurrence of analogies and discursive shifts, by which ideas and concepts from other fields were employed to describe the functioning of AI technologies; (2) a rhetorical use of the future, imagining that present shortcomings and limitations will shortly be overcome; (3) the relevance of controversies around the claims of AI, which we argue should be considered as an integral part of the discourse surrounding the AI myth. The recognition of these patterns may provide useful hints for examining the rise not only of the specific AI myth, but also of technological myths constructed in other contexts.

The presence of controversies since the early history of AI, in particular, is revealing of the dynamics through which technological myths emerge and proliferate. Pointing to the key role of controversy in fields such as parapsychology, we argue that skepticism and criticism added to AI's capacity of attracting attention and space in scientific debates and in the public arena. The AI myth originated and developed not only as the result of the discourse produced by those who professed to believe in the possibility of building a thinking machine, but rather through a dialogic relationship which involved supporters as well as critics of this vision. The functional role of controversies helps to explain the persistence of the myth, which continues to center on the same overarching questions and tropes characterizing early debates on AI.

By examining each of these patterns in the context of early AI research, this article has three main goals. First, it aims to contribute to a better understanding of the key features of the rise of AI and its cultural impact. Second, it aims to provide a relevant case study for the analysis the rhetorical and discursive strategies accompanying the emergence of technological myths. Third, our analysis also points to the necessity to revaluate claims about the history of AI. In particular, we contrast the simplistic view according to which the rhetoric of the AI myth in popular culture and the public sphere was counteracted by the computer scientists' attempt to provide an accurate image of the potential and the problems of these technologies. We demonstrate, on the contrary, that the basic tenets of the AI myth can be found in the interventions of key researchers of the field, published in magazines such as the *Scientific American* (*SA*) and the *New Scientist* (*NS*).

The remainder of this paper is organised as follows. First, we discuss technological myths as useful frameworks to discuss techno-scientific developments. Second, after having briefly described the usefulness of choosing SA and NS to conduct our survey, we discuss the three main rhetorical and discursive patterns (analogies, projector futures, and controversy) characterizing the emergence of the AI myth since the early 1950s. In the conclusion, we contend that the discourses set in motion by AI represent a powerful technological myth that still deeply influences and shapes the current digital imaginary.

Technological myths

What is a "technological myth," and why do we employ this concept to re-frame the emergence of AI? The term "myth" resonates widely in the foundations of European cultural and media studies, particularly in the intellectual legacy of French semiotician Roland Barthes, who described "modern mythologies" as the dominant cultural ideologies of our time, at the core of our relationship to technology (Barthes, 1957). More recently, Vincent Mosco (2004: 3) stated that "myths are stories that animate individuals and societies by providing paths to transcendence that lift people out of the banality of everyday life." In contemporary societies, these paths are often embodied by technologies such as digital computers and the Internet, pointing us to a "digital sublime." In a similar vein, Dourish and Bell (2011) in their study on ubiquitous computing define technological myths as powerful “organising visions” on how a new technology will fit in the world.

As Mosco underlines, the theoretical advantage in using this term in relation to digital technologies is connected to the fact that, despite the popular pejorative usage of the term “myth,” technological myths are not necessarily untruthful and deceitful. More precisely, their status of truth or falsity does not interfere with their nature of myths. As he puts it, myths “are not true or false, but living or dead” (Mosco 2004: 3). In this sense, it is not important if a belief corresponds or not to reality, but rather what it reveals about the cultural context from which it originated. A living technological myth may have deep effects, even if its tenets turn out to be grossly incorrect. Indeed, this is coherent with the characterization of the AI myth provided by information scientist Hamid Ekbia, who defined it as the “embodiment of a dream–a kind of dream that stimulates inquiry, drives action, and invites commitment, not necessarily an illusion or mere fantasy” (Ekbia 2008: 2).

The fact that popular narratives and representations of technology may or may not correspond to actual events has, as argued elsewhere (Natale 2016: 440-43), an important methodological implication for scholars interested in the study of technological myths: all technological myths have to be taken in consideration and researched in the same way, notwithstanding considerations about their accuracy or truthfulness. To use an expression conceptualized within the history and sociology of science, research into technological myths requires the application of the principle of symmetry, according to which the same type of causes should explain both “true” and “false” beliefs (Bloor 1976).

How does a technological myth become one that affects culture and society? A potential answer to this question lies in the narrative character of myths. Approaches to storytelling (e.g. Cavarero 2000) have shown that one of the characteristic of narratives is its capacity to circulate, following narrative patterns that are repeated again and again. The same applies to technological myths, whose capacity to become influential in specific societies and cultures is closely related to their nature of narrative tropes that are repeated and circulated over and over again, and are used in multiple contexts to represent the functioning, impact and promise of technology (Natale 2016; Ballatore and Natale 2016).

The early history of AI is deeply intertwined with the emergence of a technological myth, centred around the possibility of creating thinking machines by using the tools provided by digital computing. C. Dianne Martin (1993) has discussed a prominent aspect of the imaginary surrounding computers, i.e. the vision of the computer as an "awesome thinking machine." During the early years of the digital revolution, primarily in the 1950s and early 1960s, a large segment of public opinion came to see the emergent computers as "intelligent brains, smarter than people, unlimited, fast, mysterious, and frightening" (Martin 1993: 122). Martin's contention, based on a body of poll-based sociological evidence and content analysis of newspapers, is that mainstream media journalists shaped the public imagination of early computers through misleading metaphors and technical exaggerations. By contrast, according to Martin, computer scientists attempted to counteract this narrative and to exaggerations about the new devices (129). As computers moved into the workplace and into the daily lives of workers in the early 1970s, claims Martin, the myth of the awesome computing machine lost part of its credibility, but still affected a large segment of the American population. Two decades later, although further reduced, the myth was still present, particularly in its negative forms. Yet, Martin's analysis downplays the importance of such myths not only among the general public, but among technologists and researchers in computer science. As a result, the role of the AI field in establishing these beliefs is left unaccounted for, a gap that we fill in the next sections. As we will show, a content analysis of magazines were computer scientists published articles aims at the popular public shows that the myth of AI was animated not only by journalists, but also by researchers who worked within the AI framework.

The construction of the AI myth: A content analysis

As Ortoleva (Ortoleva 2009: 2) notes, technological myths condition not only the perception of technology within the public, but also "the professional culture of those who have produced the technical innovations and helped their development." In this sense, in order to understand the AI myth it is essential to look also at the professional and techno-scientific milieux of technologists beyond the inner circle of AI scientists. For this purpose, we carried out preliminary research on the period of study (1950–1975) to identify significant magazines where the development of the discipline was widely discussed also at a technical level. This thematic inspection was conducted on a sample of articles containing the words *computer*, *cybernetics*, and *intelligence*. As a result we selected two widely-read magazines, the U.S.-based *Scientific American* (SA) and the British *New Scientist* (NS), while we did not identify enough thematic relevance in others, such as *Communications of the ACM* and *Popular Mechanics*.

Although far from comprehensive, this material provides insight on how the results and the promises of AI research were presented to an informed readership. In fact, these magazines were – and still are – aimed at a broad readership of scientists and engineers. Discussing techno-scientific innovation across disciplines, they can be used as a proxy to investigate the visions, fears, desires and fantasies triggered by AI research, and to obtain clues about how an entire society debated the introduction of a new medium. Crucially, these magazines were a platform where key researchers in the AI field published articles aimed at a broader readership than scientific papers, and through which they were able to contribute to wider discussions about the potential and the future of AI.

Our use of these sources follows a methodological proposal for studying the history of media and technology that was developed by media historian Carolyn Marvin. By examining magazines that mainly targeted expert readers and to which professionals and engineers contributed articles and letters, Marvin documented the way these groups, whose ranks included scientists, electrical engineers, but also cadres of operatives from machine tenders to telegraph operators, directed their efforts in the engineering, improvement, and promotion of the new media of their age (Marvin, 1988). A further benefit of employing this approach is that it provides an opportunity for comparison and corroboration with other research in media history and new media studies employing popular scientific magazines as sources to unveil the dynamics of representations and myth-making in the reception of new media. For instance, Vanobberghen (2010) has used Marvin's methodology to explore reactions to the introduction of radio in a Belgian radio amateur magazine. For what concerns digital media, Stevenson (2016) has recently unveiled patterns of myth-making in the examination of what he calls “belief in the new” by looking at how cybercultural magazines *Mondo 2000* and *Wired* contributed to the construction of mythical narratives about Internet and the Web.

Following Marvin’s approach, we undertook a close reading of articles in the *SA* and *NS* that addressed issues and concepts relevant to the AI field, such as cybernetics, systems theory, computational linguistics, operations research, and automata theory. In the case of *SA*, we obtained 1,240 articles from the magazine’s index, while for *NS*, we screened all issues from the first issue of the magazine in 1956 to 1975, identifying about 600 articles. This corpus was then analysed, and about 100 highly relevant articles per magazine were selected for close reading. This thematic analysis led us to identify three recurring themes (analogies, future orientation, and controversies) as central in the corpus across the two magazines.

Beside its strengths, our methodology also has limitations that should be taken into full account. First, it is impossible to identify with precision the readership of *SA* and *NS* across twenty-five years. Yet, although their readership was probably broad and diversified, studies made during the same time frame confirm at least for the case of *SA* that the magazine targeted especially expert readers (Funkhouser 1967). Second, and conversely, since the construction of technological myths is performed within the public sphere, one might wonder if the *SA* and *NS* readership might be instead too limited to account for such phenomenon. Yet, as we pointed out in our discussion of the relationship between technological myths and narrative, technological myths entail the construction of narrative tropes that circulate within a number of contexts in the public sphere (Natale 2016). In this regard, magazines with a strong focus on science and technology constitute useful resources to identify contexts where technological myths are constructed and made available to be repeated and disseminated also in other contexts and through other channels.

Analytic philosopher John Searle proposed a broadly discussed distinction between weak and strong AI. “Strong AI,” in Searle’s view, purports to devise general, human-like intelligence. “Weak AI,” on the other hand, aims at creating highly specialized tools that mimic specific cases of intelligent human behaviour (Searle, 1980). John Haugeland (1985) labelled the Strong AI approach “Good Old-Fashioned Artificial Intelligence” (GOFAI), which dominated the field until the 1970s. While weak AI applications are ubiquitous and go largely unnoticed, the AI myth emerged around the possibility of strong AI. In the magazines considered in our case study, the emergence of AI was discussed as an innovation that promised not only exciting applications, but also drastic changes in the relationship between humans and machines.

The examination of how AI was represented to the readers of *Scientific American* and the *New Scientist* reveals three main patterns that characterized the construction of the AI myth. The first pattern is based on a practice that we propose to call “discursive shift,” by which concepts and ideas from other fields and contexts are used as analogies to describe concepts in AI. The second pattern is based on the construction of a mythical future, by which goals that are not met by AI at its present state are projected into the future, turning the shortcomings of AI research into potential developments. Finally, the third pattern is the recurring presence of controversies about the claims of AI, which, as we will see, played a constitutive and instrumental role in the construction of the AI myth. Let us see more closely how these different patterns and strategies worked and how they informed the representation of AI research within the public sphere.

Discursive shifts and analogies

The first pattern characterizing the construction of the AI myth is the recurrence of discursive shifts by which concepts and categories from other fields and disciplines are adapted to describing the functioning of computing technologies. Hamid Ekbia points out a fundamental tension in AI history between science and engineering. AI pioneers have engaged in engineering, scientific, and discursive practices, through a number of paradigms (Ekbia 2008: 5). The discursive practices entailed linking the workings of engineering artifacts, such as computer programs and automated devices, to broad scientific claims on the human mind, intelligence and behavior, relying on daring analogies between humans, animals, and machines. While the usage of analogies is widespread in scientific discourses and is not unique to this field (Bartha, 2013), it is particularly prominent in the transdisciplinary research approach adopted by AI researchers.

Although some authors trace its foundations to the roots of Western philosophy in a teleological manner (McCorduck, 1979; Russell et al., 2010), AI sprang up in the middle 20th century at the junction of cybernetics, control theory, operations research, psychology, and new-born computer science. American neurophysiologist Warren McCulloch and logician Walter Pitts published in 1943 “A logical calculus of the ideas immanent in nervous activity” (McCulloch and Pitts, 1943), formulating a mathematical model of neural activity. Their theory brought together seminal work in logic by Rudolf Carnap, David Hilbert, Bertrand Russell, and Alfred N. Whitehead, and the computability theories by Alonzo Church and Alan Turing. In 1948, Wiener published “Cybernetics”, a best-selling monograph that widely disseminated the idea of intelligent machines (Wiener, 1948).

In 1950, on the other side of the Atlantic, British mathematician Alan Turing published the paper “Computing machinery and intelligence”, in which he outlined several influential ideas such as natural language processing, machine learning, and genetic computing. This paper also described the much-discussed Turing test, in which the intelligence of a machine is assessed in its ability to produce a plausible conversation indistinguishable from that of a human (Turing, 1950). In this phase, the computer as a metaphor for the mind gained credibility, along with the centrality of information as a core element of reality (Floridi 2008).

While the development of cybernetics is usually associated with the Macy Conferences in New York, the formal birth of AI can be located in another academic conference, the Dartmouth Summer Research Project on Artificial Intelligence, held in 1956 in New Hampshire. The conference was conceived as an attempt to “find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves” (McCarthy, 2006). In this sense, from its inception, AI exhibited the ambitious goal of integrating diverse research areas towards the implementation of human intelligence in general, applicable to any domain of human activity such as language, vision, and problem solving, which fell outside the somewhat narrow scope of control theory and operations research. As a consequence, AI technologies were often described in the *SA* and the *NS* with terms that usually apply to human or animal behavior. This resulted in discursive shifts by which concepts migrated from different contexts through analogical arguments, carrying with them their own cultural associations and meanings, and often resulting in misleading cross-domain translations (Ekbia 2008: 5).

The articles and commentaries published in the *SA* and the *NS* often focused on the analogy between the computer and the brain, and between machines and biological life. In a 1950 article for *SA*, W. Grey Walter noted that “there is an intense modern interest in machines that imitate life,” and even suggested that “engineers who have designed our great computing machines adopted this system without realizing that they were copying their own brains” (Walter 1950: 43). Analogously, the Hungarian-American mathematician John George Kemeny observed that the human brain could be itself compared to a machine. According to his view,

> a normal human being is like the universal machine. Given enough time, he can learn to do anything. (...) (T)here is no conclusive evidence for an essential gap between man and a machine. For every human activity we can conceive of a mechanical counterpart. (Kemeny, 1955)

The comparison between artificial and biological life could go so far as to include elements of humanity that surpassed the boundaries of mere rational thinking, to include feelings and emotions. In 1971, for instance, an article in the *NS* was titled “Japanese Robot Has Real Feeling.” By reading the article with more attention, one could understand that the matter of the experiments was not so much human emotions, but rather the capacity of a robot to simulate tactile perception by gaining information about an object through contact (Anon., 1971). Playing with the semantic ambiguity of the words feeling/feelings, and alluding to human emotions well beyond basic tactile stimuli, the author added a considerable amount of sensationalism to his report. Other common attempts to anthropomorphize computers and robots were based on references to children, whose behaviour and learning strategies were regarded by some as a promising way to address the question of how a computer could learn through experiences and trial-and-error (Robertson 1975; see also Selfridge & Neisser 1960). Similar discursive shifts appear often in many other reports on AI research published in the *SA* and the *NS*, the most common being the idea that machines can "think," which ultimately turned the focus from computing technologies to the discussion of psychological issues, such as what does it mean to think or to perceive (e.g. Selfridge & Neisser 1960; Kemeny 1955; Walter 1950). Concepts from fields such as medicine (Anon., 1960), developmental psychology (Robertson, 1975) and biology (Moore, 1964), among other fields, were appropriated and absorbed into the AI discourses.

As studies in the history of technology have shown, the construction of semantic fields is often instrumental in the constructions of disciplinary fields and communities of researchers that work under a common paradigm (Kline, 2006; Oldenziel, 2006). As observed by Ruth Oldenziel (2006: 478), "words serve as weapons to frame the social realities in which some communities are invited to participate and others are not." The introduction and adaptation of new concepts helps in the creation of shared meaning that is entailed in boundary work (Gieryn, 1983). In the case of AI, discursive shifts that employed concepts and keywords from different contexts provided ground for the creation of shared meaning within the communities of scientists and engineers involved in AI research. The analogies blurred the boundary between the human mind and machines, contributing to the emergence of particular expectations and imaginaries regarding the future of AI.

Projecting the future

The second pattern characterizing the construction of the AI myth is the strong reliance on claims about future developments of the field. Predictions and visions of the future are one of the main ways in which mythical ideas about technologies substantiate into particular cultural and social imaginaries (Natale, 2014). As historians of technology have shown, future-oriented discourse in techno-scientific environment may contribute to shift the emphasis from the present state of research towards an imagined prospect in which the technology will be successfully implemented. Such "sociotechnical projectory" contributes to create a community of researchers, introducing a shared objective or endpoint that informs and organizes the work of scientists, technologists and engineers involved in such community (Messeri and Vertesi, 2015).[1]

In the case of AI research, the call to future developments was a common staple by which present shortcomings in the applications of AI research were redirected towards a

[1] The case of Moore's Law is a good example within the field of computer science for the ways projections of future accomplishments may also act as an incitation for specific research communities to project their expectations towards certain standards and, interestingly, also within defined boundaries. See, among others, Brock and Moore (2006).

seemingly proximate future in which these failings would be overcome. Numerous articles in *SA* and *NS* explicitly addressed future developments: writers reported on the potential applications of AI in fields such as transportation (Glanville, 1964; Lighthill, 1964), robotics (Taylor, 1960), and medicine (Anon., 1960), among many others. Predictions often included estimates about the lapse of time required to the development of new fields of applications: for instance, Glenville (1964: 684) was confident that "the control by a single computer of the road traffic in the busier parts of our cities" would be "without doubt, be in operation within twenty years." Even when current research was presented, contributors frequently highlighted their impact in terms of future opportunities. In discussing the results of his research, for instance, the director of the Department of Machine Intelligence at Edinburgh University Donald Michie acknowledged that "no single technique is going to bring about magic transformation," but at the same time suggested that "the consequences of effective methods for representing chess knowledge could be great" (Michie 1972: 371-72).[2]

The initial swift achievements in several areas characterised what AI historian Crevier (1993) defined the 'golden years' of AI. Such encouraging short-term advances brought with them predictions about the development of this field that were exceedingly optimistic, fuelling the plausibility of the myth of AI. Formal games, such as checkers and chess, provided a fertile test bed for AI applications. Since 1952, Arthur L. Samuel at the IBM research department had been working on a program that was able to learn how to play checkers, choosing promising moves based on a heuristic score of the

[2] On the role of computer chess software in shaping research agendas and expectations within the AI community, see Ensmenger (2012).

pieces positions on the board (Samuel, 1959). Associated with high intelligence in popular culture, chess attracted notable contributions from leading AI scientists (Newell et al., 1958). In an article published in the *NS*, Donald Michie dedicated a section to the topic of “the future,” in which he attempted to examine the prospective improvements in the methods to reproduce expert knowledge in chess (Michie, 1972). Others speculated that writing chess programs might result in the future in a better understanding of how a human brain actually works (Zobrist and Carlson, 1973). Eventually, as an article in the *SA* pointed out as early as 1952, the application of research on games could open the way for “future automatic machines which will make decisions in business and military operations” (King, 1952: 147). Yet, in the early seventies, an article in the *NS* had to admit that, despite some encouraging progress, a conference held in Britain had proved that there was still a long time to go before a computer capable of beating an international chess master could be designed (Anon., 1973). It was only in 1996 that a chess computer program, Deep Blue, succeeded to win an established grandmaster, Garry Kasparov (Campbell et al., 2002).

Predictions about the future were not only a way to imagine the potential of AI research, but also a specific area of technological development within the field. In 1958, the *NS* reported about the possibility of using computers that could make effective forecasts. Although many improvements in this context have been effectively made in the subsequent decades, the article suggested practical applications that were to be developed yet. As the magazine reported, the Russian scientist Leonid Krushinski had claimed to have discovered a new type of reflex, whose study “would help mathematicians to create machines capable of effecting forecasts on a scale inaccessible to the human brain" (Anon., 1958). Some years later, the magazine also dedicated a long series of articles to technological forecasting, collected under the science-fiction-like title of "The World in 1984." In this context, the examination of many predictions, such as how roads and traffic (Glanville, 1964) or the aviation network (Lighthill, 1964) would be twenty years later, emphasised the potential of the use of intelligent computers to perform duties usually executed by human workers. Further subjects of prediction focusing on AI-related technologies included the applications of automation in the farming industry (Morgan, 1961), the designing of techniques to mechanize haute couture (Macqueen, 1963), and the construction and workings of an intelligent chemical plant (Ridenour, 1952). In 1960, an article pointed out that AI might even help discover a cure for cancer. This hopeful claim was based on the consideration that "cancer could be defined, cybernetically, as an error in the controlling system; that is to say, as misinformation or an error in a feedback system" (Anon., 1960).

It is interesting to note that, similarly to the discursive shifts discussed above, this second pattern also entails a shift between different contexts: the results of AI research are in fact moved forward from the horizon of the present to the horizon of the future. This rhetorical move, which often characterizes techno-scientific research in new and promising areas (Borup et al., 2006), is a recurring pattern of the way AI research was represented in magazines such as the *SA* and the *NS* during the period examined. The construction of the AI myth involved an act of conceptual shift by which concepts and ideas from different fields were translated and applied to the description of AI research, or results in AI research were moved from the examination of the present state towards the imagination of future horizons and developments.

The role of controversies

The third main pattern emerging from our analysis of the construction of the AI myth in the pages of the *NS* and the *SA* is the strong presence of controversies regarding the claims of (strong) AI. Since at least the early 1960s – in a period of prevailing optimism regarding the prospects of AI – skeptics and critics actively challenged the community, rejecting optimistic predictions as groundless and pointing to the conceptual problems surrounding the core tenets of AI (Moore, 1964; Ulam, 1964). In both the *NS* and the *SA*, enthusiastic claims about the potential of AI technologies came hand in hand with critical interventions. Researchers were particular skeptical or nuanced about the possibility that a computer might equal the functioning of a human mind, mainly because of technical limitations (e.g. Voysey 1974; Albus & Evans 1976). American physicist Louis N. Ridenour calculated that, given the present state of computer technology, if a vacuum-tube as complex as the brain was made, it would require “a skyscraper to house it, the power of Niagara to operate it and the full flow of water over the falls to keep it cool” (Ridenour, 1951: 17). Researchers also realized very early after the emergence of the AI field that the dream of a thinking machine had started much before the development of cybernetics, but had not delivered convincing results thus far (Moore, 1964). Concerns about the possible consequences of automation in fields such as labour were also expressed, pinpointing the ethical and social problems involved in the applications and developments of AI (Voysey, 1975).

This tendency to invite controversies and criticism did not abandon the field throughout its development. At different times, authors, commentators, and scientists embraced, qualified or rejected the AI myth. In the inner circle of AI research, although a certain consensus on the core tenets of the discipline existed, critics rejected the assumptions of the discipline as simplistic and philosophically naïve (e.g. Taube 1961). As early AI projects relied on abstract, disembodied symbol processing, carried out through formal languages, the lack of a physical and perceptual dimension to ground reasoning was soon identified by AI critics as one of its main methodological flaws. Notably, phenomenologist and Heideggerian scholar Hubert Dreyfus launched open attacks on AI, which resulted in his ostracism from the research community (Dreyfus 1965, 1992). Between the absolute belief in the AI myth of Minsky and Dreyfus' radical scepticism, a spectrum of fluid and nuanced positions existed. While some rejected the central metaphor of the brain as a computer as unsound, other scientists still accepted the possibility of strong AI (Lighthill, 1973).

How can we reconsider the role of controversies in the construction of the AI myth? Historians of AI have most often privileged a "rise and fall" narrative to describe the rise of the paradigm in the 1950s-1960s and its apparent demise in the following two decades (Crevier, 1993; Russell et al., 2010). According to this established narrative, as AI researchers obtained early successes, unrealistic expectations spread and sustained the belief that fully-fledged thinking machines were on the verge of being created. The hype hit its peak in the late 1960s. At the beginning of the 1970s, the gap between the real outcomes of AI research and the wild visions of thinking machines resulted in the so-called "AI winter," damaging the credibility of AI enthusiasts, and resulting in a general loss of credibility and funding. The narrative of hype and disillusionment, while adequate with respect to research funding cycles, fails to adequately capture how the AI myth has always been ─not only during or since its "winter," but also during its "golden age" and in the most recent developments─ a field characterized by a high degree of controversy around the question if a thinking machine is possible or not. Criticism was not or, at least, not only a consequence of the hype; it was an element that entered into and shaped the AI myth since its very beginning. Rather than framing controversies within a rise-and-fall narrative, we might therefore interrogate if and to what extent they were a functional and integral component to the construction of the AI myth. Indeed, although scientific controversies are often regarded as an element that hinders the development of a scientific theory or field (Besel, 2011; Ceccarelli, 2011), scholars in history of science and technology ─most notably, Thomas Gieryn (1983) and, within the Social Construction Of Technology (SCOT) framework, Trevor Pinch and Wiebe Bijker (1987)─ have underlined the functional character of controversies in scientific and technological innovations (see also Engelhardt & Caplan 1987). Adopting a similar approach may be useful to comprehend how controversies have been a structural component of the AI field.

The myth of the thinking machine emerged as a body of claims, theories and technologies that constitutionally invited skepticism and criticism. Historians of AI have sometimes argued that the heightened tendency to stimulate controversies was engrained in the very name given to the discipline. Russell et al. (2010) suggests that the term "Artificial Intelligence", coined by John McCarthy in 1955, contributed to heighten expectations to an unhealthy degree, explicitly setting the target of an artificial human-like intelligence.

Extensive and apparently endless controversy, observable throughout the history of the AI, also characterizes other highly debated contexts, including parapsychology, a field of inquiry concerned with the investigation of so-called “paranormal” phenomena.[3] Addressing the case of fringe science, sociologist of science David J. Hess proposes that parapsychologists and their opponents are not mere antagonists, but rather participants in a wider discourse whose very existence is based on the incessant controversy that surround paranormal phenomena. He notes that skepticism is constantly evoked not only by the ones who criticize the irrationalism of fringe science, but by the parapsychologists themselves, who proclaim their skepticism against the corporate world, official science, the medical establishment, as well as against the claims made by other parapsychologists, New Agers, or spiritualists. In a context where “scientists engage in boundary-work to distinguish science from nonscience, but also (…) a variety of other groups construct boundaries (and consequently themselves as groups) not only with respect to more orthodox scientists and skeptics but with respect to each other,” controversies provide the ground and the condition for existence of the field (Hess 1993: 145).

Looking at the case of how religious beliefs are assessed and challenged in the public arena may also provide useful interpretative tools for addressing the role of controversies in technological myths. Indeed, Robert Geraci (2008) has argued for the

[3] It is worth noting, in this regard, that some strands of AI, such as singularity, have been often regarded by ritics as pseudo-science, not differently from parapsychology.

presence of striking resemblance between the AI myth and religious thinking. Studies in religion and media studies have shown that religious belief and practices not only coexists with skepticism, but may even require it (Taussig, 1998; Walker, 2013). Although science is, of course, very different from religion, the way beliefs are simultaneously invited and challenged in such contexts may provide useful keys to an understanding of how beliefs in scientific theories can be characterized by similar dynamics. It is, in fact, within a dialectic that the AI myth emerged and progressed, grounded in the incessant dispute between its opponents and its supporters.

As we noted at the beginning of this paper, technological myths are defined by their capacity to be present and pervasive in a particular society and culture (Mosco, 2004). In this sense, controversies are an integral and important part of the myth of the thinking machine because they contribute to its liveliness, to its capacity of attracting attention and space in scientific debates and the public arena. The controversy on AI was inflated and reinforced in the public sphere by the mass media. Jason Delborne (2011) has convincingly argued that scientific controversies are a context through which specific paradigms, theories and fields construct their audience within the scientific world as well as in the public and popular arena. Partly exploiting the allure of the limelight for scientists, the popular press shaped through sensationalistic representations of AI projects the popular perception of digital computers as “Electronic Super Brains”, even “faster than Einstein” (Russell et al. 2010: 9). This tendency is evident also in the pages of popular science magazines such as *NS* and *SA*, where controversy was one of the key ways through which the AI myth was discussed, assessed, and ultimately constructed.

Conclusion: The rise and persistence of the AI myth

The analysis presented in this article contributes to the study of the imaginary around digital technologies by framing the emergence of AI technologies as a technological myth. Indeed, it is difficult to comprehend the present cultural significance of computing technologies without considering the impact of AI, which dominated a crucial period of their development between the 1950s and the 1970s. Yet, the myth of AI did not cease to exercise a strong impact after this period, as the narrative of "AI winters" implied. In fact, this myth continues to characterize several aspects of the contemporary imaginary connected to new media technologies. Whilst the myth seemed to have exhausted its credibility in the 1970s, it was not, by any means dead, and AI has survived many winters, finding new surprising avenues and manifestations. While much recent scholarship in new media studies has mostly focused on the web as the leading technological myth of our age (Flichy, 2007), the symbolic and imaginative importance of the computer as a machine that replicates the human mind in our present day is still one of the dominant aspects within the narrative of "new media."

On the one hand, new computing approaches and technologies re-ignited the hope to implement general intelligence and attracted research funding. The wave of "expert systems" in the 1980s generated viable and profitable applications, but at the same time fostered novel expectations about AI. In the same decade, the Japanese launched a new 10-year plan to build intelligent machines called the "Fifth Generation" project, followed by equivalent American and British efforts, which all failed (Russell et al. 2010: 24-25). Neural networks also experienced a re-birth, generating the so-called “connectionist” approach to AI as a major alternative to symbol manipulation. In more recent decades, availability of large amounts of data and major increases in computing power and storage triggered remarkable advances in the areas of data mining, machine learning, and natural language processing, developing earlier AI methods into successful research paradigms.

On the other hand, the myth of AI still exerts its influence well beyond the technical sphere, and is an essential component to a strand of philosophy called “transhumanism,” whose principal tenet is the possibility of enhancing the human condition with advanced technologies, and that has been particularly influential among computer technologists since the 1980s (Hayles, 1999). Following Minsky’s speculations, robotician Hans Moravec envisages that human life will be superseded by intelligent machines by 2040 (Moravec, 1988). Futurist Raymond Kurzweil has developed the theory of Technological Singularity, a moment in which AI will have overcome human capabilities (Kurzweil, 2005). Extrapolating from alleged exponential advances in information technology, Kurzweil imagines an impending radical change in civilization, when intelligent machines will merge with humans to unleash unprecedented possibilities. More recently, philosopher Nick Bostrom has been discussing the risks of super-intelligent agents emerging from AI research (Bostrom, 2012). Robert M. Geraci has aptly named this strand of dystopian beliefs “Apocalyptic AI,” showing that the thinking machines promised by AI provided fertile ground to re-cast religious dreams of purity, perfection, and immortality, auspicating the “victory of intelligent computation over the forces of ignorance and inefficiency,” reaching computer-generated heavens (Geraci, 2008).

Whilst Apocalyptic AI is indeed the most radical manifestation of the myth, the myth of AI resurfaces in utopian undertones of more moderate theories. The spread of personal computing and networking fuelled a plethora of new technological myths which re-cast the myth of AI in novel forms dominated by the idea of network-based collective intelligence. What has not occurred on the large and clumsy mainframes of the mid-20th century will occur in the context of ubiquitous computing and the densely connected communication networks on the 21st century. In this strand of “networking AI,” authors follow the utopian visions fostered by previous advances in telecommunications, and consider the Internet as the final stage of human interconnectedness, in which interactions between individuals and machines increase collective intelligence to unprecedented levels. The web is seen as a “global brain” which can bring humans to a new level of consciousness (Heylighen, 2004). Media theorist Pierre Lévy acknowledges the limitations of traditional AI, and proposes to transform the current “opaque global brain” into a collective “Hypercortex” (Levy, 2011).

The three patterns that we have identified as characterizing the construction of the AI myth on the *SA* and *NS* in the 1940s-1970s emerge distinctly in contemporary versions of the AI myth, too. Discursive shifts continue to epitomize the way AI-related research is inserted into a wider imagination that tends to humanize technology as well as to connect it with superhuman or even supernatural powers (El Kaliouby and Robinson, 2004). Likewise, the rhetorical shift from the examination of the present state towards the imagination of future horizons and developments still characterizes contemporary AI myths.[4] Finally, the controversies about the possibility of creating "intelligent machines" is still much living, as the extent of contemporary debate about the possibility of AI demonstrates.

Our examination of the AI myth, therefore, is also meant as an encouragement to give more emphasis to the way this cultural vision reverberates in contemporary discourses on digital technology and culture. Technological myths that play today a paramount role in the discussion of digital media and culture, such as transhumanism and singularity, derive much of their claims and tenets from the discourse which emerged in the 1940s-1970s in connection to research on AI. Furthermore, the myth of AI finds fertile ground in the dream of collective intelligence, in which the idea of the thinking machine interacts and is combined in many ways to the imaginary of networked communication and the Web (Flichy, 2007). This imaginary is largely based, just like the AI myth emerged in the post-war period, on the recurrence of three distinctive patterns: the use of ideas and concepts from other fields and contexts to describe the functioning of AI technologies, the mingling between examination of present research results with the imagination of potential future applications and horizons of research, and the strong relevance of controversies in public discussions of the concept and its application.

As Park, Jankowski and Jones observe, "the history of new media presents us with something more significant than merely another opportunity to see familiar distinctions being reasserted"; it also provides us with new insights to look at the

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[4] See, among many possible instances, the numerous articles on AI-related technologies which appeared in the "Future Thinking" columns featured in the BBC's website (http://www.bbc.com/future/columns/future-thinking).

present configurations of digital culture (Park et al. 2011: xi). The important role played by the myth of AI offers relevant insights to better understand how technological myths contribute to shape the social presence of today's digital media.

Reference list

Albus JS and Evans JM (1976) Robot Systems. *Scientific American* 234: 76–86.

Anon. (1958) Another type of reflex? *New Scientist* 3(69): 32.

Anon. (1960) Cancer and cybernetics. *New Scientist* 8(205): 1078.

Anon. (1971) Japanese robot has real feeling. *New Scientist* 52(773): 90.

Anon. (1973) Computer vs grand masters. *New Scientist* 58(848): 567.

Ballatore, A and Natale S (2016) E-Readers and the Death of the Book: Or, New Media and the Myth of the Disappearing Medium. *New Media & Society* 18(10): 2379–2394.

Ballatore, A (2014) The myth of the Digital Earth between fragmentation and wholeness. *Wi: Journal of Mobile Media* 8(2): 1–20.

Bartha P (2013) Analogy and analogical reasoning. In: Zalta EN (ed.), *The Stanford Encyclopedia of Philosophy*, Stanford, Calif.

Barthes R (1957) *Mythologies*. Paris: Editions du Seuil.

Besel RD (2011) Opening the 'Black Box' of climate change science: actor-network theory and rhetorical practice in scientific controversies. *Southern Communication Journal* 76(2): 120–136.

Bloor D (1976) *Knowledge and social imagery*. London, UK: Routledge.

Boddy W (2004) *New media and popular imagination: Launching radio, television, and digital media in the United States*. Oxford: Oxford University Press.

Borup M, Brown N, Konrad K, et al. (2006) The sociology of expectations in science and technology. *Technology Analysis & Strategic Management*, Routledge 18(3-4): 285–298.

Bostrom N (2012) The superintelligent will: Motivation and instrumental rationality in advanced artificial agents. *Minds and Machines* 22(2): 71–85.

Brock DC and Moore GE (2006) *Understanding Moore's law: four decades of innovation*. Chemical Heritage Foundation.

Campbell M, Hoane AJ and Hsu F (2002) Deep blue. *Artificial intelligence* 134(1): 57–83.

Cavarero A (2000) *Relating narratives: Storytelling and selfhood*. London, UK: Routledge.

Ceccarelli L (2011) Manufactured scientific controversy: Science, rhetoric, and public debate. *Rhetoric & Public Affairs* 14(2): 195–228.

Corn JJ (1986) Imagining Tomorrow: History, Technology, and the American Future. Cambridge, Mass.: MIT Press.

Crevier D (1993) *AI: The Tumultuous History of the Search for Artificial Intelligence*. New York, NY: Basic Books.

Delborne JA (2011) Constructing audiences in scientific controversy. *Social Epistemology* 25(1): 67–95.

Dourish P and Bell G (2011) *Divining a digital future: Mess and mythology in ubiquitous computing*. Cambridge, Mass.: MIT Press.

Dreyfus HL (1965) *Alchemy and Artificial Intelligence*. Santa Monica, CA: Rand Corporation.

Dreyfus HL (1992) *What Computers Still Can’t Do: A Critique of Artificial Reason*. Cambridge, MA: MIT Press.

Ekbia HR (2008) *Artificial dreams: The quest for non-biological intelligence*. Cambridge: Cambridge University Press.

El Kaliouby R and Robinson P (2004) Mind reading machines: Automated inference of cognitive mental states from video. In: *2004 IEEE International Conference on Systems, Man and Cybernetics*, IEEE, pp. 682–688.

Engelhardt HT and Caplan AL (1987) *Scientific controversies: Case studies in the resolution and closure of disputes in science and technology*. Cambridge: Cambridge University Press.

Ensmenger N (2012) Is chess the drosophila of artificial intelligence? A social history of an algorithm. *Social Studies of Science* 42(1): 5–30.

Flichy P (2007) *The Internet Imaginaire*. Cambridge, Mass.: MIT Press.

Floridi, L (2008) Artificial intelligence’s new frontier: Artificial companions and the fourth revolution. *Metaphilosophy* 39(4–5): 651–655.

Funkhouser G R (1969) Levels of science writing in public information sources. Journalism quarterly 46(4): 721-726.

Geraci RM (2008) Apocalyptic AI: Religion and the Promise of Artificial Intelligence. *Journal of the American Academy of Religion* 76(1): 138–166.

Gieryn TF (1983) Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. *American sociological* *review* 48(6): 781–795.

Glanville W (1964) Roads and traffic in 1984. *New Scientist* 22(395): 684.

Haugeland J (1985) *Artificial Intelligence: The Very Idea*. Cambridge, MA: MIT Press.

Hayles NK (1999) *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics*. Chicago, Ill.: University of Chicago Press.

Hess DJ (1993) *Science in the New Age : the paranormal, its defenders and debunkers, and American culture*. *Science and literature*, Madison, Wis.: University of Wisconsin Press.

Heylighen F (2004) Das Globale Gehirn als neue Utopia. In: Maresch R and Rötzer F (eds), *Renaissance der Utopie: Zukunftsfiguren des 21. Jahrhunderts*, Suhrkamp: Frankfurt am Main, pp. 92–112.

Kemeny JG (1955) Man viewed as a machine. *Scientific American* 192: 58–67.

King GW (1952) Information. *Scientific American* 140: 132–148.

Kline RR (2006) Cybernetics, Management Science, and Technology Policy: The Emergence of ‘Information Technology’ as a Keyword, 1948-1985. *Technology and Culture*, The Johns Hopkins University Press and the Society for the History of Technology 47(3): 513–535.

Kurzweil R (2005) *The Singularity Is Near: When Humans Transcend Biology*. London: Penguin books.

Levy P (2011) *The Semantic Sphere 1: Computation, Cognition and Information Economy*. Wiley-ISTE.

Lighthill J (1973) Artificial intelligence: A general survey. In: *Artificial Intelligence: A Paper Symposium*, UK: Science Research Council.

Lighthill MJ (1964) Aviation in 1984. *New Scientist* 22(395): 328–330.

Macqueen KG (1963) Cybernetics and haute couture. *New Scientist* 17(328): 450–452.

Martin CD (1993) The myth of the awesome thinking machine. *Communications of the ACM* 36(4): 120–133.

Marvin C (1988) *When Old Technologies Were New: Thinking about Electric Communication in the Late Nineteenth Century*. New York: Oxford University Press.

McCarthy, J (2006) A proposal for the Dartmouth Summer Research Project on Artificial Intelligence, August 31, 1955. *AI Magazine* 27(4): 12–14.

McCorduck P (1979) *Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence*. San Francisco, CA: W.H. Freeman.

McCulloch, WS and Pitts, W (1943) A logical calculus of the ideas immanent in nervous activity. *Bulletin of Mathematical Biology* 5(4): 115–133.

Messeri L and Vertesi J (2015) The Greatest Missions Never Flown: Anticipatory Discourse and the‘ Projectory’ in Technological Communities. *Technology and Culture* 56(1): 54–85.

Michie D (1972) Programmers’ gambit. *New Scientist* 55(809): 32–329.

Moore EF (1964) Mathematics in the biological sciences. *Scientific American* 211: 148–164.

Moravec H (1988) *Mind children*. Cambridge Univ Press.

Morgan K (1961) The future of farm automation. *New Scientist* 11(251): 581–583.

Mosco V (2004) *The digital sublime: Myth, power, and cyberspace*. Cambridge, Mass.: MIT Press.

Natale, S (2016) Unveiling the Biographies of Media: On the Role of Narratives, Anecdotes and Storytelling in the Construction of New Media's Histories. *Communication Theory* 26(4): 431-49.

Natale, S (2014) Introduction: New media and the imagination of the future. *Wi: Journal of Mobile Media* 8(2): 1–8.

Natale, S and Balbi G (2014) Media and imaginary in history: The role of the fantastic in different stages of media change. *Media History 20*(2): 203–218.

Newell A, Shaw JC and Simon HA (1958) Chess-playing programs and the problem of complexity. *IBM Journal of Research and Development* 2(4): 320–335.

Oldenziel R (2006) Introduction: Signifying Semantics for a History of Technology. *Technology and Culture*, The Johns Hopkins University Press and the Society for the History of Technology 47(3): 477–485.

Ortoleva P (2009) Modern mythologies, the media and the social presence of technology. *Observatorio (OBS) Journal* 3(1): 1–12.

Park DW, Jankowski N and Jones S (2011) The long history of new media: Technology, historiography, and contextualizing newness. *Digital formations*, New York: Peter Lang.

Pinch TJ and Bijker WE (1987) The social construction of facts and artifacts: Or how the sociology of science and the sociology of technology might benefit from each other. In: Bijker WE, Hughes TP, and Pinch TJ (eds), *The social construction of technological systems: New directions in the sociology and history of technology*, Cambridge, Mass.: The MIT Press, pp. 17–50.

Ridenour LN (1951) A revolution in electronics. *Scientific American* 185: 13–17.

Ridenour LN (1952) The role of the computer. *Scientific American* 187: 116–130.

Robertson M (1975) What computer can learn from children. *New Scientist* 68(974): 210–211.

Russell SJ, Norvig P and Canny JF (2010) *Artificial Intelligence: A Modern Approach*. Saddle River, NJ: Pearson Education.

Samuel AL (1959) Some studies in machine learning using the game of checkers. *IBM Journal of Research and Development* 3(3): 210–229.

Searle JR (1980) Minds, brains, and programs. *Behavioral and Brain Sciences* 3(3): 417–457.

Selfridge OG and Neisser U (1960) Pattern recognition by machine. *Scientific American* 203: 60–68.

Stevenson M (2016) The cybercultural moment and the new media field. *New Media & Society* 18(7): 1088–1102.

Sturken M, Thomas D and Ball-Rokeach S (2004) Technological Visions: The Hopes and Fears That Shape New Technologies. Philadelphia: Temple University Press.

Taube M (1961) *Computers and common sense: The myth of thinking machines*. New York: Columbia University Press.

Taussig M (1998) Viscerality, Faith, and Skepticism: Another Theory of Magic. In: Dirks NB (ed.), *In Near Ruins: Cultural Theory at the End of the Century*, Minneapolis: University of Minnesota Press, pp. 221–256.

Taylor WK (1960) Adaptive robots. *New Scientist* 8(202): 846–848.

Turing, A (1950) Computing machinery and intelligence. *Mind* 59(236): 433–460.

Ulam SM (1964) Computers. *Scientific American* 211: 202–216.

Vanobberghen W (2010) The Marvel of Our Time. *Media History* 16(2): 199–213.

Voysey H (1974) Programming without programmers. *New Scientist* 63(910): 390–391.

Voysey H (1975) Slaves to a computerised task-master. *New Scientist* 68(980): 684–685.

Walker D (2013) The Humbug in American Religion: Ritual Theories of Nineteenth-Century Spiritualism. *Religion and American Culture: A Journal of Interpretation* 23(1): 30–74.

Walter WG (1950) An imitation of life. *Scientific American* 182: 42–45.

Zobrist AL and Carlson FR (1973) An advice-taking chess computer. *Scientific American* 228: 92–105.