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15. Artificial intelligence and social memory: towards the cyborgian remembrance of an advancing mnemo-technic

Samuel Merrill

INTRODUCTION

As the introductions to countless journal papers, books and newspaper articles repeat, a renewed interest in artificial intelligence (AI) is changing everything. This 'hype' is not only the result of actual advances in AI systems but is also down to the marketing efforts of those big tech companies that have recently sought to explore what AI can do with the huge amounts of data and computational resources that they have consolidated over the last decade (see Whittaker 2021). At the same time as these industrial AI systems are marketed as having the potential to solve the complex challenges currently facing human society, critical scholars have increasingly noted that they attract new problems. For instance, Meredith Whittaker, co-founder, and director of the *AI Now Institute*, which was founded in 2017 to study the social implications of AI, recently warned:

> This is a perilous moment. Private computational systems marketed as artificial intelligence (AI) are threading through our public life and institutions, concentrating industrial power, compounding marginalization, and quietly shaping access to resources and information. (2021)

Spearheaded by the likes of Whittaker and many others, a new interdisciplinary research agenda is emerging concerned with the critical analysis of AI systems and their impact on many different realms of public life (see Verdegem 2021a; and this *Handbook*). However, within this agenda, little has been written on AI and social memory. This is the case even though society's increasing mediatization, digitalization, and datafication and the growing use of AI systems to learn from the products of these processes is rendering more and more of our everyday lives memory-related or 'mnemonic' (Merrill Forthcoming). In other words, in a thoroughly mediatized, digitalized, and datafied society, concerns relating to AI-controlled access to information are also essentially concerns about AI-controlled access to memory (see Merrill Forthcoming; Chun 2008). We now not only live in an *information society* but also a *memory society* and thus we need to think and talk about memory as much as information.

In this chapter, I begin to address this contention by conceptually exploring AI's relationship with social memory from the perspectives of first, the social sciences and humanities via the interdisciplinary field of memory studies, and second, of those disciplines more traditionally associated with AI research and development including computer science. I start by briefly defining social memory and positioning AI systems as mnemonic technologies. Thereafter I discuss how memory has primarily been conflated with storage within AI research and development before suggesting the alternative conflation of computation to remembrance to move towards a more integrated and hybrid understanding of social memory in the AI era.

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Finally, after noting social memory studies' predominantly instrumentalist understanding of mnemonic technologies and drawing on the works of Donna J. Haraway and Bernard Stiegler, I introduce the concepts of *cyborgian remembrance* and *AI mnemotechnics* as possible ways to grasp the complex relationship between AI and social memory. I conclude the chapter by briefly indicating how such concepts can help decenter human memory in ways that might better facilitate the critical analysis of the challenges and risks associated with AI's increased influence in matters of social memory, and highlighting some of these challenges and risks as potential foci for future, empirically orientated research.

SOCIAL MEMORY AND MNEMONIC TECHNOLOGIES

While better perceived as an array and combinations of technologies and data-centric techniques than as a single technology (see Whittaker 2021), AI and the systems and intelligent agents that underpin it represent one of the latest in a long line of technological developments that have had implications for what is often referred to as 'social memory'. The concept of social memory, like that of 'collective memory', conveys that all individual remembering is also 'in some sense social' insofar as it is, for example, influenced by different social frameworks and shared technologies (Olick 1999, 346; see also Halbwachs 1992).[1] Social memories are subsequently as diverse and pluralistic as the groups and institutions within society. As such, social memory is 'an important issue in the struggle for power among social forces' (Le Goff 1992, 54) and has become a significant focus of critical scholarship concerned with 'what a society remembers, how a society's memories are contested and change over time, and which societal groups have control over the production of memory' (Merrill 2017, 28). Within memory studies, it is thus common to distinguish between official, dominant forms of social memory and the forms of counter-memory that challenges these (see Olick & Robbins 1998). It is also possible to broadly divide much of this field's scholarship into two camps (Olick 1999). The first of these has been primarily interested in 'collected memory' – 'aggregations of socially framed individual memories' (Olick 1999, 333) – and has placed focus on the organic memories of the human brain and the psychological, neurological and cognitive factors that influence these memories. The second camp has been more interested in those memories that are 'collective sui generis' (Olick 1999, 333), including those supported by mnemonic technologies external to the brain.

Mnemonic technologies (also referred to as technologies of memory) hinge on the exteriorization of individual memory through various types of documentation and media including those related to writing, images, bodies and places (see Assmann 2011; Olick 1999). These technologies have developed over time, with different sorts of social organization coming to rely on different mnemonic technologies (Olick 1999). For instance, in a Western context, the French historian Jacques Le Goff (1992), building on others' work, discussed five periods of social memory characterized chiefly by differing extents of oral and written memory transmission. These periods are as follows: a pre-literate period associated primarily with orality and embodied memory practices; second, the transition from prehistory to antiquity and the

[1] 'Cultural memory' is a broadly similar concept but is more concerned with the cultural representation of the past and has a disciplinarily lineage rooted more in the humanities than in the social sciences (see Erll 2012).

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emergence of writing; third, a medieval phase characterized by an equilibrium between oral and written memory; fourth, the period from the Renaissance until the mid-20th century that constituted a gradual memory revolution involving the increasing written exteriorization of individual memory commencing with the invention of the printing press leading to the birth of nationally orientated institutions like archives, libraries and museums; and finally thereafter, a more rapid memory revolution brought on, in part by the rise of electronic, or digital, 'means of recording and transmitting information which not only change the way we remember, but provide new ways of conceptualizing memory' (Le Goff 1992; Olick & Robbins 1998, 115).

Society today is characterized by a plethora of mnemonic technologies and media including those that are text-based but also, following 19th- and 20th-century advances in photographic, film and sound recording technology, those that are image- (still and moving) and audio-based. Each of these technologies – whether they exteriorize memories in artworks, books, newspapers, maps, photographs, songs, movies, television shows or tweets (etc.) and whether they are based on print, analogue, broadcast or digital logics – create social memory insofar as they allow for memories to become 'prosthetic' (Landsberg 2004): 'disseminated across time and space and adopted by groups and individuals besides those who experienced them in their authentic, original settings' (Merrill 2017, 35). All these technologies have broadened the spread of prosthetic memories, but it is fair to say that those that are digital in character have done so to an extent and at a rate never before witnessed – hence a new memory revolution. This digital memory revolution shows little sign of slowing as new and rapidly developing digital mnemonic technologies including laptops, mobile phones, internet and social media platforms, and even more recently augmented and artificial reality technologies, reformulate social modes of remembering. Subsequently, digital technologies and their associated platforms have become a key focus for a new wave of social memory research that has stressed how the globalization and digitalization of society have created new 'globital memory fields' (Reading 2011) and 'memory ecologies' (Brown & Hoskins 2010) through which producers and consumers of memories have become blurred and memories are prosthetically shared in a more rapid and multitudinous manner (Hoskins 2017). The strength of these research currents has been indicated by the emergence of the subfield of digital memory studies within which the concept of 'connective memory' – as indicating the relational and multidirectional aspects of memory (see Rothberg 2009) foregrounded by digital hyperconnectivity – has gained precedence (Hoskins 2017). Within this subfield, computer algorithms have gained scholarly attention leading to a discussion of 'algorithmic memory' (see Sluis 2010; Esposito 2017), especially regarding how the algorithms behind social media platforms are shaping remembrance practices (see Lambert et al. 2018; Schwarz 2014). However, the interface between AI and social memory more generally has received little consideration.[2]

[2] This is changing with a special issue of the new *Memory Studies Review* journal dedicated to bridging AI and memory studies scholarship planned for 2024. An early exception to this situation, projected from the computer sciences towards memory studies, is Kvasnička and Pospíchal's application of the collective memory concept to distributed artificial intelligence and multi-agent systems (2015).

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ARTIFICIAL INTELLIGENCE, MEMORY AND STORAGE

The relative lack of research concerning AI and social memory is intriguing given that memory, as a central human cognitive capacity, has long featured – albeit often somewhat implicitly – as a prerequisite of AI research and development. This is because intelligence partly depends on the mnemonic ability to recall, recollect, remember and recognize past events and prior knowledge and, in turn, to learn from them. Memory is, in short, 'not only a property of intelligence but, … the support on which sequences of acts are inscribed' (Leroi-Gourhan 1964/65 translated and cited in Le Goff 1992). As the AI theorist Roger Schank wrote in 1990 (1–2):

> Intelligence in the popular mind, refers to the capacity to solve complex problems, but another way of looking at the issue might be to say intelligence is really about understanding what has happened well enough to predict when it might happen again. To be a successful predictor of future events, one has to have explained confusing prior events successfully. Explaining the world (at least to yourself) is a critical aspect of intelligence. Comprehending events around you depends upon having a memory of prior events available for helping in the interpretation of new events … One can't be said to know something if one can't find it in memory when it is needed.

Despite memory's centrality to intelligence, in the earliest AI research, it featured more as a technical necessity and limitation rather than an object of exploration in and of itself. For example, in a 1955 proposal for one of their earliest projects, AI pioneers John McCarthy, Marvin Minsky, Nathaniel Rochester and Claude Shannon recognized that 'the speeds and memory capacities of present computers may be insufficient to simulate many of the higher functions of the human brain' (1955/2006, 12). A tacit concern with memory continued to underly the AI research of the 1960s and 1970s that led to the development of multi-agent systems and computer programs that solved puzzles, played games and retrieved information, as well as that of the 1980s that was concerned with expert systems (Nilsson 1998, 9–10). More recently, and as detailed further below, the role of memory has arguably gained greater recognition, with respect to self-organizing systems, machine learning, deep learning and artificial neural networks. However, as with earlier research, the 'memory' on which these AI advances have relied has been primarily conceptualized as complementing or competing with, rather than necessarily mimicking, human memory. In short, memory in AI research is often conflated with storage – memory as a store to be filled rather than as a phenomenon related to remembrance processes. Wendy Hui Kyong Chun has outlined how this conflation has underpinned many different forms of digital media and computer technology. She writes (2008, 148–149):

> key to the newness of the digital is a conflation of memory and storage that both underlies and undermines digital media's archival promise. Memory, with its constant degeneration, does not equal storage; although artificial memory has historically combined the transitory with the permanent, the passing with the stable, digital media complicates this relationship by making the permanent into an enduring ephemeral, creating unforeseen degenerative links between humans and machines…this conflation of memory with storage is not due to some inherent technological feature but rather due to how everyday usage and parlance arrests memory and its degenerative possibilities in order to support dreams of superhuman digital programmability.

She continues by noting that the 'major characteristic of digital media is memory. Its ontology is defined by memory, from content to purpose, from hardware to software from CD-Roms

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to memory sticks, from RAM to ROM' (2008, 154). But Chun also highlights that the computational conflation of memory to storage was not always as prominent as it is today. While Alan Turing, in his seminal paper *Computing Machinery and Intelligence* (1950), likened a digital computer's store to its memory, five years earlier, John Von Neumann used the term 'memory organ' instead of store in his *First Draft Report on the EDVAC* metaphorically inferring the biologically ephemeral nature of computational memory (1945; Chun 2008). In the same year, Vannevar Bush wrote *As We May Think* (1945): a work that has subsequently been canonized as the conceptual origin of the internet (Chun 2008). In it, Bush discusses the memex – a microfilm-based memory augmentation device, which although never realized, hoped to computationally mimic human memory and, in turn, address its weaknesses (see Chun 2008; Locke 2000; Ng 2021).

According to Chun (2008), the long-lasting misconception promulgated by the memex – as an influential idea – is that the internet, along with digital media and computational memory more generally, are somehow not ephemeral when in actuality they are enduringly so. In other words, it is not a case of 'the internet never forgetting' – to use the popular saying as an example – but rather of it perpetually forgetting and remembering. This misconception partly explains why the computational memory that today supports numerous AI systems is often considered to improve the capacity of human memory through stable exteriorization. Le Goff (1992), for instance, perceived human memory to be unstable and malleable, and computer memory as highly stable and more easily accessible. Similarly, and echoing the general rationalization of AI in comparative terms against human capabilities (see Ng 2021), machine learning expert Max Tegmark (2017) essentially defines memory as stably stored information and contrasts computer memory retrieval with human memory retrieval insofar as the latter relies on specifying *where* something is stored and the former on specifying something about *what* is stored. He writes (2017, 83):

> The memory in your brain works very differently from computer memory, not only in terms of how it's built, but also in terms of how it's used. Whereas you retrieve memories from a computer or hard drive by specifying *where* it's stored, you retrieve memories from your brain by specifying something about *what* is stored. Each group of bits in your computer's memory has a numerical address, and to retrieve a piece of information, the computer specifies at what address to look, just as if I tell you 'Go to my bookshelf, take the fifth book from the right on the top shelf, and tell me what it says on page 314'. In contrast, you retrieve information from your brain similarly to how you retrieve it from a search engine: you specify a piece of the information or something related to it, and it pops up.

Likewise, Rainer Rehak (2021) has recently noted:

> consciously remembering something is a highly complex process for humans which is more comparable to living through imagined events again and by that event changing what is being remembered. Human memory is therefore a very lively and dynamic process, and not at all comparable to retrieving accurate copies of stored data bits.

COMPUTATION AS REMEMBRANCE

By now, the speed and capacity of computational memory have grown at such a rate that the limitations noted in the 1950s (see above) are no longer as significant as they were. What

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this means in terms of drawing comparisons with the memory capacity of the human brain remains subject to scientific debate, however. Tegmark (2017, 83) writes that human brains store about 10 gigabytes of information electrically and 100 terabytes of information chemically/biologically, meaning that 'the world's best computers can now out-remember any biological system'.[3] Russel and Norvig (2016, 12) meanwhile acknowledge that:

> computers have a cycle time that is a million times faster than a brain. The brain makes up for that with far more storage and interconnection than even a high-end personal computer, although the largest supercomputers have a capacity that is similar to the brain's. (It should be noted, however, that the brain does not seem to use all of its neurons simultaneously.)

While Russel and Norvig continue that this state of affairs has led futurists to predict an approaching moment when computers gain superhuman capacities they temper such predictions by acknowledging that these sorts of 'raw comparisons are not especially informative. Even with a computer of virtually unlimited capacity, we still would not know how to achieve the brain's level of intelligence' (2016, 12).

One way that might help us think beyond the 'memory as stable storage' paradigm and avoid only the comparative consideration of human and artificial memory is to reconsider the relationship between memory and computation in computers. Nil Nilson, in distinguishing between these two, has highlighted how some of the reactive intelligent agents that underpin AI systems – by perceiving their environment and autonomously acting towards certain goals – do not necessarily do much computation. Their actions are 'memory-based implementations – compilations of the designer's knowledge' (Nilsson 1998, 117). However, the development of memory-based intelligent agents competent enough to perform more complex tasks in more complex environments would not only require designers to exercise unrealistic foresight in predicting all suitable reactions for all possible situations but would also demand potentially unattainable amounts of computational memory (Nilsson 1998). To reduce the memory demands of an agent some computation is usually moved inside the agent's action function. This means that the function may take longer but requires less space (Nilsson 1998). Thus, the traditional way of conceiving the relationship between memory and computation in the computer sciences maps onto the so-called 'space-time tradeoff' (Nilsson 1998, 117). This is also reflected in the criteria commonly used to ascertain the effectiveness of problem-solving intelligent agents like search algorithms. These include measuring whether an existing solution is identified (completeness) and whether an optimal solution is found (optimality) but also crucially how long it takes to find a solution (time complexity) and how much memory is required to carry out the search (space complexity) (Russel & Norvig 2016, 80).

The 'space-time tradeoff' means that the discussion of computer memory in relation to AI can seem counterintuitive for those who study memory in its more social guises (collected, collective, connective) because again it is often reduced only to a spatial storage facility and the information therein rather than also perceived as a temporal process as, for example, computation is. Tegmark actually defines computation as 'a transformation of one memory state into another' via the use of different functions (2017, 84). Keeping this definition in mind and if we accept that the goal of AI systems is to partly think and in turn act like humans

[3] Some neuroscientific research suggests that the total memory capacity of the human brain might actually be ten times larger than this, for example, a petrabyte (see Bartol et al. 2015).

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(Verdegem 2021b, 4; Russel & Norvig 2016), then perhaps it is useful to conceptualize at least some forms of computation, in particular, those involving search and retrieval tasks, as akin to remembrance. Writing from a social science and humanities rather than computer science perspective, Le Goff (1992) seems to suggest this insofar as he listed the function of memory within computers as relating to a broader array of tasks including those that many might alternatively be identified as computation. His list:

> a) a means entering data and the program; b) elements endowed with memory, constituted by magnetic devices, which preserve the information introduced into the machine and the partial results obtained in the course of its operation; c) a very rapid means of calculation; d) means of verification; e) means of extracting the results. (Le Goff 1992, 91)

Tempering memory's conflation only to stable storage by approaching computation as akin to remembering can be useful because it foregrounds the transformational component of both computation and remembering and can help highlight some of the possible conceptual similarities between human and computational memory and remembrance. For instance, across the field of social memory studies, it is widely agreed that each time individuals and groups remember they do so anew. While it is easy to fall into the computational trap of conflating memory purely to stable storage and expecting computation to generate representationally stable and consistent outputs, the fact remains that each time a computation is run, it is done so anew regardless of the seeming consistency of results it generates. Images on a computer screen are 'frozen for human eyes only' (Chun 2008, 167) or with respect to the example of the pocket calculator given by Tegmark: every time its square-root button is pressed, 'it computes exactly the same function in exactly the same way' (2017, 96).

As already noted, remembering has implicitly underpinned many AI efforts to master recall, recognition and learning processes but these efforts' technical focus and vocabulary have most often cast memory as a computational storage space rather than part of a human remembrance process that might itself be artificially reproduced. In short, those developing AI have mostly tried to emulate human tasks that require memory but not explicitly the task of remembering.

There are, however, exceptions to this situation. Over 30 years ago, Schank argued that developing self-organizing memory (what is self-organizing memory if not remembering?) within AI systems was an important and challenging goal for computer scientists (1990, 145):

> the hardest part of the creation of an intelligent entity is not finding information that it should know. We can easily figure out things to tell it. The problem is finding a way for the intelligent agent to know where to look in its own memory to find what is in there. One solution to this problem is the self-organizing memory. Scientists wouldn't have to decide where to put each piece of information in memory; rather the memory would do the job itself.

Schank's words still indicate the pervasive conception of memory as a storage space, but in referring to self-organizing memories that 'do it themselves' they also highlight an interest in emulating more human modes of remembering. Katrina Sluis (2010) has framed this sort of self-organizing computational memory in relation to the use of algorithms. She writes:

> In the process of outsourcing the function of 'seeing' and 'recalling' to machines, there emerges a desire for memory which is both automated and passive. The modularity and flexibility of media creates the possibility of an *algorithmic memory*: an increasingly intelligent self-organizing extensible

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> memory which can circulate independently of human intervention. The reliance on algorithms to process images and retrieve texts also presents a shift in focus from *storage* to *retrieval* in mnemonic labour. (2010, 231)

Internet search engine algorithms, for example (as somewhat contradictorily hinted at in the extended quote from Tegmark (2017, 83) at the close of the previous section), mimic to a greater extent human auto-associative modes of remembering insofar as they retrieve information by association rather than by address. These auto-associative intelligent agents are needed because the non-hierarchical hyper-textual network of the internet, following the conceptual precedent of the memex, mimics the human mind in how it stores information – in a dynamic, relational and associative manner – and yet has become too vast to be successfully navigated by humans alone (see Locke 2000).

More recent AI breakthroughs related to machine learning, deep learning, and artificial neural networks, in relying on algorithms that improve through experience and emphasizing the ability to learn as a primary capacity of intelligence, are also reconfiguring how we think about the relationship between computational memory, computation and remembering in novel ways.[4] In these systems, underpinned by virtual and simulated forms of memory, it is not only a matter of stressing the connections between computation and remembering but also those between remembering and learning. As these systems develop and increasingly stress the so-called 'substrate independence' – the ability to 'supervene on any of a broad class of physical substrates' whether human or artificial (Bostrom 2003, 244) – of a range of cognitive phenomena and forms of consciousness, memory, computation, learning and remembering, as well as arguably information and intelligence, may well continue to conceptually coalesce in the future (see Tegmark 2017).

While interest in self-organizing systems, machine learning, deep-learning and artificial neural networks more generally continues to animate the AI research and development field, the realization of their potential in connection to memory and remembrance might actually turn out to be something of a moot point from a sociological perspective. This is because ultimately AI's effort to emulate human memory and perhaps in time human remembering still suggests a binary between artificial and human intelligence that masks a more complicated relationship. In the next section, I turn to this relationship and propose several useful concepts for understanding it.

OVERCOMING TECHNOLOGICAL INSTRUMENTALISM: CYBORGIAN REMEMBRANCE AND AI MNEMOTECHNICS

While the exact relationship between memory's individualist and collectivist forms is yet to be fully resolved, their interaction has long been acknowledged (see Kansteiner 2002). Over 20 years ago, for example, Olick promulgated an approach to social memory that targeted a broad array of interrelated 'mnemonic processes, practices and outcomes, neurological, cognitive, personal, aggregated and collective' (1999, 346). At the same time, those mnemonic technologies, primarily conceived as contributing to collectivist forms of memory, have been treated in a rather instrumentalist manner as serving human ends rather than being ends themselves. This instrumentalism is twofold insofar as social memory scholars tend to first focus

[4] My thanks to Ben Roberts for pushing me to explicate this point more clearly.

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on the memories conveyed by mnemonic technologies – the first ends – and second, they usually conceive of these technologies as primarily or only serving the goal of extending human memory – the second ends. Even within his integrated approach, Olick, for instance, notes:

> For individuals, being able to write a note or record a message or take a photograph, vastly extends the capacity to 'remember', not simply by providing storage space outside of the brain but by stimulating our neurological storage processes in particular ways. (1999, 342)

While this instrumentalist approach has been applied to all mnemonic technologies, it is often more pronounced and, given the arguably increased agency of digital technology, more problematic when applied to electronic or digital mnemonic technologies. Before Olick, Le Goff wrote:

> we must note that electronic memory operates only on human command and in accord with human programming, that human memory preserves a larger sector that cannot be reduced to 'information', and that, like all forms of automatic memory that have appeared in the course of history, electronic memory is only an aid, a servant of memory and of the human mind. (1992, 92)

More recently, these matters have been taken up within discussions about memory and remembering in the *mind* and *wild* and the relationship between these two that is fostered by digital technology (Barnier & Hoskins 2018). Within these discussions, the instrumentalist trap of conceiving mnemonic technologies as merely mnemonic aids has occasionally been avoided by stressing that human remembering always occurs in the wild. For instance, Tim Fawns (2022) writes:

> In making use of the world to help us to remember, we distribute some of our remembering agency. The combinations of multiple media (e.g. photographs and mobile phones and social media platforms) and their entanglements in our social relations with other people are too complex for us to control … if remembering happens in the head, media are more likely to be seen simply as tools or cues, external to memory processes … On the other hand, a wild view of remembering can help us see that there is no hard boundary between remembering with and without media … Properly theorized, seeing remembering as in the wild can support a more meaningful account of the complex social and material relations in which remembering is entangled. (2022, 3–4)

Focusing on remembering and/or remembrance over memory *per see* is useful because it foregrounds the contextual specificity of the memories produced (remembered) through human use of technology (Fawns 2022; see also Merrill 2017). Yet this approach still runs the risk of maintaining focus primarily on human remembering, reflecting those limits traditionally conceived to affect the distribution of mnemonic agency. These limits are being re-delineated by society's continual mediatization, digitalization and datafication, and the results of the enrolment of these processes in wider AI systems. Given these new conditions and the conflation of 'the digital' to memory (see Chun 2008), the contact between and subsequent hybridization of human and computational memory is arguably trending towards the point where almost everything is becoming memory-related (Merrill Forthcoming). At least in certain parts of the world, everything is becoming memory-related because more and more of our human connections are saturated by digital communication media (see Hepp 2020), more and more of our

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spaces and things are infused with digital software and internet connectivity (see Kitchen & Dodge 2011) and, subsequently, more and more of our activities are arrested in digital data. In a society where (almost) *everything is memory*, debates about whether memory and remembering are primarily located in the mind or wild (see Barnier & Hoskins 2018) require further theoretical reformulation.

One way to achieve this is to acknowledge how memory's growing 'agentic hybridity' – as the outcome of human-non-human combinations – results in a hybrid of organic and artificial memory or what, drawing inspiration from Donna Haraway, I have elsewhere called *cyborgian memory*: 'a hybrid of machine and organism' (Merrill forthcoming; Haraway 1991, 147). In short, this is a hybrid of memory in the mind and the wild (or world). While it has already been noted that mnemonic technologies provide prosthetics that have turned us into cyborgs (see Olick 1999, 342), the general instrumentalist approach to technology within memory studies seems to have inhibited recognition of the extent to which our cyborgization has deepened with the growing pervasiveness of digital technology and the sorts of media, data, and algorithms that they facilitate and utilize (see Merrill Forthcoming). In this sense, the concept of cyborgian memory and more specifically those of *cyborgian remembrance* and/or *cyborgian remembering* all provide ways to think about the interaction of human and computational mnemonic actors on the more equal terms needed to grasp a world in which AI plays an increasing role in how we all remember.

The concept of cyborgian remembrance resonates with but also benefits from an engagement with Bernard Stiegler's idea of *technics* (1998). Not to be simply equated with technology, Stiegler's technics is, as Ben Roberts explains:

> not merely instrumental, a means to an end, where the 'end' remains a resolutely human need or desire. Rather technics shapes what it means to be human and the 'human' in this sense is constituted always already through technics. Indeed, technics is the 'prothesis of the human': the human is constituted not by some interior capacity (e.g. consciousness) but by a new prosthetic relationship with matter. (2007, 26)

Even more relevantly, Stiegler refers to a specific type of memory-related technics called mnemotechnics, which building on Edmund Husserl's discussion of primary and secondary retention and memory as well as image consciousness he associates with the latter as akin to a tertiary memory that is reactivated by external objects (2009, 245–250; see Roberts 2012). But while Husserl positions secondary and tertiary memory as derivatives of primary memory in an instrumentalist manner, for Stiegler, 'tertiary memory, the exteriorisation of memory into technical objects – mnemotechnics – is constitutive of primary memory, secondary memory or our perception of the temporal object' (Roberts 2012, 15; see Prey & Smit 2018). Stiegler applies these ideas to the epoch stretching to the late-twentieth century during which the collective apprehension of the past, time and memory passed 'primarily through the technical system of the written word' (James 2012, 68) as illustrated by his words: 'no longer a memory-aid, writing has become memory itself' (2009, 61). But of greater significance to the task at hand, Stiegler mostly discusses how a new mnemotechnic epoch in which the 'retention of the past passes primarily through the technical systems of analogical, numerical and digital communications media and other technically mediated perceptions' (James 2012, 68) has now taken hold, leading to the industrialization of memory (Stiegler 2009, 61; see Roberts 2012; Kinsley 2015; James 2012, 68–70).

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Following Stiegler, Sam Kinsley has discussed this industrialization of memory with respect to the quasi-autonomous agency behind the algorithmic programmes that operate upon and retain our everyday activities using the example of supermarket loyalty cards (2015). Robert Prey and Rik Smit have also applied Stiegler's ideas to Facebook's 'On This Day' feature (2018). Both these studies suggest how AI, along with the algorithms and collections of big data underpinning it, have been central to the extenuation of memory's contemporary industrialization. These *AI mnemotechnics* further blur distinctions between the individual and collective insofar as 'individual traces of activity, retained outside of the more commonly discussed somatic memory, are in this sense, never left alone, they are selected, aggregated and transformed to produce forms of collective memory – something like a memory of habits' (Kinsley 2015, 157). Thus, rather than conceiving AI in instrumentalist ways – as many mnemonic technologies have been before – and stressing how it assists and augments individual memory recall (see Gupta and Woolley 2021, 672), it is important to approach AI as a mnemotechnic that contributes to the tandem development of artificial and human intelligence. AI mnemotechnics do not merely supplement contemporary human memory, they characterize it (see Locke 2000). This is especially important given that the co-evolution of these two intelligences arguably represents the 'last great challenge of humanism and the first great endeavor of posthumanism' (Youngmin, 2020, 13).

CONCLUSION: FUTURE CHALLENGES AND RISKS

The need for social scientists, humanities scholars, and AI researchers and developers, including computer scientists, to collaboratively engage in questions of social memory is manifold. As outlined, AI has so far been mostly ignored by the former while the latter have chiefly conceived memory under the neutral and de-politicized terms of storage, increasing the risk that when social memory scholars do engage with AI to any considerable extent, they will approach it only as a mnemonic technology and from a rather instrumentalist and human-centred perspective. Relating computation to remembrance (as opposed to conflating memory with storage) and thinking through AI's impact on social memory in terms of cyborgian remembrance and mnemotechnics will, in contrast, provide opportunities to also adopt a computational, machinic perspective that decentralizes the human. Importantly, such a perspective also promises to allow better consideration of the potential challenges posed by and risks of AI mnemotechnics. These challenges and risks – regardless of whether they relate to dystopian imaginings of futures where it is possible to use AI to implant individual human memories (see Colby 1985) and counter-memory processes that are compromised through a reliance on outsourced remembrance (see McFarlane 2020); or more to immediate practical concerns related to the mnemonic impact of the 'algorithmic narrowing of information' (Hoskins & Halstead 2021, 676); new AI archival appraisal processes that decontextualize or 'dumb down' societal memory (see van der Werf & van der Werf 2022); AI's impact on academic disciplines like history (see Kansteiner 2022); or legal debates about how best to ensure the responsible mnemonic use of AI and the right to be forgotten (see Shur-Orfy & Pessach 2020; Jones 2018) – could serve as key empirical foci for future critical studies of AI. There is also a pressing need to further conceptualize AI's relationship with social memory not only in terms of remembrance but also forgetting not least because the success of intelligent agents

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hinges on their ability to discard (e.g., to forget) non-essential information as much as it does on selecting essential information (see Locke 2000). Hopefully this chapter will support these future efforts by extending the theoretical exploration of the relationship between AI and social memory and proposing several concepts that might aid our understanding of it.

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