Distraction machines? Augmentation, automation and attention in a computational age

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Title: Distraction Machines? Augmentation, Automation and Attention in a Computational Age

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Abstract: It is often argued (and feared) that the human capacity to pay attention is being transformed by computational technologies. Are computing machines distraction machines? This article takes this question as its starting point in order to address concerns about attention deficits vis-à-vis questions and issues about the mechanisation of cognitive procedures. I will claim that, when approaching the attention ecology of the twenty-first century, it is necessary to differentiate between *augmentation* and *automation*. While augmentation implies the extension of predefined forms or modes of behaviour, contemporary developments in computational automation ask us instead to consider the possibility of moving beyond phenomenological analogies. The article will thus discuss how transformations in the capacity to pay attention in a computational age need to be analysed in relation to the emergence of quasi-autonomous artificial cognitive agents driven by AI technologies, such as those known as *machine learning*. I will argue that these artificial cognitive agents can no longer be described in terms of technological add-ons to pre-existing human cognitive capacities. Today, we think alongside machines that are, is a sense, already thinking. Similarly, we pay attention alongside machines that are, in a sense, already paying attention. The challenge for philosophy and cultural theory is that of moving beyond 'projectionist' conceptions of such technological agency. This challenge, however, also involves overcoming the anthropomorphism that is implicit in expression such as 'thinking machines'. In a century where robot-to-robot communications have outpaced and outnumbered human-machine interactions, these artificial cognitive agents are not just reframing the human capacity to pay attention: they are also re-structuring the *conditions* for such capacity. Addressing the conditions for attention beyond augmentation and vis-à-vis computational automation involves considering the role and scope of both human and algorithmic decision-making, and engaging with the ways in which the humanities can intervene upon contemporary complex cognitive scenarios.

Keywords: attention, augmentation, automation, computation, philosophy, technology

ATTENTION DEFICITS

In his 2010 book *The Shallows: What the Internet is Doing to Our Brains*, the author Nicholas Carr writes:

> Over the last few years I've had an uncomfortable sense that someone, or something, has been tinkering with my brain, remapping the neural circuity, reprogramming the memory. My mind isn't going – so far as I can tell – but it's changing. I am not thinking the way I used to think. I feel it more strongly when I'm reading. I used to find it easy to immerse myself in a book or a lengthy article. My mind would get caught up in the twists of the narrative or the turns of the argument, and I'd spend hours strolling through long stretches of prose. That's rarely the case anymore. Now my concentration starts to drift after a page or two. I get fidgety, lose the thread, begin looking for something else to do ... I think I know what's going on. For well over a decade now, I've been spending a lot of time online, searching and surfing and sometimes adding to the great database of the Internet. The Web's been a godsend to me as a writer ... The boons are real. But they come at a price.[1]

Carr's comments offer a popular example of how, in recent years, it has been argued that something has happened, or is happening, to the human capacity to pay attention, as a consequence of the ubiquity and power of contemporary computing. In *The Shallows*, Carr expands on an argument that he had advanced earlier, in a much-discussed article from *The Atlantic*, which was entitled – straightforwardly – 'Is Google Making Us Stupid?'[2] Carr is not alone in asking this. From airport paperbacks to scientific articles via TED talks and national broadcasting documentaries, both the public and academia are concerned about the ways in which smartphones, computers and the internet alike are altering (in fact, even endangering) human cognitive faculties and, more specifically, the capacity to pay attention. We hear, for example, of 'ancient brains in a high-tech world',[3] or that society is barely 'surviving the technological alteration of the modern mind';[4] again, we are told that this is 'the dumbest generation',[5] and that the 'erosion of attention' corresponds to a 'coming Dark Age'.[6] Similarly, studies in neuroscience and psychology draw from theories of neuroplasticity to highlight that the human brain is being rewired in favour of new cognitive skills, and to the detriment of the intellectual practice of deeper forms of attention.[7]

In relation to these debates, a question appears to be emerging: are computing machines distraction machines? This article engages critically with that question and those debates by proposing that, when approaching and investigating such popular anxieties about attention deficits, it is important to differentiate between functions and processes of *automation* on the one hand, and functions and processes of *augmentation* on the other. This is because, while augmentation implies the extension of predefined forms or modes of behaviour, contemporary developments in computational automation ask us to consider the possibility of moving beyond a 'simulative paradigm' or

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[1] Nicholas Carr, *The Shallows: What the Internet is Doing to Our Brains,* New York, W. W. Norton, 2010, pp5-6. (Hereafter *The Shallows*).

[2] Nicholas Carr, 'Is Google Making us Stupid? What the Internet is Doing to Our Brains', *The Atlantic,* July–August 2008, https://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/306868, (accessed 28 March 2019).

[3] Adam Gazzaley and Larry D. Rosen, *The Distracted Mind: Ancient Brains in a High-Tech World*, Cambridge, MA, MIT Press, 2016.

[4] Gary Small and Gigi Vorgan, *iBrain: Surviving the Technological Alteration of the Modern Mind*. New York, Harper Collins, 2008.

[5] Mark Bauerlein, *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future*, New York, Penguin, 2008.

[6] Maggie Jackson, *Distracted: The Erosion of Attention and the Coming Dark Age*, Amherst, NY, Prometheus Books, 2008.

[7] See, for instance, the concerns raised by the brain researcher Susan Greenfield, quoted in Ian Sample, 'Oxford Scientist Calls for Research on Technology Mind Change', *Guardian*, 14 September 2010, https://www.theguardian.com/science/2010/sep/14/oxford-scientist-brain-change, (accessed 28 March 2019). Studies of the cognitive processes of attention and the structure of neurons, however, have also highlighted that 'the potential plasticity of attention mechanisms holds promise for addressing a wide array of disorders and deficits. Furthermore, as a core cognitive mechanism acting between early bottom-up processes and later higher-order processes, attention may serve as an ideal target for research into how modifiable cognitive mechanisms remain throughout the lifespan'. Joseph B. Hopfinger, 'Introduction to Special Issue: Attention & Plasticity', *Cognitive Neuroscience*, 8, 2, 2017, pp69.

phenomenological analogies.[8] I will thus argue that this differentiation between augmentation and automation can be productively applied to debates concerning attention and computing, and that the development of artificial cognitive agents driven by computational technologies, such as those known as *machine learning*, makes this distinction both possible and necessary. My point here is that what are perceived to be the transformations of the human capacity to pay attention should be studied vis-à-vis the identification of an *algorithmic* mode of attention that is developing today. This algorithmic mode pertains to the information selection carried out via the application and implementation of artificial intelligence techniques in everyday computational devices. Although a number of studies exist that examine the contemporary crisis in attention vis-à-vis technology, my argument thus concerns the necessity to consider attention vis-à-vis cognitive computing and artificial intelligence. As regards cognition and computation, however, my proposed differentiation between augmentation and automation also allows me to claim that, after the computational turn in twenty-first century culture and society, it is necessary not only to investigate what it means to be intelligent in the age of ubiquitous software, but also to consider (and problematise) the relation of said ubiquitous software with a broad spectrum of cognitive activities – including the cognitive processes of paying attention.

THE MODERN MECHANISATION OF ATTENTION

The concept of attention denotes the cognitive processes of selecting and focusing upon certain aspects of information while ignoring others. Historically speaking, the notion of attention, as a concept that designates a specific mental activity, consolidated in the second half of the nineteenth century, due to the emergence of industrialism, consumer society and experimental psychology. By the first decades of the twentieth-century, the study of attention had become a central issue in psychological investigations, and many phenomena associated with what today we recognise as attentional capacities had been already identified.[9] From that pioneering era of experimental psychology, it is perhaps the views of William James that one most often refers to when talking about attention. In the words of James, '*my experience is what I agree to attend to*'.[10] Attention, then, is 'the taking possession by the mind, in a clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought' (pp403-404). For James, who never ceased to stress the dynamic nature of mental activity and who gave us thought in the form of a stream of images, sensations, memories and volitions, attention is precisely what freezes this stream in our ever-changing brain. Attention operationally localises consciousness, and thus makes the construction of experience possible.

This belief that our basic experience of reality is shaped by our capacity to pay attention has been held for almost 150 years. In addition, the lack of such a capacity or its diminution have also provided occasion for social concerns and have done so ever since the need to pay attention became inherent to both mechanised modes of work and mechanised modes of mass entertainment. This situation has been analysed brilliantly by the art and culture theorist Jonathan Crary, who argues that the experience of modernity is one of cancelling out from consciousness much of our immediate environment, precisely at a time when this environment becomes saturated with signs and perceptual inputs.[11] In the factory, in the shopping arcade, at the cinema and in the street: the modern man and the modern woman are constantly asked to attend to things, which address them and demand to be addressed back. According to Crary, this modern 'reception in a state of distraction' that was, for instance, described by Walter Benjamin, needs to be understood in relation to the rise

[8] I name and discuss the 'simulative paradigm' in M. Beatrice Fazi 'Can A Machine Think (Anything New)? Automation Beyond Simulation', *AI & Society: Knowledge, Culture and Communication*, 34, 4, 2019, pp813-824.
[9] See the historical overview of research on attention given in Addie Johnson and Robert W. Proctor, *Attention: Theory and Practice*, London, Sage, 2004.
[10] Willian James, *The Principles of Psychology*, *Volume 1*, London, Macmillan, 1910, p402.
[11] Jonathan Crary, *Suspensions of Perception: Attention, Spectacle, and Modern Culture*. Cambridge, MA, MIT Press, 1999.

of attentive norms and practices through which Western modernity, since the nineteenth century, has refashioned human subjectivity.[12]

It is not possible to list here the many voices that have linked this interplay of attentiveness and distraction to how we became modern, and to how we did so via reconfigurations of technosocial normativity. One name that could, however, be mentioned is that of Theodor Adorno, whose analysis of the culture industry considers how the modern experience of subjective disintegration is related to the degradation of critical and reflective capacities; critical and reflective capacities that, we can add, start with the possibility (and the will) to pay attention.[13] Paradoxically, then, although modern consumerism and mass entertainment aim to attract our attention, they end up dispersing it. They do so because the technological rationalisations that they entrust arguably erode the grounds upon which this attention is predicated. In this respect, it can also be commented that much of this modern interplay of attentiveness and distraction described by critical theory is often embodied in, or epitomised by, the activity of reading – that is, in the process of looking at series of symbols and getting meaning from them. The very same quote from Carr that opened this article attests to this belief: Carr notes that he is not thinking the way he used to think, and that he can feel this more strongly when he is reading (*The Shallows*, pp5-6). However, this is also something that teachers and parents alike can bear witness to, when recounting stories of students and children who have lost, or never gained, the capacity to focus on the written page.[14] Moreover, we could say that this is also how the question of attention deficits enters, in part, the disciplinary boundaries of the humanities. It is worth lingering on this point.

Since scholarship in the humanities is usually developed via textual analysis, in that disciplinary context modern and contemporary concerns about attention (or the lack thereof) have often been elaborated under the rubric of debates concerning what counts as the practice of reading. Reading as the act of paying attention *par excellence*, then. Not just any kind of attention, though, but that engrossed and sustained concentration upon a single stream of information that the literary critic and cultural theorist N. Katherine Hayles has called 'deep attention'.[15] Issues about the intense focus that takes place or should take place, for instance, in humanities classrooms that emphasise reading, and about the gradual deterioration of this focus due to the media-saturated environments students live in, have been discussed in education studies as well as in the literary arts and philosophy. Again, Hayles has described the transformations in deep attention as a 'generational shift in cognitive styles that poses challenges to education at all levels, including colleges and universities' (p187), while the philosopher Bernard Stiegler has called this circumstance a 'disaster'.[16] For Stiegler, pedagogical concerns about deep attention are first and foremost a political issue: the fragmentation of attention by technocapitalism turns biopower into psychopower – that is to say, it shifts the site of the Foucauldian regulation of subjectivities from the body to the mind – eroding the possibility for critical consciousness and, consequently, intellectual maturity. On this topic, Stiegler offers an almost Frankfurtian assessment of media technologies in relation to the task of 'taking care of youth and the generations';[17] others (including Hayles), however, have more optimistically argued for the opportunity of revising and developing new pedagogical strategies that would be able to engage,

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[12] Walter Benjamin, 'The Work of Art in the Age of Mechanical Reproduction', in *Illuminations*, London, Pimlico, 1999, p233.

[13] Theodor W. Adorno, *The Culture Industry: Selected Essay on Mass Culture*, London, Routledge, 1991.

[14] This is reported, for instance, in James M. Lang, 'The Distracted Classroom', *The Chronicle of Higher Education*, 13 March 2017, https://www.chronicle.com/article/The-DistractedClassroom/239446?cid=cp120, (accessed 28 March 2019). The role of attention in education and vis-à- vis new technologies is also discussed in David Lewin, 'The Pharmakon of Educational Technology: The Disruptive Power of Attention in Education', *Studies in Philosophy and Education*, 35, 3, 2016, pp251–265.

[15] N. Katherine Hayles, 'Hyper and Deep Attention: The Generational Divide in Cognitive Modes', *Profession*, 1, 2007, pp187-199. (Hereafter *Hyper and Deeper Attention*).

[16] Bernard Stiegler, *Taking Care of Youth and the Generations*, S. Barker (trans.), Stanford, CA, Stanford University Press, 2010, p58.

[17] Echoing Adornian arguments, Stiegler claims that the 'cultural industries' aim to 'the elimination of the psychic apparatus through psychotechnologies'. See *Taking Care of Youth and the Generations*, p202n12.

'creatively and innovatively', with emerging forms of new media literacy, bridging the gap between the expectations of teachers and the experiences of their students (*Hyper and Deeper Attention*, p187).[18]

In this respect, it is also worth noting that debates in the digital humanities have stressed that, while humans are very good at *close reading* (i.e. the careful and constant inspection of a text), computing machines allow us to consider a broader, and at the same time more nuanced, picture. Famously, the literary scholar Franco Moretti has called this condition *distant reading*,[19] and has stressed how the computational aggregation and analysis of massive amounts of data reveal new aspects of literature to the literary critic. On this view, distance is '*a condition of knowledge*'; in Moretti's words, it is what allows us 'to focus on units that are much smaller or much larger than the text', and thus reading becomes an activity of synthesis 'between the very small and the very large', where 'the text itself disappears'.[20] Debates concerning the role and practice of reading have thus included considerations about the possibility of an 'algorithmic criticism',[21] as well as considerations about the importance of the hermeneutic faculties of human beings.[22] These examinations, in my view, exemplify the ways in which the humanities are questioning themselves vis-à-vis new kinds of challenges emerging from digital transformations – transformations that, the current crisis of attention proves, invest both research and the mind of those conducting it.

SCARCITY AND AUGMENTATION

For the scope of the present discussion, I am not interested in going into the specifics of literary studies from which the notion of distant reading originates. Rather, I wish to mobilise the idea and the method of distant reading, as developed within the digital humanities, in order to extrapolate and analyse both a trope and a rhetoric that are common in popular discourses about the fragmentation of attention by the artificial hands of technology. The trope that I want to highlight is that of *scarcity*; more specifically, scarcity in relation to cognitive capacities. The rhetoric which I also wish to discuss is that of *augmentation*, and again, more specifically, augmentation vis-à-vis the possibility of technological enhancement.

Of course, one cannot read *all* books (although, admittedly, that is a nice dream to entertain). Indeed, Franco Moretti observes, it would be impossible to read the sixty thousand odd novels that were published in England in the nineteenth century, and thus fully deserve the title of expert in Victorian literature ('Conjectures', p55). Luckily, technology comes to the rescue. Moretti recognises that machine reading, as an artificial instance of distant reading, might perhaps not count as reading at all. However, he also observes that while machines might not truly read, they might know (and knowing here for Moretti arguably means *to build patterns*) in ways that we will never be able to do, because of the limits of human performance when it comes to address huge quantities of data.[23] Distant reading as a form of augmentation, then, which offers what Moretti calls a 'fantastic

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[18] See, for instance, Daniel Keller, *Chasing Literacy: Reading and Writing in an Age of Acceleration*, Boulder, CO, Utah State University Press, 2013.

[19] See Franco Moretti, *Distant Reading*, London, Verso, 2013. For an overview of Moretti's method, see Rachel Serlen, 'The Distant Future? Reading Franco Moretti', *Literature Compass,* 7, 3, 2019, pp214-225. For a critique of distant reading, see instead Maurizio Ascari, 'The Dangers of Distant Reading: Reassessing Moretti's Approach to Literary Genres', *Genre*, 47, 1, 2014, pp1-19.

[20] Franco Moretti, 'Conjectures on World Literature', *New Left Review*, 1*,* 2000, p57. (Hereafter 'Conjectures'). Moretti gives a concrete example of his method of distant reading (as this is applied on 'the great unread' of detective stories from the late nineteenth century) in 'The Slaughterhouse of Literature', *Modern Language Quarterly*, 61, 1, 2000, pp.207- 227. (Hereafter 'Slaughterhouse of Literature').

[21] Stephen Ramsay, *Reading Machines*: *Toward an Algorithmic Criticism*. Champaign, IL, University of Illinois Press, 2011.

[22] See David M. Berry and Anders Fagerjord, *Digital Humanities: Knowledge and Critique in a Digital Age*. London, Polity, 2017.

[23] Some figures: it is estimated that, by 2020, there will be, for every living person, data equivalent to more than three million books. See Lucas Mearian, 'By 2020 There will Be 5,200 GB of Data for Every Person on Earth', *Computer World*, 11 December 2012, https://www.cio.com/article/2389819/by-2020--there-will-be-5-200-gb-of-data-for-every-person-on-earth.html, (accessed 28 March 2019).

opportunity' upon an 'uncharted expanse of literature', 'like literary history has never seen'. A 'great chance' that is also a 'great challenge': 'what will knowledge indeed mean,' Moretti asks, 'if our archive become ten times larger, or a hundred?' (*Slaughterhouse of Literature*, p227).

Arguably, a rhetoric of augmentation has always been part of cultural discourses about technology. Already in 1945, the hypertext pioneer Vannevar Bush described his futuristic vision for the coming 'information explosion' in terms of a transformation of 'as we might think'.[24] From a different perspective, but in a comparable effort to understand how media inform experiences, Fredrick Kittler saw modes of thinking, perceiving and writing as interrelated, and as shifting according to the technologies that underpin them, regardless of whether the technologies in question were a typewriter or a Unix terminal window.[25] These lines of investigation interestingly open up to wider philosophical questions about the relationship between humans and their tools. Technical issues about human-machine augmentation, as for instance those stressed in the seminal work of the computer and Internet pioneer Douglas Engelbart,[26] then link to those about the prosthetic or assemblage-like role of technology that one can find in the philosophies of Martin Heidegger,[27] Gilbert Simondon[28] and Bernard Stiegler.[29] On this topic, cognitive science productively crosses with the humanities, for cognitive science too has significantly looked at the prosthetic interdependency between human and informational technologies. What is known as the theory of the 'extended mind',[30] for instance, describes mental processes as spreading beyond the perceiving organism into the environment in which the latter is embedded.[31] Our mind encompasses the tools that we use to perform cognitive functions; today, perhaps, nothing exemplifies this cognitivist hypothesis better than a quick look at the convenient repositories of calendars, notes and reminders that busy our smartphones and laptops.

Interestingly, the big technology players seem to agree with this view; Google, for example, has said that it wants to be 'a third half of [our] brain'.[32] Possibilities of augmenting and extending both the individual and collective exercise of human cognition are of central importance to computer science and to the political economy of Silicon Valley. Social media, phone apps, networked platforms, design interfaces, smart devices and the Internet of Things: the industry frames these technologies as helpful assistants that will free us from the chore of identifying and retaining relevant information, thus allowing us to dedicate our finite time and our finite mental efforts to other things. While cognitive cognates such as memory and intelligence are also targeted, it is the human capacity to pay attention that is most called into question. In this respect, it is possible to note that Silicon Valley's assumption would be that digital machines are instruments to offload or outsource decisions on what to prioritise, what to select and what to discard. According to this view, if Siri or Alexa are paying attention, why should we do so too?

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[24] Vannervar Bush, 'As We May Think', *Atlantic Monthly,* 176, 1945, pp101–108.
[25] Friedrich A. Kittler, *Gramophone, Film, Typewriter*, G. Winthrop-Young and M. Wutz (trans.), Stanford, CA, Stanford University Press, 1999.
[26] See Thierry Bardini, *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*, Stanford, CA, Stanford University Press, 2000.
[27] Martin Heidegger, 'The Question Concerning Technology', in *The Question Concerning Technology and Other Essays*, W. Lovitt (trans.), New York, Harper & Row, 1977, pp3–35.
[28] Gilbert Simondon, *Du Mode d' Existence Des Objets Techniques*, Paris, Aubier, 1989.
[29] Bernard Stiegler, *Technics and Time, 1. The Fault of Epimetheus*, R. Beardsworth and G. Collins (trans.), Stanford, CA, Stanford University Press, 1998.
[30] Andy Clark and David Chalmers, 'The Extended Mind', *Analysis*, 58, 1, 1998, pp7-19.
[31] Andy Clark, *Supersizing the Mind: Embodiment, Action and Cognitive Extension*, Oxford, Oxford University Press, 2008.
[32] Sergey Brin, quoted in Jay Yarow, 'Sergey Brin: "We Want Google To Be The Third Half Of Your Brain"', Business Insider, 8 September 2010, https://www.businessinsider.com/sergey-brin-we-want-google-to-be-the-third-half-of-your-brain-2010-9?r=US&IR=T, (accessed 28 March 2019).

Here the software industry aligns itself with an orthodox way of thinking about attention in economic terms. In an 'attention economy',[33] characterised by an 'information overload',[34] attention is believed to be a scarce commodity in short supply. This is a belief with a two-fold consequence: on the one hand, one of the explicit aims of the cognitive tools provided by tech companies such as Google, Amazon and Facebook is to safeguard our attention from being overloaded, thereby optimising the allocation of our cognitive resources. On the other hand, however, this optimisation is meant to 'capture'[35] individual and collective attention for private profit, thus fulfilling the premises and promises of what has been described as 'cognitive capitalism'.[36] In relation to these arguments, it is very interesting to note how, according to cognitive psychology (that is, an information-processing approach to psychology), attention itself is defined by its own limitations. Empirical evidence had been said to show that human performance is conditioned by the brain's limited capacity to select and attend to information at any moment. So, if attention is a cognitive capacity, then is one that is also defined as a finite resource.[37]

In this scenario, computing devices are both what has thrown us into this dangerous deep sea of data, but also what lends us a lifejacket that prevents from drowning, and rather allows us to enjoy a swim in information. There is much to say here, but due to space constraints I will just add that this predicament asks us to consider how the ontologies and epistemologies of technoscience are never neutral, but in fact often normative and ideological, insofar as they impose upon society and culture specific assumptions and understandings of what counts as cognitive or perceptual activity. In my view, it is precisely when we do so – when we consider what might count as a cognitive or perceptual activity – that a rhetoric of augmentation reveals itself to be too limited and limiting to be applied to computation. Although this rhetoric characterises both the information industry and also some of the humanistic responses to digital transformations, I want to claim that contemporary developments in computational automation demand us instead to examine how artificial cognitive agents driven by the latest developments in artificial intelligence can no longer be described in terms of technological add-ons to pre-existing human cognitive capacities. This impossibility is, in part, a consequence of the scale and speed of these computational automations.[38] However, this is also due to the highly formalised and deeply formalising character of computation itself, and to its algorithmic nature. With computational automation, we have machines that augment us and our research: machines that help us to read more, search more, hear more, or to do so harder, better, faster, stronger. On top of this augmentation, however, with computational automation we are mechanising the execution of rules, and with that, the actualisation of novel forms of decision-making that – this is my key point – have a degree of *autonomy* from us. In the next section, I will consider the case of *machine learning* in order to explain and expand upon this claim. I will then return to discuss anxieties about attentional deficits: differentiating between augmentation and automation will allow me to introduce what I believe are important considerations on how to address the changing conditions for attention in a computational age.

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[33] For attention economy, see Thomas H. Davenport and John C. Beck, *The Attention Economy: Understanding the New Currency of Business,* Boston, Harvard University Press, 2001; Richard A. Lanham, *The Economics of Attention: Style and Substance in the Age of Information*, Chicago, University of Chicago Press, 2006.

[34] The concept of information overload has been popularised by Alvin Toffler and by Herbert Simon. See Alvin Toffler, *Future Shock*, London: Bodley Head, 1970; Herbert A. Simon, 'Designing Organizations for an Information-Rich World', in M. Greenberg (ed.), *Computers, Communication, and the Public Interest*, Baltimore, MD, Johns Hopkins Press, 1971, pp37-72.

[35] I am implicitly referring here to the work of Philip Agre, who described 'capture' as a type of privacy model of information technologists. The capture model 'is built upon linguistic metaphors and takes as its prototype the deliberate reorganization of industrial work activities to allow computers to track them in real time'. Philp E. Agre, 'Surveillance and Capture: Two Models of Privacy', *The Information Society*, 10, 2, 1994, pp101-127.

[36] Yann Moulier Boutang, *Cognitive Capitalism*, Cambridge, Polity, 2011.

[37] See Elizabeth A. Styles, *The Psychology of Attention*, New York, Psychology Press, 2006.

[38] It is said that, according to current trends in microprocessing power, a computer in 2029 will be sixty-four times faster than it was in 2017. This exponential growth, and its implications, is described in Jamie Susskind, *Future Politics: Living Together in a World Transformed by Tech*, Oxford, Oxford University Press, 2018, p38.

AUTONOMY, ANTHROPOMORPHISM AND ALTERITY

As the computer scientist Pedro Domingos explains, 'machine learning automates automation itself'.[39] Despite the fact that some of these techniques have been around for decades, the heterogenous set of computational technologies that go by the name of machine learning is often celebrated as a new way of doing artificial intelligence, made successful by the availability of massive amounts of data and greater processing power.[40] Simply put**,** and differently from a more traditional computing paradigm**,** machine learning endows computers with the capacity to modify themselves without being explicitly programmed to do so. Computer programs are said to 'learn' insofar they are not 'explained' how to perform a task, but rather they can teach themselves to change their own instructions when exposed, and in accordance, to large quantities of data inputs. This might sound exotic but is in fact very common. Machine learning is the technology behind Facebook's News Feed, Apple's Siri, Amazon's Alexa and purchase recommendations, Netflix's personalisation, Tesla's self-driving cars, and behind pretty much everything that Google does, from machine translation to typo correction via spam filters and image recognition. Machine learning is thus a technology upon which Silicon Valley and other high-tech poles are greatly investing. Bill Gates has reportedly declared that a breakthrough in machine learning would be worth ten Microsofts,[41] and labs dedicated towards attempts to achieve this breakthrough have been opening around the world. Because the results of machine learning are so promising, this field's relevance is growing exponentially. Looking at the future, machine learning has been said to be one of our most likely weapons against cancer,[42] and it has already proven to be a key ally in diverse activities such as financial fraud prevention and genome sequencing.[43] Machine learning is being implemented in government, law, education; because its computational operations are often opaque and illegible to the same programmers who have created them, however, these wide applications and implementations of machine learning in culture, society and economy are raising concerns about privacy, control and the public sphere, and also about the role that 'thinking', and 'thinking with machines' will take in the twenty-first century. It is on these considerations that I wish to focus here.

Interestingly, we can observe that the automated operations of machine-learning techniques are describable in terms of procedures of *information processing*, comparable to activities of *data selection*: these automated operations recognise configurations, create models and infer decisions. To an extent, it could be said that machine learning programs do something similar to 'paying attention' to data-stimuli: they detect some aspects of information and discard others, forming and dissolving patterns in order to shape and sharpen their cognitive outcomes based on these selections. Machine-learning programs can make *data-driven predictions*, or take *data-driven decisions*, based on the way in which they select and arrange data, and consequently they can also 'nudge' their human users.[44] Such an impact of machine learning upon human-machine ecologies

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[39] Pedro Domingos, *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*, Allen Lane, London, 2015, pp9-10.

[40] See Ethem Alpaydin, *Machine Learning: The New AI*, Cambridge, MA, MIT Press, 2016.

[41] This quotation is widely reported on the Internet and in technical literature about machine learning. However, a direct source for it is not given.

[42] For example, in diagnosis of tumours, see Derek Wong and Stephen Yip, 'Machine Learning Classifies Cancer', *Nature*, 555, 2018, pp446-447.

[43] An overview of the main uses of machine learning vis-à-vis genomic data is given in Maxwell W. Libbrecht and William Stafford Noble, 'Machine Learning in Genetics and Genomic', Nature Review Genetics, 16, 2015, pp321-332. For the application of machine learning to the exposure and prevention of fraud in payment card services, see Nick F. Ryman-Tubb, Paul Krause and Wolfgang Garn, 'How Artificial Intelligence and Machine Learning Research Impacts Payment Card Fraud Detection: A Survey and Industry Benchmark', *Engineering Application of Artificial Intelligence*, 76, 2018, pp130-157.

[44] *Nudge* is a behavioural-science concept that originates in cybernetics research. The relation between nudge theory and technology is also a close one: nudge can take the ordinary form of emails or texts, but also the more sophisticated form of wearable devices and smart phone apps designed to change people's opinions and people's responses according to human responses that are harvested and capitalised upon via the algorithmic analysis of data streams. Karen Yeung describes the networked, dynamic and pervasive nature of algorithmic decision-guidance techniques as 'hypernudge'. See

and architectures of choice is remarkable and, in my view, allows us to claim that, while addressing the changes in attentive capacities within contemporary informational societies (changes that happen both at the micro scale of the individual and at the macro scale of the collective), we should consider an *algorithmic mode of attention* that is also emerging today. This algorithmic mode of attention operates *alongside* the human capacity to pay attention; however, it is *specific* to the information selection and retention carried out by these artificial cognitive agents driven by computational automation.

In my work on the philosophy of computational technologies, I often stress the specificity of computation: '*computation is computation*',[45] and should be addressed and assessed first on the basis of its own inherent characters, potentials and limits, and not those of related fields (e.g. mathematics) or associated milieux such as those of art, culture and society at large (although I do not deny that computation entangles with these milieux, and I believe that it should be obviously also analysed within and because of these relations).[46] In this article too I want to highlight the specificity of the computational, and I want to do so by emphasising that, while it is possible and useful to detect the emergence of what could be called *an algorithmic mode of attention*, based on the computational selection and organisation of information, it is also necessary to insist on the differences – in fact, on the profound alterity – between human modes of attention and algorithmic ones. As anticipated, my aim here is to stress this sense in which 'thinking machines' can be said to be operating *alongside* us; on the manner in which, then, they function both in *proximity* to us, but also in *autonomy* from us. It is relatively easy to explain the proximity aspect by simply pointing to the many individual and collective activities and modes of living and experiencing that are today profoundly intertwined with software, algorithms and computation. The autonomy of computational automation, on the other hand, is a more complex issue, so I must explain how I am researching and mobilising the concept. Philosophically speaking, autonomy denotes the condition of self-government and self-determination; in this sense, autonomy has often been theorised in terms of the capacity to make decision or act independently. This is true also for the political interpretations of the notion, which stress self-direction and self-reliance as key aspects of autonomy. In a comparable manner, Immanuel Kant famously made autonomy a key tenet for morality, emphasising it vis-à-vis reflection and as central to what he considered to be a life lived according to the principles of rationality and criticality.[47] From a different yet equally relevant perspective, however, the notion of autonomy is also used in computing and especially in robotics. In those fields, autonomy assumes the less philosophically-charged and rather more cybernetically-oriented meaning of 'independence from control'. A device or a computational process is autonomous if the relation between the artificial agent and its designer/programmer is one of increasingly self-sufficiency. While automation denotes a set of human-defined functions to be performed by a machine, autonomy instead expresses the capacity of said machine to operate independently, without explicit instructions.

In my ongoing investigation of the *autonomy of automation*, I draw on both philosophical and technical uses of the concept of autonomy in order to develop further my theorisation of how cognitive computing is today challenging the simulative paradigm that has been looming over artificial intelligence research since Alan Turing's 1950 proposal of an 'imitation game' as the benchmark of success for 'thinking' machines. Machine-learning techniques, and AI more generally, are still far from producing artificial cognitive agents with self-mastery or self-reflection. There is no 'critical' computation, in the Kantian sense of 'criticality'. Nonetheless, it is machine-learning

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'"Hypernudge": Big Data as a Mode of Regulation by Design', *Information, Communication & Society*, 20, 1, 2016, pp118-139.

[45] M. Beatrice Fazi, *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics*, London, Rowman and Littlefield International, 2018, p187.

[46] I explain the expression 'associated milieu', and its Simondonian origin, in M. Beatrice Fazi, 'Digital Aesthetics: The Discrete and the Continuous', *Theory, Culture & Society*, 32, 1, 2019, pp3-26.

[47] See Immanuel Kant, *Groundwork for a Metaphysics of Morals*, T.K. Abbott (trans.) with revisions by L. Denis, Plymouth, Broadview, 2011, p98.

programs' capacity to improve through experience – or in fact, to learn through trial and error – that appears to be granting these computational systems with a degree of agency that can be theorised as increasingly autonomous (or quasi-autonomous): machine-learning algorithms take choices based on their perceptual inputs and upon abstractive models or rules that they give to themselves when dealing with or handling less structured tasks and data.

Because we are speaking here in terms of machine that can 'think' or 'pay attention', I should introduce an important point about the anthropomorphism that is implicit in such expressions, and also explain how this is still linked to the rhetoric of augmentation that I am challenging. To anthropomorphise means to ascribe human characteristics to non-human entities. This is a tendency in both ancient and modern civilisations. For every ancient myth of talking animals and of demi-gods who fall in and out of love, there is a modern tale of rabbits in waistcoats who are running late or of tank-engines with big eyes and big smiles. Anthropomorphism involves a form of projection. This point was made by the philosopher Ludwig von Feuerbach, and before him also by Baruch Spinoza and by the Greeks Xenophanes and Plato. For them, anthropomorphism reveals that humans ponder many things, and in doing so they project their own inward attributes outside themselves. In this projection, however, they also get acquainted with who they are.

While looking at these accounts of anthropomorphism we should of course avoid drawing too strict a parallel between very different contexts and scopes. In Feuerbach's case, for example, his aim was to expose what he called the 'anthropological essence of religion'.[48] My goal, here, is much more modest: I wish to challenge the anthropomorphisation of computational technology in order to highlight that, when we apply phenomenological analogies to computational agents (so for instance, when we are saying that machines listen or read or think, or indeed they pay attention) we are implicitly projecting specifically human definitions of cognitive activities upon operations that are in fact, somewhat *incommensurable* with ours. So, while Feuerbach considered anthropomorphic projection mistaken insofar as it forces us to perceive the anthropomorphic representation as different from us, when it is in fact the same as us, my point here is the opposite: we anthropomorphise machine agents because we think that they are doing something similar to what we do, but in fact they are not. In both cases, however, anthropomorphic representations reveal more about human beings than about the entity we attribute human characteristics to. In both cases, anthropomorphism reflects indeed a desire for humans to be free, or to recognise themselves as free, from their own limitations.

As I have already discussed earlier in this essay, technoculture has often responded to this wish to break free from limitations with promises of augmentation. What I want to add now is that, in my view, there is a link between our anthropomorphising willingness to talk of computational agents that supposedly 'think' (or 'pay attention') and the way in which we might extend or exteriorise pre-determined forms of behaviour through augmentation. To augment is to boost, to add on, to enlarge, to expand, to inflate. To augment, then, is to overcome boundaries. If our bodies and minds are limited, we use technology to make them less so. This is a somewhat straightforward McLuhanite issue. It is useful to recall here how, for the media theorist Marshall McLuhan, technology is an *extension* (or, as he also argued, a *translation*, a *repetition* or an *intensification*) of human faculties, meant to increase the power of human endeavours.[49] Equally, it is worth comparing debates about automation and McLuhan's theory of technological extension. The first and second waves of automation (which broadly correspond to the industrial revolution in Western Europe, epitomised by the steam engine, and then to those developments in the twentieth century typified by the introduction of controllers in manufacturing) might be seen to match what McLuhan described as

[48] Ludwig von Feuerbach, *The Essence of Christianity*, M. Evans (trans.), London, John Chapman, 1854, p32.
[49] See Marshall McLuhan, *Understanding Media: The Extensions of Man*, New York, McGraw-Hill, 1966. (Hereafter *Understanding Media*).

extensions of the body.[50] The present wave of computational automation can instead be seen to correspond to what McLuhan identified as *extensions of cognitive functions*: 'the final phase of the extension of man – the technological simulation of consciousness'(p19). Moreover, when considering ideas of technology as augmentation of the human body or the human mind, and when addressing these ideas vis-à-vis techno-cultural tendencies towards anthropomorphism, it is also worth mentioning the philosophy of technology of Ernst Kapp, for whom technological artefacts are explicit projections of human organs, and for whom human faculties are the blueprint for the development and construction of machines.[51]

The case of machine learning, however, shows us that the challenge for philosophy and cultural theory, or more specifically, for the philosophical and cultural study of the computational automation that will come, is that of moving beyond such 'projectionist' conceptions of technological agency. This challenge also involves overcoming the anthropomorphism that is implicit in expression such as 'thinking machines' and acknowledging instead a form of onto-epistemological autonomy in automated 'thinking' processes. The question to be addressed then becomes: what does it mean to perform cognitive processes through or alongside automated computational operations that are already quasi-autonomously selecting and organising information according to modes and forms of agency that are not easily encompassed under phenomenological (and, indirectly, universalising) metaphors or analogies? These automated computational operations, in other words, should be addressed not so much under the motif of the *cyborg* – that is, of a techno-assemblage that can be anthropomorphised or humanised because it embeds the augmentation, replication and extension of pre-existing cognitive faculties, and thus still projects a human form. Rather, the appropriate motif here is that of the *alien*, whose profound alterity is irreconcilable with any attempt to give it a human shape or destiny.

ACKNOWLEDGING THE ALIEN AND QUESTIONING THE CONDITIONS FOR ATTENTION

When addressing twenty-first-century transformations in the human capacity to pay attention, it is important to think about the autonomy and alterity of computational automation, and also about the tendency to anthropomorphise that is inherent to human modes of relation to technological agents. In this last section of this article, I want to do precisely so, while also discussing how my proposed differentiation between augmentation and automation can be productively engaged with debates about attentional deficits. First, however, I need to go back to the concept and practice of distant reading – a concept and a practice that, as already mentioned, I do not wish to consider in the context of literary theory, but which I mobilise in relation to the rhetoric of augmentation that recurs in technoculture and technoscience, and which I am here challenging.

Distant reading exemplifies the ambivalences and contradictions that can be found in contemporary practices of computational automation. On the one hand, computational activities of distant reading, as employed for instance in the digital humanities, are based on (and also imply) the prospect of enhancing what counts as reading itself. The only way to approach that 'great unread' that Franco Moretti (borrowing from Margaret Cohen) talks about is via the automated 'eyes' of computing machines. Techniques such as topic modelling are thus employed to read faster and larger: in fact, to amplify reading to the nth degree. Augmentation, then, is meant to make up for the inadequacy of human cognition when confronting the vast amounts of text available since the invention of the printing press. Yet, while on the one hand practices of distant reading would seem to uphold the prospect of technological extension and thus still label machines as 'assistants' or 'tools',[52] I believe

[50] According to McLuhan, 'what makes a mechanism is the separation and extension of separate part of our body as hand, arm, foot, in pen, hammer, wheel. And the mechanization of a task is done by segmentation of each part of an action is a series of uniform, repeatable, and movable parts.' See *Understanding Media*, p218.

[51] Ernst Kapp, *Elements of a Philosophy of Technology: On the Evolutionary History of Culture*, L.K. Wolfe (trans.), Minneapolis, University of Minnesota Press, 2018.

[52] 'Computers can assist with the study of literature in a variety of ways, some more successful than other ... Computer-based tools are especially good for comparative work, and here some simple statistical tools can help to reinforce the

that, on the other hand, it is also possible to find, in the same practice, an implicit acknowledgment of both the autonomy and alterity of these computational operations. This recognition is under-theorised by and within the digital humanities field. Still, however, it is there. Interestingly, for example, humanities and information scholar Jeffrey M. Binder talks of 'alien reading' when describing precisely the practice of topic modelling in digital humanities research, stressing 'the radical difference between the way human beings and computer programs "read" texts' and how 'machines are altering our interpretative acts in altogether unprecedented ways'.[53]

In this respect, the claim that I want to advance is that, buried within the practice of computational analysis in the humanities, there is a hidden (and often unrecognised) speculative drive. This speculative drive is instead very important, in my view, for it asks us to consider, as for instance in the case of debates on distant reading, what it means to read in ways that humans cannot. Machine reading for Moretti might not truly count as reading, yet it is still epistemologically significant. Similarly, I want to stress that, in a digital age, the challenge for the twenty-first century humanist is to differentiate between human and algorithmic thought, between human and algorithmic attention or, equally, between human and algorithmic selection of information, while finding and founding not only the specificities but also the legitimacy of both. We pay attention alongside machines that are, in a sense (here it is important to keep in mind my previous remarks about anthropomorphism), *already* paying attention. We must then open up a conceptual space that would allow us to inhabit this proximity, but at the same time also dwell and build on the alterity. This might be more my view than Moretti's (Moretti does not make this argument, as arguably, for him, distant reading is both mechanical and human, with frequent conceptual and practical overlapping between the two). Beyond Moretti then, and beyond the context of his 'heretic' (as Moretti himself would call them) literary practices, it is my contention that one of the most pressing points is to ask whether the humanities can provide this conceptual space where the negotiation, but also the construction, of the relation between different orders and modes of (human and algorithmic) intelligibility can happen.[54]

The philosopher of technology Robert Innis, when addressing what he conceptualised as the 'exosomatic organs' that mediate between the human body and nature, clarified his guiding question as follows:

> What types of categories and methods is one to use and to what types of paradigmatic examples should one appeal if we want to thematize, with sufficient radicality and comprehensiveness, the transformations of perceptual structures attendant upon technics, quite generally, and upon technology, particularly?[55]

Innis wrote this in 1984; his focus was on the technical and technological 'extensions of the human bodily equipment' that can, in his view, be analysed under the 'threefold rubric of compensation, extension, and substitution' (p68). Although Innis thus openly embraced projectionist perspectives that I want instead to challenge, I believe that this guiding question is still relevant to my proposed differentiation between automation and augmentation in the context of present debates about attentional deficits and digital technology. This is because asking what types of categories, methods

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interpretation of the material.' Susan Hockey, *Electronic Texts in the Humanities*, Oxford, Oxford University Press, 2000, p66.

[53] Jeffrey M. Binder, 'Alien Reading: Text Mining, Language Standardization, and the Humanities', in M.K. Gold and L.F. Klein, *Debates in the Digital Humanities 2016*, Minneapolis, University of Minnesota Press, 2016, pp201.

[54] Binder argues for a shift towards a media studies perspective, which, in his view, can help humanities scholars to keep the 'alienness' of computational technologies 'in sight'. I agree with Binder's point, yet I also believe that media studies can equally benefit from looking into fields such as the digital humanities, where 'the strangeness of the idea that words can be understood through the manipulation of numbers' dwells. See Binder, 'Alien Reading', p202.

[55] Robert E. Innis, 'Technics and the Bias of Perception', *Philosophy and Social Criticism*, 10, 1, 1984, p70.

and examples one should appeal to in order to radicalise the relation between technics and perception involves pushing to the fore the issue of the historicity of perceptual structures and of the concepts that one might use to address them. In the quoted piece from 1984, Innis does so – although implicitly – by referring to Walter Benjamin's analysis of the historical circumstances of modern sense perception.

I explained in a previous section of this article how Jonathan Crary contends that the way in which we concentrate or focus has a profound historical character, and that attention is a central issue in the modern construction of a productive, manageable and mechanisable subjectivity. We can now draw from Crary and pose another question, which complements that of Innis: if, following Crary, the rise and establishment of modern subjects is, in part, the result of the normalisation of certain perceptual practices, what are, today, those technosocial experiences of perception that normalise us in terms of contemporary subjects, amidst computational interplays of attentiveness and distraction? I believe that differentiating between augmentation on the one hand and automation on the other is conceptually key to attempts to engage with this question. The epitome of automation, in the twenty-first century, is not the Jacquard loom, which worried the first Luddites, but nor is the industrial control systems that preoccupied following generations of machine smashers. Instead, the quintessence of automated control is today expressed by the algorithmic execution of rules and procedures undertaken by computational systems. This is not *any* automation. This is *computational automation*: that is to say, a type of automation that is grounded on the algorithmic execution of rules and procedures via mechanised decision-making. It is precisely this algorithmic character that makes my proposed differentiation between augmentation and automation not only possible but also necessary. To be more explicit, then, I am arguing that automation in the twenty-first century must be understood in terms of the predominance of the computing machine, over all other machines. However, I am also stressing that computational systems, in the twenty-first century, have their own ontological and epistemological specificity: these computational machines, consequently, need to be examined in terms of technological alternatives to human cognitive capacities, and not as extensions or amplifications thereof. To repeat this once again, in a computational age we think alongside machines that are already 'thinking'; similarly, we pay attention alongside machines that are already 'paying attention'. The radical approach to 'the transformations of perceptual structures attendant upon technics, quite generally, and upon technology' that Innis was wishing for can be developed today only if we recognise this independence – if we acknowledge the alien in the machine, so to speak – and its consequences.

In the light of these considerations, how can we productively engage with those widespread concerns about attention deficits that are said to be precipitated by our individual and collective reliance on digital technologies? In conclusion to this essay, I propose to return to the question 'Are computing machines distraction machines?' in order, however, to shift the focus of this question towards considerations on the type of machine that we are concerned about (the *computational* machine) and on what this machine does (it makes *decisions*). Doing so permits to reverse the popular trope about the scarcity of cognitive capacities that I have identified and discussed earlier and talk instead of an *abundance* of cognitive agents that populate the perceptual ecologies of the present. Addressing directly this cognitive surplus can, likewise, help us to reframe the issue of attentional deficits in the twenty- first century from a fresh perspective. In an age where robot-to-robot communications have outnumbered human-machine interactions and where information is consumed by humans and machines alike, artificial cognitive actors are not just reframing the human capacity to pay attention. They are also re-structuring the *conditions* for such capacity.

Considerations about attention deficits have become full-fledged sociocultural issues within post-industrial informational economies. These sociocultural issues need an adequate theoretical response from humanities scholars. When it comes to addressing the complex 'attention ecology'[56] of the present day, the humanities might feel particularly invested, since the problem of attention

[56] Yves Citton, *The Ecology of Attention*, B. Norman (trans.), Cambridge, Polity, 2017.

draws a question mark on the future of humanities disciplines and humanities departments. In this view, to look for the conditions for attention means to look for the conditions of possibility for the humanities themselves, because it involves assessing the shape and destiny of literacy, understanding, judgment; activities and faculties upon which all humanities work is predicated. Importantly, however, what is at stake here goes beyond disciplinary self-preservation. This response from the humanities is necessary not only because the existence of the humanities is predicated upon activities that require the capacity to pay attention, but also because issues about changing conditions for attention in a digital age merge with the humanities' fundamental and long-standing concerns about the possibility of knowledge and of rational agency. Equally, we could say that concerns about attention are widespread today not only because people are preoccupied with what is happening to their brain, but also because people are preoccupied with what is happening to their world in relation to what is happening to their brain. What happens when we are distracted, and machines select and order information not with us, but for us? Questions such as this highlight how addressing the conditions for attention beyond augmentation and vis-à-vis computational automation involves considering the role and scope of both human and algorithmic rational decision-making and engaging with the consequent implications for the ways in which the humanities can intervene upon contemporary complex cognitive scenarios.