

RESEARCH ARTICLE

Algorithmically generated memories: automated remembrance through appropriated perception

Ellen Emilie Henriksen 

École Normale Supérieure – PSL, Chair in Geopolitics of Risk, Paris, France
Email: ellen.e.henriksen@gmail.com

Abstract

This article is on algorithmically generated memories: data on past events that are stored and automatically ranked and classified by digital platforms, before they are presented to the user as memories. By mobilising Henri Bergson's philosophy, I centre my analysis on three of their aspects: the spatialisation and calculation of time in algorithmic systems, algorithmic remembrance, and algorithmic perception. I argue that algorithmically generated memories are a form of automated remembrance best understood as perception, and not recollection. Perception never captures the totality of our surroundings but is partial and the parts of the world we perceive are the parts that are of interest to us. When conscious beings perceive, our perception is always coupled with memory, which allows us to transcend the immediate needs of our body. I argue that algorithmic systems based on machine learning can perceive, but that they cannot remember. As such, their perception operates only in the present. The present they perceive in is characterised by immense amounts of data that are beyond human perceptive capabilities. I argue that perception relates to a capacity to act as an extended field of perception involves a greater power to act within what one perceives. As such, our memories are increasingly governed by a perception that operates in a present beyond human perceptual capacities, motivated by interests and needs that lie somewhat beyond interests of needs formulated by humans. Algorithmically generated memories are not only trying to remember for us, but they are also perceiving for us.

Keywords: algorithmically generated memories; digital memories; time; Bergson; philosophy; digital technologies

Introduction

Through my phone, Google Photos notifies me that 2 years ago on this day I encountered a black and white cat on the streets of Paris. I also saw a tree hugging the pole of a fence. During my morning coffee, Facebook notifies me with a picture taken 6 years ago of me and a friend I later lost contact with jumping on a trampoline. As I am waiting for the bus, my phone buzzes to remind me that 14 years ago I finished high school in what seems like a former life.

The relatively new memory-functions appearing on social media platforms are one of the many ways in which digital media resurrects 'the faded and decaying past of old school friends, former lovers, and all that could and should have been forgotten' (Hoskins 2017, 1). In this article, I attempt to make sense of the specific form of resurrection of the past these memory-functions mediate. I borrow JeongHyun Lee's (2020)

terminology and refer to them as ‘algorithmically generated memories’: data on past events that are stored and automatically ranked and classified by digital platforms, before they are presented to the user as ‘memories’. This includes features such as Facebook Memories (Jacobsen and Beer 2021a), Apple’s ‘Memories’ (Jacobsen 2022a), the memory function on Google Photos (Lee 2020), and the newly launched ‘Advanced Stories’ feature on Facebook, which generates ‘stories’ – photos and videos that are visible on the user’s profile for 24 h – based on previous posts (Hutchinson 2023). The sophistication of these apps differs, as Apple, Google, and Facebook’s ‘Advanced Stories’ classify and rank photos according to themes – such as specific people, places, and activities – whereas Facebook’s ‘Memories’ generate both photos and text, and centres on content published ‘around this date’ in previous years (Konrad 2017). They all subject content to artificial intelligence (AI) vision that allows recognition of people, places, objects, activity, and mood, as well as simpler technologies such as rule-based filters that exclude screenshots and unfocused photos as potential ‘memories’ (Shapira 2021). They also measure the engagement with algorithmically generated memories after they are presented to the user through shares, likes, and time spent engaging with the picture. Lee argues that these memories are not memories at all based on their cybernetic legacy: memory is reduced to a combination ‘of the data put in at the moment and of the records taken from past stored data’ (Lee 2020, 6) and a ‘technical synthesis of storage and recollection’ as memory implies ‘the processing of the recorded information for future behaviors’ (Lee 2020, 3). I, on the other hand, argue that they may well generate memories, but they are not memories made for you.

Initially, this article was motivated by a sense of intrusion that arises whenever algorithmically generated memories impose themselves on my present. In an article on users’ interactions with algorithmically generated memories, Jacobsen describes a common feeling of tension as users encounter these memories, a feeling marked by ‘an uncomfortable awareness of algorithms at work’ and ‘affective tensions of unpredictability’ (Jacobsen 2022b, 13). Although I am not alone in feeling unease, other users report feeling joy when interacting with algorithmically generated memories, especially when the feature allows them to customise the memories shown, thus providing a ‘sense of agency with regards to how memories are classified, ranked and targeted’ (Jacobsen and Beer 2021b, 82). My own discomfort may therefore result from algorithmic failure and the so-called ‘uncanny valley’: the disquiet from interacting with technologies that resemble humans but are not convincingly realistic. The technology, in this case an algorithm attempting to remember in a human way, reveals itself as technology, thus failing to produce the ‘jogging happy memories’, as promised by Facebook (Reid 2019). But I believe there is more to my feeling of intrusion than algorithmic failure. I am intruded not only because the algorithm is prompting me to see specific parts of my past, but because the algorithm itself is seeing specific parts of my past: in telling me what to remember, the algorithm also sees me.

Paglen (2016) delves into ‘the invisible visual culture’ of machine-images illegible to the human eye. There is a fundamental difference between analogously sharing a photo with your friends and sharing a photo on social media. A photo on Google, Apple, Facebook, Instagram, or Tiktok is immediately subject to machine vision dissecting it into data points that are legible to other machines, but not to humans. The machines, in this case a network of immensely powerful AI systems, reformulate content produced by us into machine-readable signals that are beyond our perceptual capacity. We encounter algorithmically generated memories through vision: I see a picture of a tree embracing a fence. But that picture has already been re-packaged as a digital one, classified and ranked according to a series of identifiers created through machine vision and categorisation of billions of pictures, before it is identified as a picture that will probably bring me joy. And as I am watching the picture, the duration of my gaze, whether I share it, or if I

delete it, are data to be extracted. The algorithmic systems generating my memory are perceptive, or as formulated by Paglen (2016): your pictures are looking at you.

On algorithmic autonomy

Algorithmically generated memories are at the same time digital memories and targeted content, and transformative of both. When Instagram prompts me to buy a black t-shirt, it does so based on clicks, likes, purchases and searches that I've done in the past: my past behaviour is mobilised to influence my present choices. Aradau and Blanke (2022) argue that algorithmic reason undoes the distinction between speech and action, as data on my behaviour become the 'truth' about who I am. My speech and conscious expressions are not the narratives that define me. Rather, acts that can be datafied are what render my 'truth'. Memories are central to how we perceive and understand the world, and how define and understand ourselves. When Google Photos prompts me to reminisce on cats I've met in Paris, it is an automated challenge to my auto-narration, as analysed by Jacobsen (2022a), generated by perceptive technologies that shift the epistemologies of self-knowledge. According to Henri Bergson, memory always informs (conscious) perception, and in challenging my memories, the algorithmically generated memory also challenges my perception, such as the way I view Paris, or how I perceive the beauty if cats.

To capture their complexity, this article centres on three aspects of algorithmically generated memories: the spatialisation and calculation of time in algorithmic systems, algorithmic remembrance, and algorithmic perception. My point of departure is Bergson's philosophy of time, memory, and perception. Central to my argument is that algorithms cannot remember because they cannot live in duration, but they can perceive. Whereas duration – time itself – is a qualitative multiplicity characterised by indivisible change, the time of algorithms is spatial, quantitative, and reduces change to the divisible. Algorithmically generated memories rupture our duration as they impede on our attention to time as it passes, by invoking involuntary remembrance. They are not alone in evoking involuntary memory-work, but the scale and intimacy of their knowledge of our past, combined with the calculated rhythm of when pictures from our past are to be shown, make them different from other forms of involuntary memories. The generation of algorithmically generated memories depends on machine-learning technologies, computer systems with the capacity to learn from and adapt to their surroundings without explicit instructions, and I argue that this makes them perceptive. They do not perceive as conscious beings perceive, but in a manner that lies closer to what Bergson describes as 'pure perception': the aggregation of images in the present, uninformed by the past. Bergson argues that perception prepares the 'body' – the one that perceives – for action. It is therefore related to the perceiver's power to act. Consciousness and duration, on the other hand, relate to indecision: to retain time, hesitate, and to perceive the world without immediately acting on it.

Perception is to carve out static images of matter, it is always partial. What is perceived, which images are carved out, is motivated by the interests, and needs of the perceiver. When humans perceive, our memory pushes onto our present to inform our perception. As such, concrete perception – how we *actually* perceive – is somehow in the past. An algorithm cannot remember, it cannot actualise a virtual past to inform present perception, but only act on accumulated data that is materially stored in the present. Algorithmic perception is not a mere tool of human perception in the way that microscopes let us see bacteria and telescopes let us see the stars. Machine-learning algorithms, and AI technology in general, have a certain autonomy which is irreducible to the design by the original programmer, because they automate their own adaptation to an ever-changing world (Matzner 2019). Parisi (2019) conceptualises this autonomy as an

automation of automation, as the adaptive practice of machine-learning technologies allow them to generate new algorithmic rules. Hayles' (2016, 2017) recognises that not all cognition is conscious, and that both humans and some machines are capable of non-conscious cognition. Consciousness, according to Hayles, includes primary consciousness, an awareness of self, shared by humans, many mammals, and aquatic species such as octopi. Additionally, secondary consciousness, shared by humans and (perhaps) a few primates, is associated with 'symbolic reasoning, abstract thought, verbal language, mathematics, and so forth' (Hayles 2017, 9). The autobiographical self is associated with higher consciousness, and is 'reinforced through the verbal monologue that plays in our heads as we go about our daily business' which is in turn 'associated with the emergence of a self aware of itself as a self' (Hayles 2017, 9). Cognition, however, which is shared by humans, animals, and some machines, involves a much faster processing of information than what consciousness is able of and the recognition of 'patterns too complex and subtle for consciousness to discern, and drawing inferences that influence behavior and help to determine priorities' (Hayles 2017, 10). Hayles argues that technologies such as AI, machine-learning algorithms and neural networks are nonconscious cognisers and can be transformative actors. Thus, what they do is irreducible to what a conscious mind intended for them to do (Hayles 2017). In Bergson, consciousness refers to the introduction of a delay – hesitation and indecision – between an impression received and the mobilisation of a body (Bergson 1946). As such, consciousness is related to the ability to not act, to hesitate: to receive an impression through perception, without immediately translating it into action. Additionally, consciousness involves the capacity to be affected by the force of time, and to feel emotions in the presence of memories, and it is a question of mind rather than the brain (Bergson 1946, 2004; Lazzarato 2007). Hayles and Bergson both agree that action does not depend on consciousness, but whereas Hayles emphasises the role of processing information in nonconscious cognition, a Bergsonian approach allows for a greater emphasis on the capacity to act beyond consciousness.

To argue that machine-learning algorithms are perceptive is not to argue that they are mere technological prolongations of human perception, or to argue that their perception is wholly autonomous from any human intent. But the interests and the capacity to act that inform algorithmic perception are irreducible to any human consciousness. The field of perception for an algorithmic system – the scale and granularity of big data – correlates with the power to act on that data, and both lie predominantly beyond human vision and conception. In the context of algorithmically generated memories, algorithmic perception implies that our memories are increasingly subjected to a perception that operates only in the present, and that the interests that inform algorithmic perception lie somewhat beyond interests or needs formulated by humans.

On digital memories and Bergson

Almost two decades ago, Jose Van Dijck asked how digital technologies affect acts of memory. More pertinent to this article, she asked how digital technologies frame new ways of 'retrieving mediated records of time past' (Van Dijck 2005, 313).

There are obviously many ways to respond to both questions, as digital memory studies have shown, and any answer to these questions requires assumptions as to what a memory is. In *Digital Timescapes*, Robert Kitchin writes that 'memories are remembered pasts – the recollection of and engagement with past events, experiences, thoughts, viewpoints and emotions' that are triggered by specific encounters with surroundings, and it differs from storage of information because 'memory relates to the qualities of the information recorded and how it is experienced when encountered' (Kitchin 2023, 58). Jacobsen and Beer refer to memories as something that 'mediate those things that have been

experienced' (Jacobsen and Beer 2021b, 2). By referencing to Walter Benjamin's writings on memory, they describe memory as 'an action' of 'digging' for memory in one's past: in fact, 'it is this very process that defines a particular past moment as a memory' (Jacobsen and Beer 2021b, 2). If we take Benjamin's conceptualisation at face value, it would be difficult to argue that algorithmically generated memories are memories at all. It is the algorithm, the platform, which sorts and ranks 'your past' in these memories. Removing the 'digging activity' of a memory would therefore be a way of moving the past into the present through something else than a memory. However, as Kitchin notes above, a memory is also the engagement with the past: even if it is Google Photos that has ranked the picture of a cat from 2 years ago as worthy of remembrance, I am also engaging in that remembrance with my own personal memory-images of that cat, of that day, and of that street. Google Photos has hierarchised my past in a way that is extensively out of my control, but some of the memory-images of my past are still mine to behold.

Van Dijck's notion of mediated memories implies that we remember both in and through media technologies (Van Dijck 2009). The mediation of memories happens in and through technologies that are produced and mediated by the 'political economy of attention' (Garde-Hansen and Schwartz 2017). This involves an acknowledgement of the social and shared nature of memories: that our recollection of and engagement with the past is never only a personal endeavour. The collective, or social aspect of memory has been recognised by memory studies long before the advent of digital media, amongst others by Maurice Halbwachs (Marcel 2007). Where Bergson's philosophy of memory is centred on the memory-images in a person's mind, and the way memory informs a person's perception in the now, his contemporaries like Halbwachs and Pierre Janet emphasised the social nature of remembering. Janet argued that the very definition of memory is social: memory is a narrative, or account [récit]; there is no memory if we do not have a narrative of a past to share with another – regardless of whether that narrative is actually shared or not (Janet 2006). From a sociological point of view, the digital memory economy fuelled by digital media is therefore monetising an already social practice, which perpetuates already existing inequalities in social remembrance (Pogačar 2017). In addition to being highly industrialised and complex, digital memory is a field of social production that is 'both external and internal': digital technologies record data from within our body through medical imaging, and they 'capture and record data memories from far reaches of the universe and bring that knowledge to earth' (Reading and Notley 2017, 235). Memory, as an 'egocentric yet deeply social' activity (Hoskins 2016, 348), is therefore reaching further in, and further out, through digital technologies. Algorithmically generated memories are one of the ways in which digital memory is reaching further in, and to capture this it is necessary to appreciate the intimate activity of remembering. The story we tell about a memory, the social negotiation of how the past should be actualised in the present, can never occur in a vacuous individual mind. However, the accumulated images from our body's perception of matter through time are of an individual nature; although the past is organic, flexible, and negotiable, it is moved into the present as a memory by a consciousness. And it is this very intimacy that algorithmically generated memories tap into. To capture that process it is appropriate to start with a theory of memory which supposes the mind as the mediator of memory.

In a broad sense, this paper is centred on the last of Van Dijck's questions mentioned above: how digital technologies frame new ways of retrieving mediated records of time past. Bergson has previously been mobilised to analyse transformations to memory instigated by digital media. Ernst (2017) and Van Dijck (2009) both refer to Bergson to argue that memory always forms part of the present and the active nature of remembrance, as 'the present dictates memories of the past: memory always has one foot in the present and another in the future' (Van Dijck 2009, 160–161). As I will discuss below, the present

too always has one foot in the past. In his analysis of biobanks as an exteriorisation of memories of life, Clarizio (2022) uses Bergson to emphasise how memory pertains to life – that it is the living that remembers, and not the inorganic. However, memory can also be exteriorised through intelligence, and materialised as technology. In the context of biobanks this duality is actualised as memories of life, beyond the individual that is living, are materialised in technology. Amoore and Piotukh (2015) refer specifically to Bergson’s notion of perception as the authors analyse the way in which machine-learning algorithms perceive the world within which they move, to adapt to said world. They argue that algorithms are ‘organs of perception’ that quantify the world and see only parts of objects that are of immediate interest. Parikka (2017) engages with Bergson’s philosophy to a lesser extent, as he does not engage with Bergson directly, but references Maurizio Lazzarato’s (2007) in-depth analysis of Bergson’s *duration* [la durée]¹, and the way in which time is what prevents everything from happening at once. Lazzarato analyses video and information technology as machines that crystallize time. He views videos as corresponding to Bergson’s notion of perception in order to ‘pose the only reasonable question that can be addressed to these new technologies: to what degree of power [puissance], to what capacity to act, do they correspond?’ (Lazzarato 2007, 93, emphasis in original) Bergson views perception as directly linked to a capacity to act, and memory and time as inevitably linked to a capacity to feel. My analysis differs from Amoore and Piotukh’s references to the machine-learning algorithm as an ‘organ of perception’ because I argue that machine-learning algorithms, as autonomously adapting to a changing environment, are perceivers, and not mere prolongations of human perceivers. Rather, I agree with Lazzarato’s observations that machine perception – in his analysis a video machine – ‘has something of pure perception about it’ (Lazzarato 2007, 98) and Hayle’s assertion that the speed of algorithmic cognition – in her analysis of High-Frequency Trading – introduces ‘a temporal gap between human and technical cognition that creates a realm of autonomy for technical agency’ (Hayles 2017, 142; see also Beer 2017). Combined with the aforementioned scale of algorithmic perception, machine-learning algorithms should be conceptualised as perceivers, rather than mere organs of perception.

On duration and the time of algorithms

I had forgotten my friend pictured with me on a trampoline. We had never been close, and our estrangement had been undramatic. We had simply shared a shallow bond for a breath of time, which had disintegrated into nothingness without either of us paying too much attention. When Facebook nudges me to reminisce about this specific moment lost to the past, it is part of the ‘programmed sociability’ of social media (Bucher 2018). My former friend and I are still ‘friends’ on Facebook, and ‘friendship’ is at the heart of Facebook’s business model. Of course, the Facebook version of ‘friend’ has little to do with what we otherwise think of as friendship, but is a category created to drive interaction, association, participation, and time spent on the platform (Bucher 2018). But there is more at stake here than a computational ambition to create friendships from collected sets of zeros and ones. There is also a tension arising from time being fractured. The past is too sharply cut off from the present as the I in the picture is not me, it is another, and the past shown is not my own. Before I habitually picked up my phone, the durational

¹ The translation to English of certain key concepts of Bergson’s philosophy is the source of both confusion and conflict. Even though several of his books were translated during his lifetime and authorised by him, their English translation sometimes fails to capture the original French meaning. I have, therefore, decided to include the French term in brackets when introducing his key terms. See Tomlinson and Habberiam (1991) for a short discussion on the translation of Bergson’s work to English.

me was drinking my morning coffee in the present, whilst travelling between memories of the past, thoughts of the day, plans for the future and the fluid moment of the present: the process of caffeination here and now.

Bergson introduces the concept of duration in his doctoral thesis, the English title of which is *Time and Free Will, an essay on the immediate data of consciousness* in 1889. Duration is not the quantitative time measured by clocks, but a 'heterogenous multiplicity': flowing, fluid, and rhythmic, and accessible through intuition. Duration cannot be measured in seconds and minutes, where each moment is gone as the next one arrives. The length of a moment is fluid, and it is a question of *attentiveness* to a period of duration. Duration concerns 'the happening of time as it passes' (Guerlac 2021, 45, emphasis in original). To describe duration, Bergson often turns to the image of music, to rhythm, to capture the qualitative nature of time as opposed to the quantitative nature of space. When we listen to a piece of music, we do not listen to each individual note, but we 'perceive them in one another', so that 'if we interrupt the rhythm by dwelling longer than is right on one note of the tune, it is not the exaggerated length, which will warn us of our mistake, but the qualitative change thereby caused in the whole of the musical phrase' (Bergson 2001, 101). Duration 'knits past, present, and future together' as the musical phrase 'both flows through time and holds time, bonding the first notes ... to the last in an unusual structure in which unity and multiplicity overlap' (Guerlac 2021, 47). In a lecture on the soul and the body, given in Paris in April 1912, Bergson writes that 'our whole psychological existence is something just like this single sentence, continued since the first awakening of consciousness, interspersed with commas, but never broken by full stops. And consequently I believe that our whole past still exists' (Bergson 1920). Duration – the happening of time as it passes – is therefore a question of attention in a literal sense, as the division between present and past is relative to 'the extent of the field which our attention to life can embrace. The 'present' occupies exactly as much space as this effort' (Bergson 1946, 127). Just as history becomes history when it does not have any 'direct interest to the politics of the day and can be neglected without the affairs of the country being affected by it' (Bergson 1946, 127), our present becomes our past when our immediate attention to duration is broken.

The past doesn't cease to exist as a new present arrives but goes on to exist in a virtual state. Whereas the present is actual [*actuelle*]² and real, the past is virtual. Bergson refers to the virtual past of everything that has ever been as 'pure memory' [*mémoire pure*] which we may actualise in the present through remembrance. Our attention to life is conditioned by memories, but if incohesive, memories impede our attentiveness to the present, and the past demands privilege over the actual life of now. To be attentive to the present is not about forgetting one's former states, 'it is enough that, in recalling these states, it does not set them alongside its actual state ... but forms the past and the present states into an organic whole' (Bergson 2001, 100). Pure duration, to exist fully in time, is the form assumed by 'our conscious states ... when our ego lets itself *live*, when it refrains from separating its present state from its former states' (Bergson 2001, 100, emphasis in original). As illustrated by Sinclair (2020), we do not understand a work of music by recollecting the previous note as the current one is being played. Rather, we experience the whole melody as one continuous flow of time which is not delegated to the past until the rhythm has stopped. To act as our whole being, as our whole duration as one, is for Bergson the highest degree of freedom.

But memories are often incohesive and rupture our attention to life – this is not unique to algorithmically generated memories. Any part of our surroundings has the potential to

² Bergson uses 'actual' in contrast to the 'virtual' ontological status of the past. The choice of the word 'actual' to describe the material realness of the present is more intuitive in French than in English. Whereas the English meaning of 'actual' lies closer to 'real' or 'in fact', in French, '*actuelle*' means 'current' or 'existing'.

trigger a memory disrupting our morning routine and Bergson acknowledges that many memories are involuntary, and that always being attentive to life is unattainable. I may detach myself from my present and rupture my attentiveness to duration, if I smelled the perfume of someone missed, or heard a tune I had forgotten that exists. And had the former friend jumping on the trampoline been someone dear to me, I may even have reminisced in gratifying nostalgia, as many social media users do. But somehow, targeted content generated by digitally stored personal data and information seems qualitatively different from familiar perfume worn casually by a stranger. One obvious reason for that is that the pictures generated by these media are directed towards me. A stranger wearing a certain perfume is not doing so to evoke specific memory-work in me – to deliberately rupture my attentiveness to duration would require them to possess detailed knowledge of my past and to mobilise this knowledge would be rather manipulative. An algorithmically generated memory has a purpose. Its aim is to give me a pleasant feeling and make me spend more time on the platform; my memory-work is manipulated in a quest for revenue (Reid 2019). But to be targeted by algorithmically generated content is not unique to algorithmically generated memories. The very temporality of social media, the rhetoric of how the world is formulated on the interface I behold is already composed for my eyes, or more specifically an assumption of who the one who sees is (Bucher 2020; Jacobsen 2022b). And this assumed I – the data double composed by all traces I have left online coupled with assumptions on what someone ‘like me’ ‘is like’ (Lury and Day 2019) – has its own ‘rhythm’ (Carmi 2020) which operates in tandem with my own duration and my own becoming. But my data double does not become – it is not a conscious being and it feels nothing at all in its encounter with an algorithmically generated memory – it has no attentiveness to time as it passes that can be ruptured: it is an emotionless, spatialised shadow of my conscious being, whose development is targeted, in an attempt to target me, by algorithmically generated memories.

It is the ‘universal becoming’ and the assertion that ‘reality is becoming’ (Bergson 1946, 131) that came to form part of the metaphysical background for cybernetics. Halpern argues that Wiener (1948) chose to refer to Bergson specifically in *Cybernetics* because Bergson’s attempt to ‘produce forms of thought that did not remain static and always combined the memory of an event with its future’ (Halpern 2014, 52) gave Wiener the ‘tools for creating systems that were self-referential and in which the temporal frames of recording the past and producing the future became compressed’ (Halpern 2014, 53). The cybernetic, and computational, view on machine memory as the storage and categorisation of information to inform future action is similar to Bergson’s insistence on the past never ceasing to exist, but pushing onto our present which is always directed towards the future. However, cybernetic, computational, and algorithmic time is always a spatial one, as pointed out by Amoore and Piotukh (2015). AI, for instance, cuts up time in ‘time slices’, during which variables can be ‘measured’ as the world is viewed as a series of snapshots (Russell et al. 2010, 567). Although the length of the time slices varies, they always serve to cut up continuous change, such as the slice of time I let a picture of a cat cover the screen of my phone, during which my actual gaze moves from the picture’s background, to cat, and to inwards reflection as I conjure my own memory-images. In algorithmic reason, becoming is always divisible, dividing up change, and algorithmically generated memories are generated in time slices, crystallising time (Lazzarato 2007).

On how the past survives in the present

It is afternoon and I am trying to recall what I need to get from the supermarket. Google Photos notifies me with a composed selection of images taken at twilight titled ‘The golden hour’. One of the photos is taken as I am eating apples next to a bonfire. Next

to me is my partner at the time trying to devour a melted marshmallow without compromising their elegant disposition. I notice a former colleague I had never liked; I had forgotten they had been there. It is cloudy, although I had always imagined the evening sky to be clear. The shopping list I had been drawing up in my mind only minutes earlier has disappeared, as I feel sadness in hearing laughter long gone and a bonfire that stopped burning almost a decade ago.

As I have already discussed, the past represented in this photograph is not gone but goes on to exist in a virtual state. It is this virtual state that Bergson refers to as 'pure memory', but it is perhaps more accurately described as 'pure past' (Sinclair 2020). Pure memory is not a conservationist argument claiming that memory is merely the accumulation of all that has happened. Rather, it is a metaphysical argument as to the 'pastness' of a memory-image. When all that is real and actual is the present, a memory-image too is in the present, just as any imagination with no relationship to something that has happened is in the present. To distinguish a memory-image from an imagination, something about the memory must give it its 'pastness', which cannot be anything found in the present such as a data centre, diary, or the brain. As such, it is hard to capture by language as we cannot ask where it goes, because the framework of space is misplaced: it is virtual and not material, it does not go any'where'. But data on my behaviour, on the time and place the photo was taken, are all material and stored 'somewhere' in the cloud, in the present. The data stored in big data is therefore only a specific form of *knowledge of the past*, limited to knowing only the past that can be datafied.

Bergson describes the activity of remembering as how the past survives in the present (Bergson 2004). He argues that although we remember more than we seem to think, we cannot capture pure memory in its totality. Rather, the parts of pure memory that *survive* in the present depend on the present whence it is conjured. It is an activity of the present which allows the past to take actual form but the form it takes will never be 'accurate', it will never be a complete reproduction of the past in all its complexity. Pure memory, for Bergson, is not the storage of everything that passes, which can then be replayed at will. Rather, pure memory is the predicament of remembrance: 'there can be *no pure act of remembering*' (Sinclair 2020, 100, emphasis in original).

The complexity of our memory-images depends on our interests in the present situation we remember in. When memories are mobilised to inform action, they are reduced in detail, and we recollect only what is useful for our actions in the present. When I am composing my shopping list, I am recalling my empty fridge to readily inform my action in the present, which is to write down which foods I am lacking. I am reducing the complexity of the image I have of my kitchen; of the dishes that should have been washed, and the boredom of my morning routine. When we move towards pure memory, memory-images retain more fully their details, as 'we detach ourselves from our sensory and motor state to live in the life of dreams' (Bergson 2004, 211). A memory is therefore necessarily organic and flexible as what past survives in the present depends on the presence whence it is visited. This processual notion of memory, that it is a process of moving the past into the present, forms the basis of the cybernetic imagination of memory, as memory becomes a 'temporal matter of processing the archive, instead of the spatial matter of recording data in storage' (Lee 2020, 5). As argued by Lee, the composition of photos presented by Google is an example of how 'computer-memory is no longer read-only storage, but the successively generated archive ... even though what appears on the screen seems permanent, link locations of information always change in every regeneration of the information' (Lee 2020, 5). There are, however, nuances to that claim. Coeckelbergh (2021) points out that the very data points that are stored do not change in real-time as soon as they enter the data set: we can change the algorithm, but the data on the past is stored in data points, spatialised in an eternal present. But these data points are

illegible to us, or to use Paglen's (2016) formulation – they are invisible to us – and the only way in which we can see them is through algorithms that evolve through time, showing us bits of our past when it is considered the 'right-time' (Bucher 2020; Jacobsen 2022b) to do so.

Bergson is not always clear on how pure memory – the past – comes to be actualised in human remembrance. On one hand, memories push onto the present; they inform perception even when I am not conjuring them. As such, perception is already memory, because in practice 'we perceive only the past, the pure present being only the ungraspable progress of the past gnawing into the future' (Bergson 2004, 194). But on the other hand, he describes the past as impotent, until 'consciousness ... follows memory at work' (Bergson 2004, 171). Whereas the first formulation describes how perception is never without memory, as 'it is impregnated with memory-images which complete it as they interpret it' (Bergson 2004, 170), the latter accounts for the voluntary memory-work of letting parts of pure memory become actualised in the present. Sinclair argues that the notion of pure memory both pushing onto the present, and impotent until activated by memory-work lets us 'understand involuntary memory as a function of memories that come back to us without us having sought them' (Sinclair 2020, 105).

The series of photographs taken at twilight, composed by Google Photos as a category of the past to be remembered, invoke involuntary memories in me. They rupture duration as I am not taking a voluntary leap into the dreamlike state of nostalgia, which 'I may lengthen and shorten at will; I assign to it any duration that I please' (Bergson 2004, 91). The fluid present of my morning coffee is ruptured by spatialised knowledge on my past, as I involuntarily actualise memories of a past deemed valuable by algorithmic systems owned by Google Inc. However, as I engage with the algorithmically generated memory, I am re-negotiating my memory-images, as their meteorological canvas and social composition are called into question. As such, my interaction with the algorithmically generated memory is at both times involuntary and voluntary. My memory-images are triggered without me having sought them, but I consciously engage with them as they emerge in 'an interactive and iterative process of interpretation and reinterpretation of an 'imagined reconstruction' of the past and [my] relationship to that past' (Jacobsen and Beer 2021b, 64).

As described by Lazzarato, duration is force, 'and it acts like one because it produces the capacity to 'feel', to be affected' (Lazzarato 2007, 95). A memory-image both informs my actions in the present – it implies a capacity to act – and it evokes emotions in me, it leaves me affected. An algorithm cannot remember, and duration lies beyond its grasp because it can act only in spatialised time. But it can act on my duration; it has capacity to make me feel, to be affected. And it can do so because it perceives without memory. And it can do so effectively, because its power to act is proportional to its perceptual horizon, and not its will or consciousness.

On algorithmic perception

Despite never having labelled any of the photos stored in the Google cloud, Google photo has managed to identify and categorise photos taken during 'the golden hour' and anticipate that seeing these photos would affect me, and hopefully bring me joy. Such a categorisation depends on the Google algorithm being able to distinguish sunlight from artificial lightening, just as it can distinguish cats from dogs, and smiles from frowns. The automatic generation of albums implies that 'the algorithms can identify not only information about photos but also information *in* photos' (Lee 2020, 8, emphasis in original). Algorithmic perception is not entirely autonomous from human needs and interests. The categories are usually created by human beings, and the algorithm has been trained,

usually with some supervision involved, on training sets consisting of photos taken by human beings. But subsequent perception happens without supervision, and what an algorithm can perceive is often beyond our sight. This is both because of the sheer scale of what is perceived, and because their perception follows a logic that seems alien to the human eye. Paglen (2016) writes that Facebook's DeepFace algorithm, which was first deployed almost 10 years ago to identify faces, can achieve 97% accuracy at identifying individuals. That percentage is comparable to what a human can achieve, but 'no human can recall the faces of billions of people' (Paglen 2016). The Eigenface technology, used in surveillance technologies, identifies the uniqueness of faces by subtracting all common features from a face, thus creating facial 'fingerprints' (Acar 2018; Paglen 2016). Machine vision is developed to transcend human vision through its own set of perceptual rules, which are continuously being updated through the expansion of available training sets.

The present, according to Bergson, the extended period of duration we refer as 'now', is actual and real. Although concrete perception is always informed by memory which pushes onto our present, pure perception is not virtual, but spatial. When we perceive an object, we perceive an aggregate of images. The word 'image' does not denote anything more mysterious than the impressions made on my sensory organs by my morning coffee. In arguing that matter is an aggregate of images, Bergson sought to undo the dualism of materialism and idealism: our perception of our surroundings is not independent of the objects we perceive, but it is limited and can never capture the totality of what we have in front of us (Bergson 2004). Our body too is an image, just as the external world is an aggregate of images. But our proper body is privileged compared to the others, because perception is informed by what the body that perceives finds useful; what is of interest to the body, and it does so to prime the body for action. I have already argued that machine-learning algorithms cannot be reduced to their original design: their automatic adaptation as they voyage through the actual world has a degree of independence from their original design. The perceptive machine-learning algorithm is therefore more than an 'organ of perception', as argued by Amoore and Piotukh (2015), but lies closer to a 'body that perceives', a perceiver.

Perception is subjective and extracts from a given situation 'that in it which is useful, and [stores] up the eventual reaction in the form of a motor habit, that may serve other situations of the same kind' (Bergson 2004, 218), and it is this lag between perception and bodily action which is created by consciousness. In conscious perception, it is through the moment of hesitation and indecision that 'the impression received, instead of expanding into more movements, spiritualises itself into consciousness' (Bergson 2004, 100). In a certain way, Bergson's perception recasts how we commonly approach questions on agency and consciousness. In Bergson, consciousness is not directly related to action, but to the moment of hesitation which allows us to choose how to act. Consciousness is to be found in a time lag: in indecision, in inaction, the ability to receive an impression through perception *without immediately acting on it*. Pure perception is the perception of the world without duration, it is the perception of the world of only images, without any rhythm of duration, but human perception is never pure, but concrete. When conscious beings perceive, pure perception is always coupled with memory, which allows concrete perception to perceive images in one another, fitting them into rhythms and continuous change (Bergson 1946, 2004), but in pure perception, duration is abolished and 'the result will be an infinitely more divided, diluted duration' (Lazzarato 2007, 94).

The records of the past stored in the cloud were once records of the present: all pasts have at some point been present. When these records are perceived, they too are perceived in the present and do not let the past *survive* in the present. Rather, they reduce the past to actual and real data points that can be perceived in the present; they deny

the past its virtuality. Lazzarato writes that ‘technologies simulate corporeal perception in that they operate on the single plane of the present, like a mechanism that receives and returns movements’ (Lazzarato 2007, 110). But duration ‘is what hinders everything from being given at once. It retards, or rather it is retardation’ (Bergson 1946, 75). The speed between perception and movement is also central to Wiener’s moral and technical reflections on automatic cognition, as he writes that machines ‘can and do transcend some of the limitations of their designers, and that in doing so they may be both effective and dangerous’ (Wiener 1960, 1355). A danger he identified was the speed at which machines can perform tasks, which means that human criticism of their performance risks always being too late (Wiener 1960). As mentioned above, Hayles (2016) too argues that the speed of machine cognition creates a time gap for machine agency. Duration, and consciousness, introduces a delay between impressions received and bodily reaction, which in turn retards power to act on the world. The power of algorithmic technologies lays in their lack of consciousness, in their abolishment of hesitation between perception and action. But as unconscious, a machine-learning algorithm’s adaptation to its surroundings is purely automatic. The direct translation of impressions received into bodily action is deterministic and devoid of choice. What makes the machine-learning algorithm change in ways that may seem unpredictable, is not the unpredictability of its reactions to input, but the unpredictability of what it perceives. It feeds off human hesitation, and as such also human consciousness. Its power to act lies in its lack of choice, and its power to adapt lies in our indecision.

The present within which algorithms perceive is an extended one, as it is composed by data of an immense scale and granularity. Aradau and Blanke argue that algorithmic reason ‘promises to transcend the methodological and ontological distinctions between small and large, minuscule and massive, part and whole’ (Aradau and Blanke 2022, 23). When we perceive something distant, its capacity to act on us is virtual, and so is our capacity to act on it. But as the distance between us and what we perceive decreases, the ‘more virtual action tends to be transformed into real action’ (Lazzarato 2007, 100). In undoing the distinctions between small and large, algorithmic reason also seeks so undo the distinction between distant and near: the immediate presence is ever more expansive. In the context of algorithmically generated memories, that means that knowledge of an event of my past lies close to the real and actual actions of immensely powerful AI systems, whilst distant and invisible to any conscious being trying to perceive the same data. This is not exclusively bad. It is presumptuous to assume that all that is forgotten should be forgotten, and there may be things in pure memory that I can only actualise through the help of algorithmically generated memories. But it does mean that my past does not primarily exist in a virtual state, that I access and leave at my own will, or that potently informs my present through my perception. It means that knowledge of my past persists in a spatialised and actual form, which is no more accessible to me than my pure memory, but whose legibility is extensively determined by algorithmic perception. In a way, we can never perceive our past, but an algorithm can.

Perception is a determination of the possible: we see what we can act on. That algorithmic perception is motivated by more than human interests, also means that the actions that can be acted on are formulated by more than human capacities. When Facebook nudges me to remember a former friend, it is doing so because my former friend is on Facebook: we are Facebook friends, and our reconciliation is actionable on Facebook. In perceiving my past, algorithms are also appropriating the delineation of what can be acted on, in my life. Facebook was able to perceive that my former friend and I had previously spent time together through organic content published on the platform. Facebook could also perceive that the former friend and I had not been a couple that broke up, and that neither of us was dead, because in both those cases it could be unpleasant for me to

be reminded of my memories of them. The person on the trampoline is not the only former friend I could have reminisced on and potentially re-establish contact with. But if they are not on Facebook, in a photo, with me, and Facebook friends with me, that is not perceivable to a Facebook algorithm, because it is not actionable to Facebook. That may not significantly influence my life: I am still free to reminisce in my own memory-images, searching for friends I have lost contact with and choose whether I want to reach out to them or not. But no matter what I choose, the algorithm will feed off that choice, adapting its future behaviour based on whether I ignore the picture, share it, or delete it. I can also ignore the compilation of 'The golden hour' that Google has composed for me, or I can quickly skip from one picture to the next, delete some of them, delete all of it, or share the whole album with my friends. The choice is mine, but the delineation of available choices is created by Google, and it is generated in front of me faster than anything similar I could have achieved myself. And no matter what I choose, it will feed off that choice, adapt to it, and therefore encompass it in an ever-expanding present beyond my perception.

Conclusion

I have the freedom to turn off the notifications on my phone, and to limit the amount of photos I take and the photos I share. I may also choose to ignore algorithmically generated memories and spend my days reminiscing in my own memory-images, free from buzzing notifications. But neither of those choices would stop the transformation of memory-practices brought on by digital media, and algorithmically generated memories plays an important part in contemporary memory-practices. On social media, algorithmically generated memories are a way to salvage platforms from decreases in organic content published by their users (King 2023), and for users they are a convenient way to generate attention without having to create new content (Hutchinson 2023; Worb 2022). In this article, I have untangled the power that pertains to algorithmically generated memories and argued that machine-learning algorithms should be understood as perceptive. When perception immediately leads to action, those actions are 'determinate movements', according to Bergson (Bergson 2004, 219). But in dreaming, which is the opposite to what I have described as nonconscious perception, perception 'melts into an infinity of memories, all equally possible' (Bergson 2004, 219). The lack of hesitation between perception and action which demarks the power of algorithmic perception, is also what delimits the possible in algorithmic reason. Because it is their nonconscious perception which allows them to perceive widely and act quickly. And it is their lack of hesitation which limits their – and subsequently some of our – imagination of what is possible.

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Ellen Emilie Henriksen is a PhD researcher in philosophy at École Normale Supérieure-PSL and a collaborator at Chair in Geopolitics of Risk. Their main research interests include time, digital technologies, memories, Henri Bergson, and uncertainty.

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