RECURSIONS

Memory in Motion

Archives, Technology and the Social

EDITED BY INA BLOM, TROND LUNDEMO AND EIVIND RØSSAAK

Amsterdam University Press

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The book series Recursions: Theories of Media, Materiality, and Cultural Techniques provides a platform for cutting edge research in the field of media culture studies with a particular focus on the cultural impact of media technology and the materialities of communication. The series aims to be an internationally significant and exciting opening into emerging ideas in media theory ranging from media materialism and hardware-oriented studies to ecology, the post-human, the study of cultural techniques, and recent contributions to media archaeology. The series revolves around key themes:
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Cover illustration: *Ephemerol Scan,* 2016. Courtesy of the Scandinavian Institute for Computational Vandalism (SICV). An object from the archive of Guttorm Guttormsgaard placed on a flatbed scanner is minutely read on various levels of resolution, which are then arbitrarily distributed across the image. The Ephemerol Scanner turns any object into a field of fluctuating pixels and allows you to move within and between such images through wormholes of corresponding pixels.

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Table of Contents

Lives

Images

Socialities

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Ina Blom,
Trond Lundemo,
Eivind Røssaak.

Introduction

Rethinking Social Memory: Archives, Technology, and the Social

Ina Blom

Memory and containment

'The languages of containment have taken a deep hold over our thinking on memory, whether it is the brain or the computer that provides the container that cribs and confines memory.' This is Keith Ansell Pearson discussing Bergson's theory of memory, with reference to a key point in Edward Casey's *Remembering: A Phenomenological Study*.[1] If Bergson's account of memory has at times been described as hard to 'grasp', it is precisely due to its vehement resistance to all concepts and metaphors of grasping and holding, the very notion that memories are object-like entities that we keep safely stored away in some archival system whose stability, durability, and accessibility are always the critical point. The brain, for Bergson, was certainly not such an archive, not a separate object or organ that produces and stores representations of the world. It was an integral part of the material world, and more specifically – thanks to its ability to receive and distribute the stimuli that prepare the body for movement – part of the essential mobility of matter itself. If the brain seems to contain images or memories, it is only because the world itself is an aggregate of image sensations that constantly receive and produce the movement of stimuli. Images or memories are essentially actions, points of connection and disconnection, relays that draw sensations together.[2]

But the concept of container memory is also increasingly being challenged, on a practical and well as philosophical level. The reason is simple: for a long time now, we have been surrounded by technologies of memory that are premised on the constant activity of circuits and relays. Officially, these technologies may speak the language of storage and containment. They tend to promote an unprecedented capacity for storing memory, now accounted for in the precise mathematical language of 'bytes' – a unit of digital information in computing, most commonly defined as a combination of eight zeroes and ones. Today we are all 'counting' storage space in terms of a thousand bytes to the power of two, three, four, five, and so on – megabytes, gigabytes, terabytes, petabytes. Yet the mathematical terms betray the

ambivalence of the promise of storage. With digital technologies, nothing is stored but code: the mere *potential* for generating an image of a certain material composite again and again by means of numerical constellations. Forget to update the software through which an encoded material is made visible, and there is little left – at least from the point of view of the cultural interface. This is not because information is 'immaterial' but because visibility is not a measure of its specific forms of material inscription: inscription is simply some kind of modification of an electromagnetic substratum.[3] If archives used to be described in terms of principles of ordering, they are now, as Wolfgang Ernst has pointed out, better understood through concepts such as 'fields' and 'dynamics'. With digital archives, documents and contents are no longer separated from the archival infrastructure: once the archive is based on networked data circulation, its emphatic form dissolves into the coding and protocol layer, into electronic circuits or data flow. Archival data have, of course, always been in circulation: the whole point of an archive is to allow documents to be mobilized for the shifting needs and inquiries of the present. But with the networked digital archive, this circulation becomes a feedback circuit whose material structure is that of vectorial dynamics and electromagnetic fields.[4] And this accounts for some of the ambivalences surrounding digital memory, the fact that computer archives are targeted as the source of archival destruction and loss of cultural memory. As Wendy Chun points out, software enables a logic of permanence that conflates memory with storage, the ephemeral with the enduring. Through processes of constant regeneration or 'reading', it produces an enduring ephemeral that promises to last forever, even as it marches toward obsolescence or stasis.[5] The conflation of memory with storage is, in other words, undermined by a technical emphasis on dynamic processes of memorizing. To the extent that computer memory exists, it is essentially activity; virtual as well as actual, and its images are electronic events.

This technical conundrum presents numerous dilemmas for the various institutions of cultural memory that are the hallmark of modern, dynamic societies and their anxious obsession with memory in the face of always potential memory loss.[6] Pierre Nora named them *lieux de mémoire* in order to emphasize their desire to fix and monumentalize memory in terms of *space* and *place* and to distinguish them from the *milieux de mémoire* of premodern, rural societies, where memory – the unbroken bond with the past – was organically embedded in every gesture of a society's members and where the question of safekeeping and memory

loss was not an issue.[7] To digitize archives, records, and collections is in many ways to lighten the burden of archival site specificity, the problem faced by every memory institution as ever more materials from an ever wider range of sources are deemed memorable and of public value. Servers, which present their own type of spatial challenges, nevertheless seem to exchange the question of space with that of time: expensive square metres are remediated as processing time, volumes as information, subjected to varying degrees of 'compression' or 'resolution'. There are other benefits as well: digitization facilitates searchability, making memory materials more or less instantaneously available to anyone, anywhere in the world. Digitization seems, at least in theory, to promote a radical democratization of memory: everything may, potentially, belong to everyone. A proliferation of digital paywalls and passwords is the reality; vestiges of a bounded, territorial concept of space, just like the duplicitous concept of storage.

Yet issues of fragility and ephemerality that come with informational transformation of space perennially haunt digital archives. How safe is cultural memory if it depends less on locked, temperature-controlled vaults than on software updating, compatibility, synchronization, energy flow, and channels of transfer? And how to select what to remember when the exponential growth in the processing power of microchips seems to promise that there will, in principle, be 'capacity' for everything?[8] The question pertains not just to the encoding of non-digital objects and documents but – even more pertinently – to how digital society will memorize itself and the constant stream of instantaneous communications and interactions that seem to be one of its key features. If the traditional archive is premised on the selection of a few original, exemplary, finite objects and documents, each one attesting to one time and place,[9] how can a world of networked mobilities, – relays, updates, negotiations, associations, and speculations – even be archived? How to decide where connectivity starts and where it ends?

These concerns are practical ones, challenging archives, libraries, and museums all over the world. Enormous efforts are invested in handling the numerous dilemmas of informatization. But they are also ontological, challenging not just ideas of what it means for societies to remember, but what concepts we have of 'the social' in the first place.[10] Archival anxiety and the preoccupation with memory loss on a grand scale is not a universal condition but premised on a very specific image of sociality. It is premised, in the first instance, on a particular concept of reflexivity:

that society, in order to exist, must have a self-image. Cultural memory, we are often told, is a portrait: it allows us to see who we are and who we have been. Aspects of this line of thinking emerged in Émile Durkheim's *The Elementary Forms of Religious Life*, where he described religion as a celebration of a mythical past that confers identity on individuals and groups. Religion then allows us to understand shared memory as a key element of social life. Society is memory, and memory is recognition, identity.[11] This emphasis on the way in which shared images and imaginations of the past produce collective identity in the present was reinforced and deepened in Maurice Halbwachs' *On Collective Memory,* where he described all those things handed down by tradition – languages, rituals, myths, songs, monuments, institutions – as the material frameworks through which collective memory and collective self-images assert themselves.[12] But what if the material frameworks of memory seem to lack the type of stability and durability that confer identity on things? What *is* a society's self-image if this image may be the object of instantaneous erasure, dispersal through multiple relays or information overflow, or transmutation through dynamic feedback circuits? What is society if its memory images are perhaps not even representations?

In many ways, it might seem as if modern societies' accelerating monumentalization of memory – its obsession with storage and safekeeping – is intimately connected with a type of reflection 'on' the social that is a key characteristic of the same modernity. The role of the modern social sciences has notably been that of picturing society 'as such', as a distinct, finite entity or substance that can be represented and hence also theorized, analyzed, compared, questioned, and managed. The more fundamental challenge posed by the contemporary changes in memory technologies then touches on the very relation between memory, representation, and social ontology. If radical technological changes compel us to understand memory in new ways, will this not have consequences for how we understand whatever it is that we call collective or social phenomena?

This is the question informing the collection of texts in the present volume. Our aim has not been to add to the numerous and brilliant studies of the various aspects and complexities of social or collective memory practices but rather to provide some examples of recent mobilizations of memory that should compel us to rethink social memory from the ground up. These mobilizations are, as already indicated, at once technical and theoretical: radical changes in the material frameworks of memory are intimately interwoven with changes in the conceptualization of memory.

The material frameworks in question are, as already noted, a series of technologies that not only store time (in the sense that magnetic tape and film could be seen to contain distinct passages of time) but produce and manipulate time in ways that may have certain rudimentary traits in common with the way in which the brain itself produces time.

This new emphasis on the material frameworks of time *production* is all-important. As Barbara Misztal has underscored, Durkheim understood time and space as social constructions, i.e. as objectively given social categories of thought produced within societies. The time of collective memory is primarily characterized by its abstract and strictly impersonal quality; it is precisely as a universal force that cannot be questioned that it can have an integrative function and be a social institution that is immobilized in the group memory. Halbwachs contributes to this perspective by describing how tradition is upheld by an illusion of timelessness – an effect of the way in which groups order important dates within a commemorative sequence.[13] Yet it is precisely this abstract, impersonal, timeless memory time that is taken apart with the increasing dominance of technologies that exposes us not only to a multiplicity of temporalities and measures but, even more pertinently, to a sense that time and events are a matter of technical production. From this point onwards, memory time is no longer a common given but a 'gift' in Derrida's sense of the term – i.e. an excess production or game shifter that breaks open the habitual cycle of exchanges.[14] No longer a neutral background or foundation, time and temporalization has become a dynamic foreground, a critical object in its own right.

Many have pointed out the fundamental change to social organization that came with the introduction of the mechanical clock – not least, as Robert Hassan puts it, as 'a scheduler and organizer of everyday life' that 'struck deeper and deeper into the world's cultures and societies and capitalism spread and suffused modernity in its wake'. The power-time of capitalist industrialism universalized and standardized the measuring of time, colonizing or displacing the world's variety of changing, context-depending timescapes.[15] Clock time subtends networked electronic and digital machineries as well, for instance through their all-important synchronization processes which depend on universal and mathematically precise standards of measure. Yet there is a qualitative difference between the type of clock time that is used to organize and synchronize human labour and keep track of mechanical technologies of production, and the clock time subtending media and information machineries whose 'raw materials' and 'product' is time itself.

For one thing, machine clocks at work in such technologies organize an 'open-ended spectrum of temporalities measured from a picosecond (one trillionth of a second) upwards'.[16] A huge number of these temporalities, then, have nothing to do with any human sense of scheduling and organization, and knowledge about their existence promotes visions of a quasi-autonomous realm of machine operationality and machine agencies. They exemplify Dominique Janicaud's claim that there is no unified phenomenon that can be called 'time', since any sense of time is dependent on some kind of measure and since such measuring instances are all highly different technological entities with their own distinct purposes and procedures.[17] Many such operations complicate the idea of an apparent 'flow' of time, just as the periodical series of frequencies in an alternating current breaks with the idea of electrical power as a continual flow. Here, time flow is broken up into counted regularities or measures that make the electromagnetic waves discrete and the electrophysical event of the 'spark' (the moment of interaction between an electrical conductor and an electromagnetic field) a borderline phenomenon between singularity and repetition.

But the same spectrum of microtemporalities underpins a time production that is marked not just by quantification but also by qualitative intensities, the free, measureless consciousness that Bergson called 'duration'. In fact, Janicaud claims that Bergson's distinction between quantitative and qualitative forms of time – a distinction between what he saw as 'spatially oriented' mathematical time and 'time as time only' – should be seen as a subtle differentiation rather than a principled divide.[18] With machine additions happening in the fifth millionth of a second, the most microscopically precise of measures also present themselves as in some sense 'immeasurable' or incommensurable: it is hard to see how electronic events at this scale could be said to privilege spatiality over time or in what way they actually differ from the infinitely rapid movements that underpin perception and thinking. The contractions and distributions of time material in electronic and digital media productions have therefore been viewed in the light of their structural resemblance to – and association with – human perceptual and affective capacities and mental/intellectual work. Real-time technologies operate on the single plane of the present as mechanisms that receive and return movement, contracting and dilating time matter by transforming asignifying flows into signifying flows (signals and code): these are then also the key machineries at work in the industrial organization and exploitation of memory.[19]

Archive, media archaeology, and individuation

Once the 'social frameworks of memory' include time-producing or time-critical media – i.e. media constructed around technologies that modulate, compress, distribute, and differentiate time – the abstract sense of time subtending collective memory refracts into a myriad of different timescapes. Advanced synchronization clearly produces its own a-synchronicities. Such a scenario might provide another set of footnotes to the familiar narratives of modernity – the story of fragmentation, lack of social cohesion, loss of communal memory causing the 'fabric' of the social to fall apart, and so on. Another approach – the one we take in this book – is to ask whether social memory studies ever had a concept of the social that was equal to the *technical* dynamics and arrangements of memory. Robert Hassan touches on this issue when he writes that the truly revolutionary thing about the new information technologies and the network society they are rapidly constructing may be something social science has not yet given much thought to: notably the creation of a new form of time and a new relationship with temporality.[20] This may well be true, but the focus needs to be radicalized with respect to the purported task of social theory. For the question is not just that of a new relationship with temporality but how this new sense of time may produce different understandings of what it actually means to say that something is 'social' or 'collective'. We could in other words ask, with Maurizio Lazzarato, to what degree sociology ever gave much thought to memory – its 'technical-mental' aspects. It could seem as if it raced to the description of the thing called 'the social' without stopping to ask more fundamental questions about the temporalizing phenomena that actually produce mental links between people and make them think and behave in similar ways, over time and across distances. What exactly *is* the thing we call memory? And how does knowledge about technologies of memory impact social theory? What is, in other words, the connection between memory and social ontology?

A point of departure for elucidating this question may perhaps be found at the intersection of media archaeology, archive theory, and a social philosophy informed by (among other things) process ontology and new materialist perspectives. If the archive is in many ways the paradigmatic object of these inquiries, it is in large part because of its ambivalent status within the field of memory studies. For while the archive is often intuitively associated with the safekeeping of cultural memory, already its original, pre-digital modes of organization were based on a principle of generative technicity that is different from the collective memorizing of the past and

the construction of historical consciousness.[21] From its Greek and Roman origins to its role as the instrument of the expanding nineteenth-century bureaucracies, the archive was, as Cornelia Vismann has shown, designed for the efficient performance of law and government. It was all at once obdurate and generative, topological and nomological: a *place* where documents are ordered so as to be able to perform and produce law. An archive would only become an object for historical research and memory once it was no longer in active political use.[22] Despite the obvious differences between paper files and computer files, there is, in other words, some degree of continuity between the non-human topologies of the digital archive and its pre-digital orders.[23] And for this reason the archive can also be approached as a discursive site where alternative conceptions or formulations of 'the social' may emerge.

The significance of media archaeology in this context is precisely its 'archival' bias in favour of technics over history. Media archaeology studies the generative laws of technical media at the expense of media history and its emphasis on technical development. Already here, two distinctly different approaches to memory present themselves. Media history traces technical traditions and innovations, developmental lines and accumulation of knowledge over time, inscribing media within the narrative horizon of historical memory. Media archaeology, in contrast, focuses on the strictly operational memory of technical machines and their various components – a form of operationality that may attest to historical context but that also radically ignores it, in the sense that a functioning machine, however 'dated', may produce effects in ever-new contexts. It may, in fact, *generate* ever-new contexts: as long as it can be made to work, its performative potential is in principle unlimited.[24] From such a perspective, we are focussing on the diagrammatic aspects of media technologies, an operational power that

> makes history by unmaking preceding realities and significations, constituting hundreds of points of emergence or creativity, unexpected conjunctions or improbable continuums. It doubles history with a sense of continual evolution.[25]

The deep significance of the concept of the diagram in this context is not only its resistance to (media) history as a representation of 'preceding realities' but also, even more pertinently, its emphasis on concrete, empirical situations of 'emergence' or 'creativity'. There are, as Deleuze puts it, many diagrammatic functions and matters – as many as there are social fields in history – because every diagram is a spatio-temporal multiplicity.[26] The

diagrammatic functions of media technologies reside in their technical-mathematical operationality, a special case of the 'materiality in action' that has been the focus of much recent theory. Diagrams are generally understood as ways of visualizing the 'information patterns, circuits and relations that give an idea of how the otherwise so complex machines work'.[27] But the circuit diagrams of electrical and electronic engineering might also be paradigmatic examples of what Deleuze indicated with the term diagram: notably an abstract outline for the production of new events, new instantiations of reality. Media archaeology focuses precisely on the multiplicity of temporalizing operations and spatiotemporal constellations that can be found in technical media, the many different ways in which time is made productive. Obviously, machines that operate on time scales equivalent to a millionth of a second produce different realities than machines counting seconds and minutes, and they activate pre-existing materials and contexts in very different ways. Beyond a 'purely' technical fascination with machines, the critical impetus behind media archaeology resides in the possibility of paying attention to a multiplicity of memory forms, events, and operations that cannot be accommodated by the narrative framework of media history and its emphasis on past realities. This pertains in particular to the miniature dimensions of the time-axis manipulations that Friedrich Kittler saw as a key feature of modern media technologies in general.[28] Once time-axis manipulation is no longer just a mechanical feature, as in the sound-reversing phonograph of Edison, but an effect of signal processing, the notion of static objects of memory is replaced by an understanding of technical memory as temporal events, defined by a dynamics of difference and repetition.

It might be argued, of course, that the memory forms of signal-based processes have little to do with social memory since they so radically undermine the normal frameworks of human perception (as Kittler was always happy to point out). Yet it is precisely on this point that we have to interrogate what exactly it is that is 'emergent' in the diagrammatic operationality of microtemporal machines. From a strictly machine perspective – as represented for instance by the work of Wolfgang Ernst – media archaeology essentially focuses on the active agencies of a machine reality whose complexity cannot be reduced to a set of standardized operating systems underpinning the familiar culturally oriented interfaces based on iconographic, theatrical, literary, and journalistic modes of presentation and interaction. A supplementary term, media *archaeography*, is introduced in order to further underscore the reality of machine autonomy and to save the realm of machines from always being explained in terms of

anthropomorphic figures and modes of understanding. Hence the concept of media archaeography indicates a sort of epistemological reverse engineering in which the 'media archaeologist' is not necessarily a human scholar discovering the generative principles of technical operations. In contrast, technical media are seen as active inscription machines that may also figure as archaeologists of their *own* forms of knowledge: the feedback systems in cybernetic technologies point to the pertinence of such perspectives.[29]

Yet this all-important emphasis on machine autonomy, complexity, and reflexivity must not be confused with machinic solipsism. The emergent properties of technical operations – the events of machine memory – cannot be restricted to the realm of technical machines in the limited sense of the term. It is, in fact, difficult to see how a viable delimitation of the machinic and the technical could ever be made without returning to substantialist and representational terminologies. To speak of technical agency is to recognize that machines become specific and autonomous precisely through their interaction with their 'associated milieus' – environmental factors that may include anything from minerals and microbes to plants, animals, and humans. The term 'associated milieu' is taken from Gilbert Simondon's foundational work on the modes of existence of technical machines – a forceful critique of facile humanist oppositions between culture and technics that blind us to a technical reality 'rich in human effort and natural forces'.[30] For Simondon, a technical object is, essentially, a unit of becoming: a fleeting moment in always ongoing processes of individuation or differentiation.[31] There is such a multiplicity of machines that they are difficult to define as a species: similar technical structures have very different functions in different machines, and the interrelations between particular machine functions and human actions further complicate attempts at definition.[32] The most general feature of the process of becoming machine is the process of concretization through which formerly separate functions converge in new and more specific technical beings. Simondon's key example is the modern car, in which each piece is connected with the rest by reciprocal exchanges of energy – very much in contrast to the early car engines, where each element comes into play at a certain moment in the cycle of operations without affecting the others.[33] Such processes are a result of feedback, or relations of circular causality, between technologies and their milieus, resulting in the sudden crossing of a threshold and the emergence of a new coupling. Associated milieus are here understood as the very conditions of possibility of innovation and are never simply external to the technical objects as such.[34] The autonomous technical object is, as Brian Massumi has underscored, the

very *relation* that clicks in as different functions or elements converge. A new and highly specific technical 'individual' may have been produced, but the process of individuation, which starts out from less-differentiated, pre-individual fields, creates all at once a new individual and a new collective or relationship.[35]

Social memory, social ontology

The question of individuation and concretization in Simondon provides a perspective that honours media archaeology's emphasis on the autonomy, specificity, and performativity of machines (against preformatted anthropocentric interpretations) while recognizing that technologies do not constitute a separate, self-explanatory reality. This perspective becomes crucial once we try to reframe the question of social memory from a perspective that takes the various technicities of memory into account – for the simple reason that such reframing must necessarily challenge the comfortable divide between the technical and the cultural. This divide may well be operative at the level of social discourses (historical narration and the cultural obsession with the past are, obviously, living practices that are radically different from the technomathematical logic that makes machines work[36]), but this does not imply that it provides the most valid ontological framework for understanding what the social actually is. Jussi Parikka has pointed out the potential limitations of a media archaeological perspective in which the analytic emphasis on hardware and technomathematical operationality remains too isolated from everything else: it might, he suggests, benefit from a closer dialogue with the perspectives of political economy, among other things in order to 'articulate more tightly the wider networks in which the techno-mathematics of media take place'.[37] This may obviously be relevant when it comes to deepening our understanding of phenomena such as the new forms of labour that emerge in the age of digital networks or the relation between electronic microtemporalities, global markets, and the financialization of the economy, to take just two examples.[38] Yet when it comes to rethinking social memory from the ground up, the key concepts of political economy – labour, capital, and exchange – may actually also serve to defuse the problem by having resolved it in advance, in the sense that everything pertaining to the social relation is understood to derive from the question of useful production and how the means and fruits of production are distributed. As it happens, insights into the material/technical forces of memory may outline a more primary relationality – an ontological ground

on the basis of which the production and distribution of necessities (and all related asymmetries and forms of subjugation) may be reframed.

Here, Maurizio Lazzarato's reading of the 'psychological economy' of nineteenth-century social theorist Gabriel Tarde provides a distinct alternative.[39] The advantage of reading Tarde in the context of radical technological change comes in no small part from the fact that he was writing at a time when sociology had not yet hardened into a discipline with close institutional connections to the practical concerns of modern government: the question of what constitutes social facts was, in other words, still very much open. Where Durkheim defines social facts as the values, norms, and structures that transcend the individual and provide real constraints on human behaviour, Tarde casts his net much wider, refusing to define the social in terms of interhuman relations only. In *Monadology and Sociology*, originally published in 1893, he promotes the idea of the essentially social behaviour of all phenomena in the universe, from atoms and chemical substances to all living beings.[40] In the first section of the book, he argues that Leibniz's monads – designed to bridge the philosophical gap that separates mind and matter, movement and consciousness, object and subject, the mechanical and the logical – have slipped 'into the heart of contemporary science'. Newton's theory of gravitation and Schwann's cellular theory provide him with examples of how the apparent unities of an older science (planets, organisms, and cells) 'pulverize' into multiple distinct elements that are not only linked to each other but also to the elements of other aggregates. Every form of being is a non-containable multiplicity.[41] The capacity for constant aggregation or association is then not a special property of higher-level living beings (so-called 'social animals') but takes place at every level of material organization, down to the infinitesimally small. Two terms – *belief* and *desire*, ordinarily associated with mental properties only – are now used to account for the essential *striving* that informs all forms of material aggregation or ordering.[42] No theory of a mystical vital force distinct from matter is needed. Social facts are, in other words, not predefined constraints on behaviour but the *techniques of association* that come into play with each new aggregation of elements.

The details of Tarde's monist argument are of some interest when it comes to the relation between technology, human memory, and social ontology. Movement and consciousness are neither seen as two aspects of a single fact nor as heterogeneous phenomena that flow from a single source. For Tarde, the only tenable position is that matter *is* mind. Belief and desire play exactly the same role in the psyche, with respect to sensations, as do

space and time in the external world with respect to material elements. The concepts of belief and desire thus resolve the wavering between psychology and mechanism that is found in the monist thinking of biologist and philosopher Ernst Haeckel. The lack of resolution in Haeckel derives from the fact that movement is defined in quantitative terms, whereas mental properties – sensations – are defined in qualitative terms. However, the concepts of belief and desire indicate mental states that also vary quantitatively: we have more or less belief, stronger or weaker desire.[43] And this *technical* property, which regulates every act of association – including memory's task of connecting one sensation with another for the purposes of bodily action – invalidates the principled difference between the movement of matter and the states of mind.

Tarde's brand of sociology is, in other words, based on an identity between matter and mind that places the basic, associative *forces* of memory at the heart of the social. And, as Maurizio Lazzarato has shown, this has wide-reaching implications for the theory of the social frameworks of memory on which the major body of research on collective memory is founded. Languages, institutions, rituals, artwork, and habits obviously play a major role in connecting the collective past with the present. The question is only what explanatory power these frameworks, as such, actually have. For without the basic temporalizing forces of memory/matter – the ability to produce delays between sensations and to pull them together in new crystallizations of time and sensation – institutions, languages, and rituals would simply be dead forms. To explain social memory in terms of social frameworks or (in Bourdieu's case) habitus is to end up in a circular argument, and moreover one that is not really able to account for change. Social frameworks only persist as living practices to the extent that they are continuously animated by the temporalizing technicity of memory – or, more precisely, the *events* of new associations.[44] In fact, Lazzarato shows that Durkheim, in contrast to Halbwachs, is aware of this fact: in a little known text from 1898, Durkheim actually comes close to a Bergsonian description of memory as a quasi-independent and creative force of associations that is not in itself imparted by social institutions and whose effects go beyond that of being an epiphenomenon of neuronal activity. And his sociological conclusion echoes important aspects of the social ontology of Tarde: the creative independence of memory shows that collective life cannot be reduced to the world in which it resides.[45] Collective life is, in other words, not defined or contained by given forms but is a function of more fundamental processes of invention.

With these philosophical perspectives, we may return to the contemporary memory scenario that we are trying to address in this book. Here we have, first, a widely felt crisis in the institutional frameworks of human memory thanks to the increasing dominance of technologies that appear to turn all that was stable and contained into the fleeting events of transfer and updating in digital networks. Second, we have the theoretical and empirical discipline of media archaeology that provides insight into a host of machine agencies that constitute, each in their own way, forms of machine memory and machine realities. And third, we have the intuition that the dominant formulations of the ontological premises of shared memory are not adequate to the technological and technopolitical changes that are taking place. From a traditional cultural perspective, the prevalent descriptions of a new condition of memory loss or a disappearance of emphatic memory may be true and relevant, but is this really the best set of conceptual tools for a situation in which memory is, ever more emphatically, change or invention?

What needs to be considered, in other words, is how attention to the general technicity of social memory (over and above specific memory contents or pre-established institutional or ritual frameworks) may allow us to discover new types of aggregation across the spectre of human and electronic capacities. Tarde's monadology suggests that there is no principled difference between the events of association/invention in different material composites: the electrochemical reactions that cause the contractions and distribution of time and sensation in the neuronal system of humans is simply one very particular aspect of the contractions and distributions of matter/memory taking place across the board. All are equally social – i.e. connective. This is also why he resists the anthropomorphism of political economy, which opposes human and machine work as the work of the living vs. the work of the dead. Instead, Tarde's thinking is in many ways consistent with the much more finely differentiated conception of machines that emerge in media archaeology, where cooperation between various types of 'internal' or 'external' machines may become visible. Such perspectives do not imply that brains (for instance) are like digital networks or that the operations of computing resemble those of the brain – that would be a gross misreading of all the very different technical processes involved here. To speak of the social character of brains and information technologies implies no identity between them, only a basic recognition of the fact that both may be approached in terms of a general capacity for production of time/difference that is the technical basis for all forms of association or aggregation. And this, by extension, affects the understanding of the social nature of the institutions, languages, artwork, and rituals that they animate or mediate.

Such perspectives are not simply theoretical or philosophical but impact research and practical organization as well as socio-political imagination. It makes a difference, for instance, whether or not the memory crises faced by large and small archiving institutions are instantly framed by the implicit terminologies of a managerial/sociological tradition designed to handle very different types of 'social problems', not to speak of the interests and terminologies of the expansive memory industries that turn cognitive and affective capacities into new types of products. To question social ontologies at a critical moment of archival reorganization is, at the very least, to insert a necessary margin of indecision – or delay – into the negotiations over the various forms of 'care' for memory.[46]

Sites of archival reflexivity

One of the tasks of this book has been to present and discuss a number of sites where such questioning or re-inscription of social memory has already taken place or is currently being performed. These are sites marked by what we may perhaps call 'archival reflexivity', in the sense that the various technologies of the modern mobilized archive are foregrounded in ways that may indicate not just memory crisis but new collective modalities. What these sites demarcate or reflect is the distinctly social reality of aggregations that extend across the boundaries between the human and the non-human, the spiritual and the material, the individual and the 'dividual', the qualitative and the quantitative, the living and the dead. Wendy Chun touches on these issues when she discusses how the packaging of programming capacities in the notoriously elusive entities we call software has turned all information into a thing – with the proviso that 'thing' here is not simply used to indicate a commodity but should be understood in its older sense, which is that of gathering or amalgamation. Software and the related logic of programmability then point to profound changes in our understanding of what is internal and external, subject and object, tangible and intangible.[47] And while such sites of archival reflexivity may be symptoms of, or responses to, the broad shift in inscription technologies called informatization – underway since (at least) Charles Babbage and Ada Lovelace's early nineteenth-century work on the difference engine and the analytical engine – they also extend beyond the realm of digital technologies in the strict sense of the term. For the emphatic mobilization of the archive and the increasing displacement of the metaphor of container memory is a process that involves all the new media technologies of the

nineteenth and twentieth centuriesy – telegraphy, telephony, photography, film, radio, sound recording, and video/television as well as the wider ecologies or processes of individuation of which they are a part. These are all privileged objects of digital remediation, but their various ways of facilitating transmission and distribution of cognitive and affective materials across time and space have been closely interlinked with processes of informatization, both technically and discursively. On a technical level, the discrete worlds of bits and bytes never actually separated from the analogue world of continuous signal modulation: not only was the concept of signals the point of departure for the theory of information but electronic signal modulation also remains a vital component of computational operations.[48] And while some theories of informatization have launched the reductionist hypothesis that the technical basis of media specificity disappears on digital platforms that subsume all previously separate media under the logic of zeroes and ones, a more viable hypothesis is that programmability programs or individuates in unforeseeable ways, producing a proliferation of new situations of mediation, association, or aggregation. Such perspectives in turn fuel a new interest in the programming and individuating affordances of pre-digital media, whose various technical affordances are now understood in terms of their performative or processual powers rather than as a set of stable or formal 'properties'.

Such approaches distinguish the contributions in this book from the main tenets of social memory research – including work on the relation between social memory and new media, where the emphasis is often less oriented toward the machinic or operational aspects of media memory and the nature of collectivity than on the specific contents of media memories and the new types of group boundaries and definitions they engender. Interest in technological change (such as the Internet revolution) therefore mainly serves to map new collective identities related to various types of networked users.[49] Collectives are here essentially understood as associations between humans and based on ideas of a shared past that is invented or made relevant by means of material frameworks that have a certain capacity for repetition and propagation. As Jeffrey K. Olick and Joyce Robbins have put it, the expansion of social memory studies after 1980 is related to the persistent modern emphasis on mobilities and shifts in the realm of human association and marked by three major tendencies: multiculturalist critiques of the memories of dominant cultures, postmodernist critiques of essentialist approaches to questions of truth and identity, and hegemony theory's focus on a class-based politics of memory.[50] In addition, the growing sensitivity to issues of time and temporality provides a horizon

for bringing forth a modernity characterized by a 'crisis of memory' and a problematization of tradition: the loss of 'living memory' embodied by the everyday rituals of premodern societies, as described by Pierre Nora, or the dissolution of time in an age of simulation and high-speed information networks, as described by Andreas Huyssen.[51]

For all the evident merits of these approaches, they give relatively few clues as to how to think the collective in an age when intelligence and the capacity for memorizing are increasingly distributed among humans and machines. Yet such issues evidently touch on the question of agency – the ability of groups and individuals to act upon each other and the world – that is at the heart of the social sciences and which must also be key to any concept of social or collective memory. The media archaeological study of the way in which microtemporal operationality formats emergent realities beyond the scope of human intention (and power of attention/explanation) obviously extends the range of potential social agents to be 'counted' as part of 'a collective'. But, more significantly, the concomitant focus on technical individuation and associated milieus serves to reframe the focus on agency as such. No longer an inherent property *of* certain predefined social beings (whether they are called human individuals, robots, groups, structures, or fields), agency is a moving target that only expresses itself in the event of new associations: these are now a function of technical performance in both the narrow and wider sense of the term.[52] These are perspectives that inform approaches to social memory that take a more pointed interest in the wide range of technical functions in new media.

From this overarching focus, a number of different approaches and concerns emerge. This collection of texts revolves around a series of distinct technological-social sites related to sound recording, film and photography, analogue video/television, and computational technologies. Sound and sound recording perhaps represent the most obvious challenges to paper-based archives and monument-based memory frameworks. A paradigm of temporality, the series of frequencies that constitute sound had no means of storage before the age of electromagnetic technologies. Melodies and rhythms were relayed through repetition by memory or had to be transcoded into notational systems; the contextual, embodied, and environmental aspects of sound itself were, apparently, beyond the grasp of ostensive memory. In their contributions, Wolfgang Ernst and Sónia Matos explore different memory scenarios related to the affordances of sound recording. Emphasis on the specific media channels of storage reformulates the concepts of cultural tradition and collective memory as

a non-anthropocentric and technomathematical theory of transmission, Ernst asserts, before discussing Milman Parry and Albert Lord's mechanical and electronic recording of the oral poetry of the southern Yugoslavian *guslari* culture in the 1930s. This oral tradition had caught Goethe's interest, yet he accessed this culture through transcriptions that focused on words only: philology neglected the one-stringed Gusle instrument that was integral to the performance of a material that Leopold von Ranke saw as the sonic essence of nationalism. However, Ernst's key point is that it is not national history that is recounted in such performances: rather, the past is made present by means of the type of reverberative memory that only the servo-motoric feedback circuits of live sound can engender. The sonicist relation between present and past is based on resonance: a non-historicist figure of time that is itself temporal in its articulation. Sonicity, with its time-critical qualities, is here a metonym for the temporality of the world as event. This perspective is further underscored by the mnemo-*generic* capacities of recorded sound and in particular digitized sonic materials that are susceptible to the operative memory of algorithmic procedures. Sónia Matos has studied the archival potentials of a purely sonic language in danger of extinction, namely the whistle language known as *Silbo Gomero* that is still partly in use on the La Gomera island in the Canarian archipelago. Not only is this language composed of sounds that have no relation to alphabetic transcription, its articulation is also very much a function of the spatial context, i.e. the exact placement of the speaker in the hilly landscape of the island. This means that generic recording and storing of linguistic units fail to convey the actual functioning of the language. How can such a language be 'saved' for cultural heritage? What type of technical storage might provide it with a continued, dynamic life? In her effort to approach this problem, Matos had to discard traditional ideas of archival preservation that usually support the protection of endangered languages. To gain a situated and embodied understanding of the whistled language and the different media needed to study it, she outlines an interactive digital approach to language transmission that draws on (among other things) bioacoustics and neurological data so that the ecological acoustics of the language's sonic heritage becomes the key element. Ultimately, her analysis results in a reformulated concept of heritage as constantly disrupted by both temporal and spatial phenomena, and a call for linguistic archives in general to be more open to ambiguity and change.

Key to Matos' work is both a practical and critical approach to the archival functions of software, reflecting the increasing significance of software as agents of social memory. This is also a significant issue in the work of

Matthew Fuller, who has helped establish software studies as a critical discipline where close attention to the materialities and propensities of applications intersects with political, economic, aesthetic, and speculative concerns. In such a context, software are no longer simply finished tools but seen to comprise 'a social relation made systemic and unalterable' – all the more natural since the techniques of structuration are often imperceptible.[53] To counter such naturalization, the strategy of software studies is therefore to interrogate the multiple scales of operation enmeshed in a particular technology. This is the approach taken in Matthew Fuller, Andrew Goffey, Adrian Mackenzie, Richard Mills, and Stuart Sharples' research on the archival properties of Github, one of the largest dynamic repositories of software online, providing a platform for software sharing for millions of programmers around the world. As a sophisticated, distributed way of writing code in groups, Github could be studied from a perspective that tracks and analyzes the behaviours of a programming meta-community – a flow of practices that include patterns of work (coordination, development, and group structure) as well as the migration of such patterns across different settings. With a double emphasis on the granularity of this meta-community *and* its large-scale aspects, the software archive is here not just seen as a place of storage but as a veritable media ecology, a social site that produces fine-grained analysis as well as increasing divergence and incoherence. Following Jacques Derrida's emphasis on the way in which the technical structure of the archive determines the structure of archivable content in its very coming into existence as well as in its prehension of the future, David M. Berry, for his part, approaches the digital archive as a producer of new abstractions that are closely related to its functionality. To make a material computable implies that it is abstracted twice over: first it must be encoded in a symbolic language, and second it must be captured in a grammar of actions, an algorithmic procedure that can be prescribed back onto physical activity. 'Capture' here implies the creation of a model of the underlying processes that are objectified in the physical world. The processes of abstraction that underpin the digital archive are therefore not technical processes in the limited sense of the term: they radically reshape the world, 'transmitting the social bit by bit'. Algorithms recast the world into the shapes dictated by computational analysis and algorithmic processes: the expanded design thinking embedded in all aspects of computational production – exemplified by Apple's new 'flat design' grammar and Google's 'material design' counterpart – makes it possible to trace the application of the logics of computation in the organization of knowledge and action.

The relation between biological and technical life forms is a longstanding concern that has become more acute in an age of bioengineering and ecological crisis where the question of human futures and life itself is increasingly at stake. With his recent research into the mineral and chemical aspects of media technologies, Jussi Parikka reviews human communicational history and the concept of the archive in light of the geological timescapes of the natural resources that make up our media technologies as well as the critical futures that are evoked when the same technologies return to the ecosystem as toxic waste. In his text, Parikka revisits planetary futures that could be seen as instances of 'programmed history', demonstrating how various media technological contexts open for a production of future memories of the past, and how such memories may envelop both scientific knowledge production and political narratives in a technological culture facing possible collapse due to an ecological crisis. The span between the dystopic ecopolitical narratives of authors and scientists Naomi Oreskes and Erik Conway and media art pioneer Erkki Kurenniemi's concept of future life as information give some idea of the various technical/geological timescapes underpinning the contemporary political moment as well as the complex collective of agents involved in the handling of our planetary crisis. While such perspectives have been radicalized in recent years, they are not new: my own chapter in this volume documents how experimentation with video technologies in the late 1960s produced a series of analogies between video feedback and basic life processes. The microtemporal operations in analogue video exposed artists and activists to the fact that memory is not just a function of humans handling a world of more or less stable or ephemeral things but a property of the myriad of cognizing systems that make up the material world. In this context, video came to figure as a quasi-biological entity, a key mediator between biological and technical memory systems in the context of the early 1970s ecocrisis and the concomitant organization of political action. In particular, a curious alliance between video and water resulted not only in new conceptions of nature but also of social ontology. The concept of technical/mediatic life is also at stake in Eivind Røssaak's discussion of a contemporary attempt to reanimate Kurenniemi's concept of extended informational futures in terms of today's digital networks. Taking a transversal approach to Kurenniemi's vast and heterogeneous personal archive, which comprises a vast range of media technologies and types of inscription, members of the Constant group's Active Archive initiative use the principles of database interactivity and software sharing to transform Kurenniemi's files into new social aggregates. Kurenniemi's concept of bio-informational life is no longer premised on the idea of finite

informational 'bodies' floating in some kind of post-planetary space but on a principle of distributive imitation and invention that activates files on multiple levels of sharing. The combined effects of sharing files, sharing the knowledge of sharing, and sharing the knowledge of the users promote a vision of digital networks as living systems where memory above all figures as a mode of action.

If digital technologies may have spurred the new inquiries into the archive and the question of social memory, they also shed new light on the infrastructural properties of photographic and cinematographic technologies. Trond Lundemo compares the Paris conjured up in the world-mapping cinematographic archive of Albert Kahn (1908-1931) with the Paris of relays, circuits, control, surveillance, and points of transit produced in Bruno Latour and Emilie Hermant's digital interactive installation *Paris ville invisible* (2004). Both projects bypass the representational primacy that marks most mapping projects, constituting heterogeneous media networks or diagrams that produce distinct collective individuations. While Kahn assembled photographs and cinematographic snippets from cultural sites around the world in order to produce a recombinable, event-based cartography for a future when the locations would be irrevocably changed, Latour and Hernant bring out the invisible connective underpinnings of contemporary Paris, drawing out the new non-human incarnations of Paris in action that operate below the more famous Paris of memory images. In this context, photographic and cinematographic images are mainly discussed in terms of their unique capacity for propagation, for quickly relaying the belief and desires at work in the production of new social realities. This is the focus in Pasi Väliaho's analysis of a gesture observed in a random shot from a semi-private celebratory occasion found in a photographic archive. Yet this modest image-gesture – emerging as if it were a still from a film that was never made – is not alone but could be seen to weave in and out of the expanded cinematographic networks of Nazi Germany, part of an affect-based, dream-like flux that is never contained by any one medium but that mould actions and make history. It is, in short, an exemplary instance of the reality and agency of images.

Yet another mode of photography-related mobilization can be found by tracing the history of the international passport, and particularly the shift to the contemporary biometric passport, where personal information encoded in a microchip makes the passport into a digital archive in instantaneous communication with a host of official databases. As Liv Hausken argues, passports have contained biometric information all along, but the connectivity of their current digital incarnations have made the boundaries

between police registries and other governmental registries far more fluid, increasingly inscribing mobile bodies into a global archive of pre-criminals.

The two final chapters of the book are devoted to more in-depth studies of the philosophical sources for the social ontologies brought forth in this volume. Drawing on Leroi-Gourhan's theory of the technical milieu as a membrane between the interior and the exterior world, Yuk Hui returns to Simondon's concept of the associated milieu of technologies in the light of industrial globalization and its impact on the concept of social memory. A key point here is that the technical milieu no longer functions as a membrane but increasingly becomes the force that determines all syntheses and hence loses its more limited function as a medium of exchange and protection. Simondon observes this qualitative shift in technical progress and proposes a new way of understanding the interaction between culture and technics. Tiziana Terranova returns to the Leibnizian roots of Tarde's *Monadology* in order to outline an alternative to the neoliberal interpretation of social production, or peer-to-peer production, that has been presented in the work of Yochai Benkler among others. Acts of social memorization – the sharing of feelings, ideas, and values – are examples of a form of voluntary cooperation that is greatly facilitated by the peer-to-peer architecture of digital networks and that has become an important source of revenue, most famously through so-called social media. The falling cost of computer equipment has amplified the power of decentralized individual action so that economic production in the realm of information is to a large extent based on the coordinate effects of non-coordinate actions. Yet while neoliberal economists usually explain such uncoordinated voluntary work in terms of the pleasure it gives each individual actor, post-workerist Marxists do not just see such cooperation as a source of value. It is, more significantly, the specific expression of living labour in an information economy where labour does not just involve the completion of predefined tasks but is also a socialization of invention and the production of new values. Terranova argues that the concepts of individual pain and pleasure cannot explain the connective, viral dynamic of social production and hence are not able to account for the genuinely creative or inventive aspects of voluntary collaboration. Peer-to-peer production depends first of all on the flow of basic affects that mobilize all mnemonic work and only secondarily on capital and the division of labour. And this is why Tarde's psychological economy and his emphasis on the ontological priority of the connective forces of belief and desire are uniquely placed to explain what is genuinely

'social' in an economy that exploits the memorizing affordances of humans and technical machines alike.

With this final contribution, the present volume draws together at least three alternative approaches to the question of the archive: a media archaeological inquiry into the agencies of technical machines, a series of empirical sites in which the archive seems to question or reformulate its own practices, and a sociological critique of the memory industries that go beyond the well-rehearsed perspectives of political economy. Together, they provide a glimpse of what is at stake in the effort to rethink social memory from the ground up.

Notes

1. Ansell-Pearson, p. 64.
2. Bergson.
3. In Matthew Kirschenbaum's study of computer storage (2008), he draws a distinction between formal materiality and forensic materiality and uses the latter to study the many varieties of material traces and forms of inscription that exist in digital media. The study counters the myth of a new immaterial culture and also the privileging of the interface in the interpretation of digital objects.
4. Ernst, 2013, pp. 95-101.
5. Chun, pp. 137-140.
6. According to Aleida Assman (in Ebeling and Günzel, pp. 165-75), cultural memory is informed by both functional memory and storage memory. The latter injects cultural memory with a dimension of forgetting (storage is about hiding as well as safekeeping) – a forgetting that is made more dramatic with the mass of archival materials available through the Internet. In her view, the Internet then opens up for a redefinition of memory as forgetting.
7. Nora, pp. 7-24.
8. Cf. 'Moore's law': Intel founder Gordon Moore's observation that the number of transistors in a dense integrated circuit doubles approximately every two years. The history of computing hardware has so far confirmed the observation (Moore 1965).
9. Spieker, pp. 17-34.
10. It is impossible to account for the vast and rich field of recent social memory studies in this brief introduction. An excellent overview of the development of the field and its various lines of inquiry is provided in Olick and Robbins (1998). Misztal (2003) provides an introduction to the classic and contemporary theoretical foundations of the field, while expansive anthologies such as *The Collective Memory Reader* (eds. Olick, Vinitzky-

Seroussi, and Levy) and *Memory: History, Theories, Debates* (eds. Radstone and Schwarz) assemble a rich body of classic texts on the subject as well as critical reflections on historical memory practices, memory and modernity, the physiological, subjective, and public workings of memory and memory practices as sites of controversy and contestation.

11. Durkheim, 1976.
12. Halbwachs.
13. Misztal, 2003. See also Halbwachs.
14. Derrida, 1992. Wolfgang Ernst (2012) repeatedly returns to the theme of the giving or producing of time in electronic technologies.
15. Hassan. See also Landes.
16. Hassan.
17. Janicaud.
18. Ibid., pp. 116-125.
19. Lazzarato, 2007.
20. Hassan.
21. As Wolfgang Ernst (2009: 182) points out, archives are not listed among Halbwachs' 'social frameworks of memory'.
22. Vismann.
23. The structural ambivalence of the archive was also the topic of the first section of Jacques Derrida's *Archive Fever.* Returning to Freud's concept of the death drive and his description of the psychic machinery as a 'mystic writing pad' (Wunderblock), Derrida describes the archive as an exteriorized technique of repetition that takes place *at the original place* of the structural breakdown of living memory and recollection. This is, he asserts, a fact that becomes even more pertinent with the electronic technologies that seem much closer to memory operations than Freud's mystic writing pad. The archive therefore represents the non-human forces of 'unprecedented rhythms' or events that operate in the midst of the apparatuses of cultural memory and the general search for archivable meanings. The increasing dominance of electronic technologies of inscription and their production of events show that the archive is more than a technique in the limited sense of the term: to fully acknowledge archival forces is thus to be open to juridicial and political transformations.
24. Ernst 2013, pp. 55-59. See also Ernst, 2002.
25. Deleuze, p. 35.
26. Deleuze, p. 34.
27. Parikka, 2011, pp. 52-74.
28. Ibid., 58-59. See also Kittler, pp. 34-36.
29. Ernst, 2013, pp. 55-73.
30. Simondon 1989, p. 9. English quotes taken from Mellamphy, Mellamphy, and Mellamphy's translation in progress (2010).
31. Simondon's account of technical becoming must, as Brian Massumi has pointed out, be seen in the light of his theory of individuation (Massumi

in De Boever, Roffe, and Murray 2009) See also Gilbert Simondon, 'The Genesis of the Individual', in Crary and Kwinter (1992). Simondon understands individuation as ontogenesis rather than a process of becoming within a general state of being. For this reason, individuation can only be approached in terms of the principle of individuation and the related concept of metastability and not with reference to the finished individual (which is always a provisional phenomenon). It follows from this idea that the true principle of individuation is mediation and that it is the function of memory to operate the mediation between different orders of magnitude in the living individual.

32. Simondon, 1989, p. 19.
33. Ibid., pp. 19-23.
34. Mitchell. In this article, Mitchell problematizes Simondon's distinction between machines and living beings (which might make his work seem less relevant to the recent development of biotechnologies). Simondon's concept of associated milieus may, on the one hand, be related to Lamarck's concept of the milieu as a condition of possibility of organic innovation and on the other hand to Claude Bernard's idea that milieus are never simply 'outside' the animal.
35. Massumi in De Boever, Roffe, and Murray, p. 39. See also Simondon, 2007.
36. Ernst, 2013, pp. 55-73.
37. Parikka, 2011, p. 67.
38. See, for instance, Terranova or Boutang.
39. Lazzarato, 2002.
40. Tarde, 2012.
41. Ibid., pp. 6-10.
42. Ibid., p. 16.
43. Ibid., pp. 16-21. Significantly, Tarde takes care to note that belief and desire are not anthropomorphic figures (they include unconscious states) and are not felt 'by themselves' but are applied to any sensation whatever and may therefore also apply to unknown and even unknowable phenomena. Ultimately, Tarde argues that belief and desire must be understood as forces that are objectifiable to the highest degree (18-20). At the level of human relations, belief and desire underpin the basic psychological and 'intensive' connection between human beings without which no form of exchange, communication, or collaboration is possible. This last point is elaborated in Tarde's writings on sociology and economy (see Tarde 2010: 73-135).
44. Lazzarato, 2002, pp. 211-247. This emphasis on the primary technicity of memory and desire in Tarde (over the various discursive frameworks of emphatic memory) resolves the principled divide between the archive and social memory set up in the work of Wolfgang Ernst. Ernst references Halbwachs' claim that memory is always a function of its social frameworks but states that in the archive these frameworks are not the result of individual desires but rather of medial formats. This means that subsuming

the archive under the agencies of collective memory and its discursive processes prevents us from paying attention to the difference of the archive as a set of technical procedures. In Tarde, such a distinction becomes devoid of meaning: like the archive, social memory is first of all a set of technical procedures of connectivity and distribution (Ernst 2009).

45. Lazzarato, 2002, p. 222. See Durkheim, 1898.
46. For a discussion of one particular form of care for memory, see Parisi and Goodman's discussion of mnemonic control and the exploitation of future memories in an economy organized around the affective relation to brands.
47. Chun, pp. 4-9.
48. Ibid., pp. 142-157.
49. See, for instance, Neiger, Meyers and Zandberg, 2011.
50. Olick and Robbins, p. 108.
51. Huyssen, 1995: 1-12.
52. See for instance the discussion of agency in Bruno Latour, pp. 44-86.
53. Fuller, pp. 3-4.

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Oralities

Chapter One

'Electrified Voices': Non-Human Agencies of Socio-Cultural Memory

Wolfgang Ernst

Present culture increasingly dedicates its individual and collective memories to electronic and digital records. Does it thus become non-human and asocial? A genuinely media-specific theory of storage technologies inevitably challenges classical theories of social memory agencies developed in sociology and cultural studies. Once storage is technically defined in terms of specific media channels, concepts like 'cultural tradition' can be reformulated in terms of a techno-mathematical theory of transmission. The difference between technical and 'social' memory can thus be articulated, as well as the difference between communication studies of mass media memory and its technological definition. From a media-archaeological point of view, the technological dynamics of memory devices call for descriptions that investigate their hardware and software in order to reveal possibilities for a refreshed terminology of cultural 'memory' and 'time'. This can be exemplified by analyzing the symbolic (or alphabetic) 'technologizing of the word' discussed by Walter Ong as well as the mechanical and electronic signal recording of 'oral poetry' exemplified by Milman Parry and Albert Lord's work on southern Yugoslavian *guslari* culture. Such analyses direct attention to the creative possibilities emerging with the techno-mathematical mobilization of stored data.

A non-anthropocentric look at memory culture

Current discourse analysis drifts away from the 'culturalist turn' of the last two or three decades and its concern with individual and collective memory as an extended target of historical research. Instead, the focus is on the technologically induced temporal dynamics that is a function of recent storage technologies. 'Changes in the dominant technologies of memory necessarily impact how we conceptualize sociality as such.'[1] But rather than simply interpreting changes in social memory as a function of the technological a priori of a given society, a different interpretation might be allowed: technologies of memory drift apart from social memory, evolving

into an autonomous field of its own. While the term 'memory' has been used in early drafts of electronic computers to name the storage organs[2] (with the 'organ' taken here in its Aristotelian sense as a tool), it might now be appropriate to draw a clear distinction between the cultural semantics of 'collective memory' and micro-electronic embodiments of storage and intermediary data transfer. Time-critical micro-technologies and their algorithmic concepts, such as Kohonen's *Self-Organizing Map* (SOM),[3] run parallel with what neuroscience describes as the memory functions within the human brain. Conceptually (but not technically), the neural processes of immediate, short, and long-term memory within the brain resemble the current hierarchy of storage functions within microprocessors.

Electronic and digital recording does not imply that social memory is transformed into a direct function of intermediary and short-term storage which successively shores up emphatic referential memory thanks to the immediacy of recall; in fact, social memory is not mirrored in micro-technologies anymore. These new *archives* (in the Foucauldian sense[4]) define what can be electronically expressed and digitally articulated and deserve a techno-philological reading of their own. Such a reading requires a reversal of the traditional 'archival' idea of emphatic memory, since 'electronic text is hopelessly ephemeral'.[5] Dynamic technical memory systems (DRAM, SRAM) based on volatile binary storage elements can only be counterbalanced by analogue storage media like chemical or hardware inscription.[6] When 'the present' itself turns out to be a function of intermediary memory-technical operations (both neurologically and digitally), the transformation of the traditional temp*aura*lity of 'collective' memory – i.e. the transformation from 'archival' space to temporal memories – needs to be observed. This is not just another step in the historical evolution of social memory practices but an epistemic rupture. Dynamic micro-media produce a shift in cultural emphasis from permanent storage to restless transfer and file sharing. To decode this aesthetics of high-frequency 're:loads', we need to pay attention to the fact that the new affinity between storage operations and cybernetics now anchors memory in feedback processes and time-shifting operations.

Whereas the audio-visual recording of past experiences in today's mass and online media might still be articulated in the sociological terminologies of collective or social memory, their technological conditions require analyses that refrain from anthropocentric categories. G.W.F. Hegel already elaborated the difference between dynamic *Erinnerung* (subjective remembrance which is always 'in motion') and technical *Gedächtnis* (memory as mechanical storage).[7] Technological affordances and discursive *logos* move

in separate directions. From the phenomenological perspective, media temporalities affect the human perception of time; in a more radically media-archaeological analysis, such technologies enable a different logic of remembrance, one that transforms the classical notion of memory from within.

On the difference between technical and 'social' memory

Society is memory, Émile Durkheim stated. Society is communication, Niklas Luhmann answered. Both perspectives converge in a digital culture where the two media functions of storage and transfer merge. 'Today's new time technologies and the concomitant redefinition of the archive make us question not just the classic description of social memory but the social ontology that it presupposes.'[8] There is a discourse of the 'social' to which media archaeology refuses to submit when it focuses on topological connections described in terms of engineering and of diagrams. Any technological analysis of social networks goes down to the level of protocols (as described by Alexander Galloway) and the source codes in computing that govern communication. Critical storage analysis is the application of a materialist and mathematical hermeneutics to the interpretation of computer 'memory' as hardware and software; it is a methodological combination of media archaeology and digital forensics[9] which ultimately also understands the technological object as a subject or form of agency. Such sub-social material and logical hermeneutics practices a critical *close reading* of the electronics and wiring of storage media which is, at least for a moment, consciously detached from so-called historical, biographical, and social contexts.[10]

We should therefore not confuse technical storage with 'collective' and cultural memory in Maurice Halbwachs' humanist sense of the term. The socio-historicizing or contextualizing discourse runs the risk of becoming so all-encompassing that it becomes limitless, undefined. For this reason, the analytic reduction of cultural memory to the materialities of storage tries to identify forces that escape human control, pointing at discontinuities between collective memory and techno-mathematical storage. In the late nineteenth century, Gabriel Tarde developed an 'archaeological' sociology that was closer to statistical data operations than to human subjective or collective agencies and which provided a framework for alternative descriptions of social memory.[11] The techno-philosophies of Alfred North Whitehead and Gilbert Simondon have applied the concept of 'the social' to describe the connectivity of molecular communication and technical

ensembles,[12] and, in contrast to the criticism of technology typical of the Frankfurt School of Sociology, Bruno Latour's actor-network model has liberated the 'social' from its limited anthropocentric meaning, thus deconstructing the conventional separation between brute technology on the one hand and social, cultural, and economic 'external' forces on the other.[13]

But even such extended usage of the term 'social' carries with it the metaphorical ghost of a human-like collective. Media archaeology, more radically, does not even aim at identifying social forces with*in* technological formations but keeps both regimes analytically apart. By no means does media archaeology want to ignore the political, economic, and social vectors that co-determine technological configurations, but such contextualization rather leads to media historiography instead of archaeographical descriptions of technomathematical conditions (the Heideggerean and Derridean *arché*, the Kantean and Foucauldean *a priori*).

An example of a more object-oriented concept of memory is the popular cassette storage technology used in early personal computers like the *Commodore 64*. There is, notably, a crucial difference between the technical format of data storage on tape which is, first of all, addressed to the microprocessor, and the popular culture where the same cassette tape has served as an almost anarchival device of non-legal distribution immediately addressed to the human ears for musical memory. On the one hand, there are the inherent temporalities or temporal properties of technological media; on the other hand, there are the tempo*realities* that reflect how media time affects human perception. Once human memory is coupled to media like that of the dog Nipper listening to 'His Master's Voice' from a phonograph, it is subjected to media temporalities that differ significantly from the cultural temporalities of social memory studies, which focus on tradition between human generations rather than on the technical conditions of storage and transmissibility. We should therefore not confuse the symbolical order of the institutional archive with human memory or recollection, nor should we confuse it with technological storage.

On the level of storage media, a non-social memory is at work, a rich memory culture that is based on its own inherent logic, tailored to the needs of the so-called 'von Neumann architecture' of computers which is still in use after more than half a century of computer development. Some names of the components of this techno-mathematical configuration like the 'register' in the central processing unit actually constitute a metaphorical transfer of familiar terms of traditional archivology. The closer we look at this micromemory architecture, the more its topology and organization

turns out to be a mirror of traditional archival and administrative practices. However, by including the storage elements *immediately* into the action of the electrical current, computer architecture creates one operational horizon out of two phenomena that are separated in cultural discourses, notably storage and action. Once the technological archive takes over, media archaeology and its emphasis on machine action displaces traditional historical research. Technological archaeology is no longer an ancillary science to the master discourse of historical research, nor should its rather autopoietic autonomy and specificity be absorbed by an extended notion of sociology which embraces non-human agencies as well.

Re-discovering the sound of 'texts': Oral poetry

Storage only happens when trusted to enduring structures, whereas memory phenomena can be ephemeral like discourse itself. For the longest time in occidental history, legends were vocalized segments of bygone events. While Florens Chladni was already experimenting with visualizations of ways in which the vibrations of a violin bow could create acoustic wave figures in sand, 'Goethe's definition of literature did not even have to mention [...] acoustic data flows' or signals that define oral poetry.[14] Goethe took interest in the cultural knowledge made available thanks to Vuk Karadzic's 1814 transcriptions of Serbian oral epics, but philologists have for the most part neglected the fact that the singers are accompanied by the one-string *gusle* instrument. In *The Serbian Revolution*, Leopold von Ranke saw these songs as a form of oral history *avant la lettre* (in every sense of the term) and even as the sonic essence of nationalism, as described in the opening chapter entitled 'State of Affairs before Agitation: National Sense of Being and Poetry'.[15] For Ranke, such memory is definitely collective: 'These poems appear to be the collective product of national interests and orientations. [...] The people regard them almost as natural occurrences.'[16] It is not history that is recalled here; the past is related to the present by means of reverberative memory, both in the voice and the *gusle* string that together form a vocal-instrumental feedback circuit. The oral dictation by a poet to a scribe lacks the kind of servo-motoric feedback that is characteristic of the 'musical' performance, revealing the function of the accompanying string instrument. A time-critical temp/orality is at work when the poet simply dictates: 'His mind moves ahead more rapidly than does the writer's pen.'[17] The *real-time* sensimotor feedback that arises in the interaction between human articulation and rhythmic *gusle* play turns out to be of

a servo-mechanical rather than musical character (unless we understand 'musical' in media-archaeological terms).

The sonicist relation between present and past is therefore not a relation between a present moment and an archive of the past but is based on a non-historicist figure of time which is itself temporal (and even time-critical in its articulation): resonance. *Sonicity* in its time-specific quality is here a metonym of the temporality of the world as event. As expressed by Ranke, all over the Serbian country one could 'hear the sound of singing',[18] which is a concept of the national community as a sonosphere – an acoustic space in Marshall McLuhan's sense of the term, extending to a non-historic but temporally emphatic 'collective' memory. The non-historical information in such oral poetry is radically non-archival and non-documentary, transitive and immediate, and has the quality of acoustic communication: 'One expresses what one experiences.'[19]

Until today (and even more after the Balkan wars in the 1990s), the *gusle* has been the main 'voice' in the transmission of national mythical memory in Serbia. This was documented in Pawel Pawlikowski's 1992 BBC documentary *Serbian Epics,* where the leader of the Republika Srpska Radovan Karadzic at one point in the interview grabs a *gusle* to perform songs in front of the portrait of nineteenth-century Serbian linguist and song collector Vuk Stefanovic Karadzicas, as if he was his successor 'or even his reincarnation'.[20] Coupled with the *gusle*, oral poetry is not a representation of historical memory but of the operative past, an act of *re-presencing*.[21] The instrument is being addressed like the muses by Homer: it is an internalization of the sonic technology of the vocal alphabet itself. The *gusle* actually becomes a mediated *double* of the singer himself: 'Hey *gusle*, beloved music-maker. You have always accompanied the Serbian tribe. Ever since the Slaves came to the Balkans, the gusle has been the Serb's best friend. Since I took you, *gusle*, in my hand, how often I had to wipe tears from my eyes, remembering the wounds of my great tribe.'[22] There it is: the traumatic reverberations of a sonic medium.[23]

Obviously, such memory does not come from a recording medium (though it is tempting to compare the single horse-hair string of the *gusle* to the Webster Chicago Wire Recorder with which Albert Lord recorded such performances around 1950). Oral epic memory is not called forth from an archive but is re-created with slight variations in each performance (as defined in Milman Parry's poetological 'formula' theory). For this reason, it does not make sense to put an inert *gusle* in a vitrine of an ethnological museum. Like most other historical musical instruments, it actually has to be played in order not to decay physically. This form of direct use

– which can be compared with the fact that techno-historical electronics implies replacing some active or passive electronic elements[24] – does what is strictly forbidden in traditional archives, notably to interfere with the original 'record'. Re-performance and signal processing is the essence of musical and technical objects; the *archive in motion* or an active material philology is their only mode of existence. The *gusle* is then not simply a musical augmentation of the textual narrative but actually the device of re-actualizing this memory in acoustic re-presencing. In contrast to other forms of popular music that have become commercial audio-visual *turbo folk* in the meantime, the *gusle* therefore seems to resist becoming an object of the music and media industry: 'It became a voice of the death, speaking to the living. Nationalistic rituals, in which the instrument played a central role, created an aura, which forbid its mixing with electronic instruments and new media.'[25]

What defies all transcriptions of oral memory transmission is approachable only by means of non-literary media: technical signal-recording of 'oral poetry'. When, in the mid-1930s, Milman Parry saw the unwritten memorizing techniques of the *guslari*, the epic singers of southern Yugoslavian, as a living example of the Homerian epic, it was direct phonographic sound recordings on aluminium discs that formed the analytic basis for his theory: that the hour-long oral tales were regenerated for each occasion from a stock of existing formulae.

The practice of oral traditions in Europe has been mostly silenced by the general textualization and 'only survive in written format; that is, under pre-technological but literary conditions. However, since it has become possible to record the epics of the last Homeric bards, who until recently were wandering through Serbia and Croatia, oral mnemotechnics or cultures have become reconstructible in a completely different way.'[26] This difference is dramatic, since it implies a change from symbolic recording to signal recording. 'Even Homer's rosy-fingered Eos changes from a goddess into a piece of chromium dioxide that was stored in the memory of the bard and could be combined with other pieces into whole epics.'[27] The traditional media-critical argument (since Plato's dialogue *Phaidros*) is that alphabetic recording kills the living memory culture of oral poetry by dead letters. Textualization is a threat to oral traditions indeed. At a recent conference organized by the Milman Parry Collection at Harvard University, one of the topics was 'The Textualization of Oral Traditions'.[28] Was Parry's theory of formulae-based oral poetry itself an effect of an analysis that relied on a transcribed and thus textual form – just as Aristotle gained his insight into the phonetic character of speech only after its literary elementarization by the phonetic

alphabet? The alphabetization of phonographically recorded oral poetry in philological studies involves a repression of its essential medium, which is that of sound. In a somewhat oxymoronic yet significantly honest way, the name given by Albert Lord to Harvard University's impressive archive of recorded oral poetry from the former South Yugoslav countries is 'The Milman Parry Collection of Oral Literature'. But from a media-archaeological perspective, there is no text here, only recorded voices and sound. And it was only after Milman's original sound recording that this material was transcribed as text and musical notation (by Bela Bartók, among others).

As an acoustic event, oral memory does not necessarily demand a narrative organization. The art form that is called *Hörspiel* in German – the radio play – is in the Anglophone world often called 'radio drama'.[29] This expression is still oriented towards a logocentric definition of drama as a literary script in contrast to a medium-centric or radio-phonic emphasis on the relation between the word-based radio play and the acoustic-based *Schallspiel*.[30] The latter dramatizes the materiality of the radio transmission and foregrounds a genuinely media-dramatic approach.[31] The signal-based recording of oral poetry operates not beyond but below textuality – in the sense that it is both neurophysiologically subliminal and poetically 'sublime'. In the age of 'electrified voices'[32] and electro-mathematical media, memory has once more become transitory, even more so than what was the case in so-called oral cultures. In analogy to Walter Ong's famous analysis, a kind of derived *mem/orality* takes place.[33]

Technically induced 'secondary orality'

A misunderstanding starts once one mistakes oral poetry for literature. There is nothing 'literal' in oral poetry, no letters, no alphabet. The message of the medium is neurotemporal – it is real-time poetics, not literary spatiality. The musical aspect of oral poetry performances lies not in their melodic harmonics but in their rhythms – the chronopoetic and time-critical dimension of prosodic articulation.[34] With Edison's phonograph, the sound of such language could for the first time be recorded not only symbolically but as a real audio signal. 'We can't understand orality without consideration of sound', and the archaeology of sound at stake here is 'closely connected to recording technologies that simultaneously [...] shape our sensory experiences of oral poetry.'[35]

Before the phonograph, any sonic expression (be it speech or music) had to enter individual or collective memory or be symbolically translated into musical notation in order to survive over time. With technical recording,

sound immediately becomes inscribed in a new type of non-historical, non-human, signal-based archive, which – like the *guslari* performances and the turning disc – literally has to get in motion in order to get re-presenced. With all the emphasis on dynamic recreation, both collective and technical memory here decouple the past from historical discourse, yet in different ways. 'The concept of linear, historical time is denied, if not actually eliminated, by electroacoustic media. If a particular sound can be preserved and embedded within that originating from any other time, the concept of a linear flow of time becomes an anachronism.'[36]

Textual dictation *versus* sound recording

In order to open cultural articulations like 'oral poetry' to academic research, speech and sound events first had to be symbolically or technologically recorded and archivized so as to slow them down for careful and detailed analysis. Time-axis manipulation ('slow motion') is the *a priori* condition for scholarly analysis of the time-critical processes that Edmund Husserl once called pro- and retention and which in neuroscientific terms equals the three-second time span or 'window of presence' for a sung verse line (such as an ancient Homeric hexameter).[37] An early application of sound film for philological research is Milman Parry and Albert Lord's recording of the oral poet Avdo Medjedovich, made in Montenegro around 1935. When listening to such a sound, we tend to be trapped by the referential illusion, believing that we are confronted with the indexical audio-visual signal. But let us pay closer attention: in any *online* or CD replay of such films (for instance the CD that accompanied the second edition of Albert Lord's *The Singer of Tales*), discrete bit strings are in fact being processed. What we are confronted with here is sublime textuality operating on the subliminal level of our understanding – an unexpected technical realization of what Gottfried Wilhelm Leibniz once described as an unconscious mathematical calculating perception, operative, for instance, when listening to breaking waves at the seashore. We should therefore not just ask what happens 'beyond textuality' – a question induced by signal-recording 'analogue' media – but also notice the powerful way in which textuality reappears within techno-mathematical machines. The alphabet returns in a secondary writing, that is, in alphanumeric code and disguised as 'secondary orality'. A note to Ismail Kadare's novel *The File on H.* emphasizes: 'In fact, part of the Milman Parry Collection of Oral Literature at Harvard has been digitized, and it is now possible to hear some of their field recordings *online*!'[38]

Electrified memory

The legacy of Milman Parry and Albert Lord can thus not be reduced to philological transcriptions but encompasses the long-neglected collection of original audio signal recordings as well. Is the type of social memory represented by oral poetry of a different nature if it is not mechanically recorded by a 'graphic' technology such as the phonograph or gramophone, as Milman Parry did around 1935, but electronically, on magnetic wire or tape, as Albert Lord did around 1950 with the same cultural material? As indicated by its very term, phonography and the gramophone relate to writing. But audio recording, which captures the acoustic signal itself, differs drastically from alphabetical notation, which codes phonetic speech as symbols. The act of alphabetical notation, which is primarily cognitive, is replaced in favour of the time-shifting operations of an actual physical event. In the preface to *The Gutenberg Galaxy* (1962), Marshall McLuhan declared his book a mere footnote to Albert Lord's *The Singer of Tales*. The same McLuhan later envisioned the electronic age as a culture without writing. Electronic registration, transmission, and processing take us back in time to pre-literary forms of social memory. Yet the return of alphabetical communication in so-called 'digital culture' is based on alphanumeric code, which is invisible to most human users of such technologies.

> What phonographs and cinematographs, whose names not coincidentally derive from writing, were able to store was time: time as a mixture of audio frequencies in the acoustic realm [...]. To record the sound sequences of speech, literature has to arrest them in a system of 26 letters, thereby categorically excluding all noise sequences.[39]

Such technological signal recordings stimulate a kind of scientific analysis which is no longer just philological or musicological: Through spectral analysis with electronic measuring media, it investigates sub-semantic poetic articulations at the media-archeological level, thus revealing a different but still poetic material. Phonographic recordings of real voices irritate the historical consciousness of cultural memory. The recordability of oral poetry as a physical audio event facilitates a re-presencing of past performances that is invariant to historical time. This allows for technologies of cultural feedback. When such a past recording is being replayed today to local cultures in Serbia, the political and even ideological bias might have been transformed dramatically, but by using the original recording

Fig. 1.1: Webster Wire Recorder magnetic spool with the one-string *gusle* in the background. Photo: Media Archaeological Fundus, Humboldt University, Berlin (Benjamin Renter).

device, the Webster Wire Recorder puts us and the oral poets exactly in Lord's position when he recorded a *guslar* performance.

Analogue sound signal recording does not reduce the memory of oral poetry to its literary value but keeps all the traces and noise of the actual event. More dramatically still, the digital processing of such recordings is not just another technical extension but an unexpected return of the very technique that drives oral literature in the very moment of its performative 'coming into being'. In a crude way, the algorithmic processing of poetic rhythms internally corresponds with the re-generative 'formulaic' principle that Parry identified as the poetic mechanism of reproducing epic memory in the absence of textual memory aids.

Technical recording versus symbolic transcription (Bartók)

According to a radical classicist thesis, the Greeks added vowels to the Phoenician alphabet for the explicit purpose of making the musicality of Homer's oral epics recordable.[40] But this notation was still symbolic, like the musical transcription that Bela Bartok provided based on Parry's aluminium disc recordings of *guslari* songs. Recorded on these discs was a

certain surplus: non-musical articulations such as background noises and birdsong and even the singer's occasional scoffing. In contrast to notational transcription to a musical score, signal recording of cultural articulations involves electro-physical measuring of recorded events, digitally done by 'sampling'. And this process subjects the cultural event to experimentation, enabling a non-hermeneutic analysis of cultural articulations on a sub-philological, sub-alphabetical level.

So oral poetry as well as noise was recorded, yet the transcription into musical notation treats the sonic event as 'oral literature', thus keeping the analysis within the disciplinary discourse of the researchers (Milman Parry was a trained philologist). Emphatically opposed to 'notebook-orientated scholars',[41] Alan Lomax, for his part, used mechanical and electronic recording devices to catch folk songs more precisely than any symbolic score notation can do, since such notation was developed to suit 'harmonic' occidental music. From this practice, Lomax also derived the methodological impulse to analyze such sound recordings by electro-technical means – a literally media-archaeological way of uncovering latent sonic knowledge:

> Today it may be possible with modern scientific measuring instruments such as the visible speech machine, the electromyograph and other instruments, to describe the various types of vocalizing in precise scientific terms. [...] there seems to be evidence that these unconscious but culturally transmitted vocal patterns are direct evidence of deepening emotional conditions [...]. Thus, ethnomusicology may bring us close to deep-lying aesthetic forces that have been dynamic in all human history.[42]

At the end of the twentieth century, the legacies of Milman Parry and Albert Lord – both the textual and pictorial documentation of the Yugoslavian research journeys and some of the recorded *guslari* songs themselves— were transformed into digital files. Does this sampling-based digitization transform the essence of such a memory? And how can we describe the new 'archive' to which such *online* files give access? What happens to oral poetry when the 'online' performance (on the *gusle* string) and the 'online' recordings (on Lord's wire spools) become accessible 'online' in the World Wide Web sense of the word? For millennia, the tradition of songs and tales took place through mnemotechnics of oral transmission that were increasingly supplemented by notational writing (the vocal alphabet, musical notes). The early twentieth century enabled a media-induced re-entry of orality – in Walter Ong's view, a secondary orality based on analogue recording technologies like phonography, magnetic tape, and cinematography. In

the late twentieth century, symbolic notation took revenge in the form of alphanumeric computer code. The digitization of the audiovisual legacy of Parry and Lord on aluminium discs and wire spools makes a difference to the testimonial essence of its cultural content; Plato's original 'media' critique of writing as an ambivalent memory technology becomes valid again when phono-graphical signals are being processed alpha-numerically. Memory, here, turns into information.

The poetic event should, however, not be reduced to its verbal semantics. It makes a media-archaeological (rather than philological) difference for the notion of 'oral poetry' when its notation made available for analysis does not take place in symbolical writing but by electro-physical recording media. One might then be able to consider micro events in the performance of oral poetry, such as near-discontinuous change and mathematical probabilities of transitions as well as retentions and protentions that require stochastic rather than statistical analysis. Oral poetry can be re-generated by the machine, transforming Parry's *formulae* by algorithms. Claude Shannon once defined artificial languages abstractly as 'a stochastic process which generates a sequence of symbols'[43] – the exact definition that Jacques Lacan gave to the mechanism of signifiers within the human unconscious.

New options of sound and image retrieval

From the technification of Serbian epic songs, we now switch to the mnemo-*generic* capacities of recorded sound. Once digitized, auditive and visual memory records are accessible for algorithmic procedures. Implemented in electronic computers, algorithms produce new forms of *operative* memory – a form of memory that differs from the *performative* social or individual mechanisms of human memory. Even if (re)search interests still need to be driven by the epistemologically curious human mind, algorithmic memory operations reveal a past that has never been accessible to historiography.

The archive is not a semantic memory or storage technology but an organizational form, a well-defined system, a symbolic order based on inventorizationorality – a rule-bound procedure that is non-invasive in relation to its object. We may, however, imagine 'experimental archives' that differ from the organizational form of the institutional archive. Sampled and quantized (digitized) analogue films can be transformed into a vast image bank which can then be unified as data sets and subjected to image-based search operations such as matching of similarities, object feature detection, statistical colour value comparison, and entropy.[44] With algorithmically

driven 'automated' tagging, a type of metadata gained from within the sonic signal event reveals its endo-temporality. Such digital immersion into ancient sound (which might be called 'archaeonautics') is the opposite of 'social tagging' but may still be combined with it in Open Access Web 2.0 circulation, which is non-classified in similar ways: a hybridization of order and random access, of techno-logical and 'collective' memory. Therefore the very notion of the archive is in transition. As long as there were only symbolical, alphabet-based archives, the phantasm of recording the acoustically real has generated imaginary and supplementary modes of sonic memorizing.

Rereading archival records has for a long time been thought of as *reanimation* – a historians' syndrome.[45] Stephen Greenblatt once openly declared his *new historicist* impulse an explicit wish 'to speak with the dead', like Shakespeare's Hamlet in the graveyard.[46] This prosopopoietic desire takes place against the better knowledge that every dialogue with the past only mirrors one's own voice.[47] The textual *gramophone* (written letters) inevitably belongs to the realm of the symbolic, which is the order of the archive and which differs from the immediacy of physical-indexical traces (such as the rays of light in photography or soundtracks of recording media). Such technical memories are no longer archives or libraries. But as a new type of *record,* the phonograph was still subjected to forms of inventorization and administration that were developed for the long temporal horizons of paper-based archives.

The moment phonographic records had to be digitized in order to preserve them against physical entropy, a new epistemological option emerged. Retrieved by technical sampling, sound recordings can be stored on digital media not just for archival purposes but also for further processing; the sonic memory that is read off of rotating Edison cylinders or gramophone discs gets in motion indeed. 'Big data' are generated by the retro-digitization of analogue sound archives, but the surplus value lies in the algorithmization of these data, not in their pure quantity, since unstructured data as such are useless. The transformation of the archival order is not only the beginning of a different history but 'Il y a substitution d'histoire'[48] – but maybe not even *history* any more. (Multi-)media archaeology thus points out the discontinuities that arose with the invasion of audiovisual records in traditional archives, libraries, and museums in the twentieth century, resulting in a rethinking of the options of retrieval under digital media conditionsorality orality – transcending the notion of the archive itself by the technical and cultural application of stochastic order out of media-immanent signal disorder: i.e. search operations such as similarity-based sound retrieval.

Between media archaeology and cultural semantics

Whereas genuine signal-recording media such as the phonograph represented a challenge to the text-based archives, digital media and its binary encoded electronic records signal the return of the archive as a symbolical regime. The vocal alphabet as writing system had been developed already in an attempt to *analyze* (literally dis-connect) oral speech into its sub-phonetic elements. Here, a 'semantic gap' opens between the hermeneutic approach and its focus on cultural 'understanding' as practiced in musicology and the emphatic measuring approach that is facilitated by appropriate software for audio analysis, such as spectrography. When measuring melodic similarity, human *versus* algorithmic judgements[49] do indeed clash: whereas the hermeneutically disciplined human perception strives to identify immediate causal relationships between temporally adjacent events, algorithmic signal processing in big data (such as the NSA or Google 'archives') identifies *correlations*, replacing visual surveillance by potentials for predicting (human) behaviour .

Micro memory is already involved in the sonic sensation of presence; this present is by no means experienced as a punctual 'now'. During the Second World War, Norbert Wiener based his time-critical anti-aircraft techno-mathematics on such a calculation. What Wiener, in somewhat Pythagorean terms, called harmonic analysis is today the predictive analytics of big data, where algorithms do not focus on the individual event but detect patterns, rhythms, and regularities to be extrapolated into the future.[50] From this emerges the notion of the *pro-active archive,* which differs from the historicist function of the nineteenth-century archive. Collective memory is thus no longer a reference to a remembered past but a way of analyzing the present as a collection of big (meta-)data in real-time for future prediction. When the analysis of sound is no longer the work of musicologists/historians but of software acting as media archaeologists listening to audio(visual) recordings from the past, linguistic programmes such as *Praat* come into their own. The first computational algorithms for voice recognition were developed in the field of linguistics; since then, for example, the analysis of vocal pitch in historical films has led to sociolinguistic insights. All of a sudden, new forms of micro-social memory emerge, replacing the traditional 'historical source' material.[51] 'Will we become the atoms in the "social physics", first dreamed by the founder sociology Auguste Comte in the middle of nineteenth century?' The question was posed by Lev Manovich when he presented an algorithmic tool for comparing facial expressions in 'selfies' collected from social media such

as Instagram in order to detect the distinct 'visual signature' of individual cities.[52]

In such a context, questions of privacy arise. The archive has always been the opposite of open access. It refuses instant usage for non-authorized agencies and favours instead a temporal delay (which apostle Paul, in his second letter to the Corinthians, called the *katechon*). With the *online archive,* a challenge arises: how to temporarily shelter data from external access – the well-known archival 'classified' restriction – by logical/symbolical or physical dis-connection. With the temporary (en)closure of records and archival resistance to the claims of collective access in the 'social web', social memory might be appropriately replaced by time capsules.

Notes

1. As expressed in the outline for the *Rethinking Social Memory* conference (Oslo, December 5-6, 2014).
2. von Neumann, pp. 34-79.
3. See Kohonen.
4. Foucault, pp. 129 and 131: The archive 'governs the appearance of statements as unique events', whereas archaeology 'questions the already-said at the level of its existence […] and the general archive system to which it belongs'.
5. Kirschenbaum, p. 50.
6. The common use of the term *media* has the tendency to create misunderstandings. In the following argumentation, it does not refer to its discursive mass-media meaning but to the material and mathematical essence of technological signal and data transmission.
7. See Schmitz, pp. 37-44.
8. Ina Blom, Eivind Røssaak, and Trond Lundemo, call for contributions to the present volume (distributed to the authors in January 2013).
9. See Kirschenbaum.
10. For a more compromising version of this radical point of view, see the introduction (on 'Critical Code Studies') to *10 PRINT CHR$(205.5+RND(1)); : GOTO 10*, p. 6: 'CCS invites code-based interpretation that invokes and elucidates contexts.'
11. Gabriel Tarde, especially p. 99 and p. 114.
12. According to Simondon, 'technical objects are always embedded within larger networks of technical ensembles, including geographic, social, technological, political, and economic forces'. N. Katherine Hayles, p. 90.
13. See Bruno Latour.
14. Kittler, p. 7.
15. See von Ranke.
16. Ibid., p. 35, as quoted in Zimmermann, p. 404.

17. Albert Lord, as quoted in Foley, p. 41.
18. Von Ranke, p. 36.
19. Ibid.
20. Zimmermann, p. 407.
21. I owe this term to Vivian Sobchack, pp. 323-333.
22. As quoted in Zimmermann, p. 407.
23. The one-string Pythagorean *monochord* belongs to the most ancient 'media' of epistemological experimentation in the Occident.
24. Such is the case with the early electro-acoustic instrument *Subharchord* in the archive of the Academy of the Arts, Berlin.
25. Zimmermann, p. 409.
26. Kittler, p. 7, referring to Ong.
27. Ibid.
28. *Singers and Tales in the 21st Century: The Legacies of Milman Parry and Albert Lord* (3-5 December 2010), Conference on the occasion of the 50th anniversary of the publication of Albert Lord's seminal *Singer of Tales* and the 75th anniversary of the death of his mentor Milman Parry who developed the oral-formulaic theory.
29. See Crook.
30. See Kolb, Knilli, and Huwiler.
31. Schöning.
32. This term in the title of the present contribution is inspired by *Electrified Voices*, edited by Zakharine and Meise.
33. Kittler, p. 7: "Primary orality" and "oral history" came into existence only after the end of the writing monopoly, as the technological shadows of the apparatuses that document them.'
34. See Chafe.
35. McMurray.
36. Truax, p. 115.
37. See Turner and Pöppel.
38. http://www.amazon.com/File-H-Novel-Ismail-Kadare/dp/1559706279; accessed 22 September 2006. For such digital audio files from the *Milman Parry Collection of Oral Literature* at Harvard University, listen to http://www.chs.harvard.edu/mpc.
39. Kittler, p. 3.
40. Powell.
41. Lomax, Bartenieff, and Paulay, p. 275.
42. Lomax, p. 134.
43. Shannon, p. 5.
44. See Manovich.
45. See, for example, the metaphor of the historian's task in Lamprecht, p. 4.
46. Greenblatt, p. 1.
47. Shakespeare, *Hamlet*, act V, 1st scene. See as well the final passage in Derrida's *La voix et le Phénomène*.

48. de Certeau, p. 5.
49. Müllensiefen and Frieler.
50. See the entry 'Predictive Analytics' in Geiselberger and Anderson, p. 301.
51. See Müller.
52. E-mail disseminated by Lev Manovich on 27 May 2014. See www.selfiecity.net.

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Chapter Two

Can Languages be Saved? Linguistic Heritage and the Moving Archive

Sónia Matos

Drawing on Wolfgang Ernst's understanding of archival media as 'active agents', this essay will discuss the questions that have instigated the design of learning materials for *Silbo Gomero*, an endangered form of language still used on the small island of La Gomera in the Canarian Archipelago. Looking specifically at the unique perceptual and interconnected materialities afforded by digital media, I will problematize the preservation of endangered languages through the techniques of storage and transmission. If language is an emblematic example of a living and moving archive that is passed on from one generation to the next, we are confronted here with a form of heritage that is constantly disrupted by both temporal and spatial phenomena. In particular, the digital appropriation of *Silbo Gomero* suggests that a linguistic archive should also open space for ambiguity and change. Memory, tradition, and heritage cannot be saved, only rematerialized, renegotiated, and reinvented – a process that resonates with an understanding of culture as a performative act.[1]

In 2007, I travelled to the small island of La Gomera in the Canarian archipelago with the intent of learning *Silbo Gomero*, a whistled form of language that can still be heard on this small Atlantic island. Part of my doctoral studies at Goldsmiths College, University of London, my aim was to design didactic materials for the local schools that still currently teach this ancient and whistled form of language. Upon arrival, I immediately encountered two distinct ways of understanding and in fact learning this form of language: first, by directly accessing the wealth of knowledge transmitted by two local teachers who learned this form of language in their youth and while working in the fields of the island, and second, while studying the body of work proposed by the linguists who have successively analyzed *Silbo Gomero*. Both bodies of knowledge and their contrasting depictions explored in this contribution clearly illustrate some of the key ideas discussed by Wolfgang Ernst when addressing the possibility of an archaeology of 'sonic heritage' – a term that appears in the 2013 English-language collection of his work.

My aim here is twofold: first, to explore the distinct 'readings' of *Silbo Gomero* while exposing their contrasting knowledge practices as well as

their underlying media archival practices, and second, to examine the ways in which each body of knowledge – 'scientific' and 'indigenous' – are characterized by distinct 'media' but also to examine how these two distinct paradigms inform different approaches to the design of educational materials. As a result, this contribution will propose a shift from a 'phonological stage' toward an understanding of the whistler's own cognitive milieu, a process that ultimately leads to an alternative approach to the revitalization of this form of language – one that is less based on safeguarding the language itself but rather one that sets forth the importance of revitalizing its sonic heritage.

This movement between two distinct approaches and bodies of knowledge will shift the underlying project – designing a language support system for *Silbo Gomero* – from the systematic recording and analysis of whistled utterances towards an interactive media approach where the ecological acoustics of the language's sonic heritage becomes the key element. While incorporating bioacoustics and neurological data as well as drawing on the whistlers' own accounts, the purpose of this study is to gain a situated and embodied understanding of this whistled form of language and of the different media involved in its study and safeguarding.

Silbo Gomero: A phonological study

In his latest book *El Silbo Gomero, Nuevo Estudio Fonológico* from 2006 (first published in 1978), Professor Ramón Trujillo establishes a clear separation between the three different phases of study that have largely influenced our understanding of *Silbo Gomero*: the 'impressionist' (or ethnographic) stage conducted by Juan Betthencourt Alfonso and Antonio Maria Manrique in the late nineteenth century; the 'phonetic stage' of Max Quendefelt (1887), Joseph Lajard (1891), and André Classe (1957); and finally the 'phonological stage', where the work of Ramon Trujillo himself as well as the work of linguist Annie Rialland (2005) can be located.

It is in this same body of work that we discover that it was only with the phonetic stage (particularly with the article '*Pfeifsprache auf der Insel Gomera*' by Quendefelt) that one finds the first linguistic and scientific study of this unique form of language. As suggested by the linguist himself, after many foreign and impressionistic accounts, for the first time Quendefelt recognized that *Silbo Gomero* was not a language in its own right since it simply imitates the Castilian Spanish spoken on the island; in fact, what is

being whistled are the syllables of words that are locally spoken[2]. As suggested by the author, Quendefelt's work established a foundation for further linguistic theorization while postulating that *Silbo Gomero* manipulates the basic units of spoken words (both consonants and vowels) and can therefore only be understood as a surrogate of speech.

This phonetic stage was later surpassed by the 'phonological stage' as seen in the work of Trujillo himself and in the work of Annie Rialland mentioned above. Therefore the 'phonological stage' presents *Silbo Gomero* as an independent phonological system:

> that contains a reduced number of phonic schemes that are used to produce different sonorous substances [...]. The Silbo has its own logic that cannot be simplified by direct representation. For example, the grave vowel /A/ [...] is not a simplification of the Castilian Spanish grave vowels /o/, /u/ and /a/, but is a different vowel altogether because it belongs to an independent phonological system.[3]

In this sense, 'the *Silbo*' (corresponding to *'el Silbo',* a term used by local islanders) has: 'a rigorously articulated structure which clearly distinguishes it from standardized sign systems and whose most notable attribute is that the meanings of its smallest consistent units cannot be analysed'.[4]

According to this account, the formal simplicity of the whistled language – with its two groups of vowels and four groups of consonants – means that it can be used to communicate any given non-tonal language such as Castilian Spanish. As a result of the data collected during the 'phonological stage', one is able to attribute precise values to each vocalic element. We can therefore say that the grave vowel corresponds to the /a, o, and u/ vowels used in the spoken regional Castilian Spanish language. As Trujillo suggests in both editions of his phonological study, their frequencies correspond to: 1800, 1600, and 1600 Hz. The acute vowel corresponds to the /i and e/ vowels and correspond to the values 3300 and 3000 Hz, an idea that is also presented by the same author. The limitation of the whistling apparatus is considered by Trujillo to be the main constraint, which explains why a whistler can only produce simple differences in terms of tone visible in the 'grave'-'acute' distinction. The linguist also suggests that while spoken vowels rely on a different set of physical resonators (allowing one to distinguish between acute/grave, open/closed, partial/intermittent, and complete vowels), the whistled vowel is shaped by and depends upon one resonator only: the mouth.

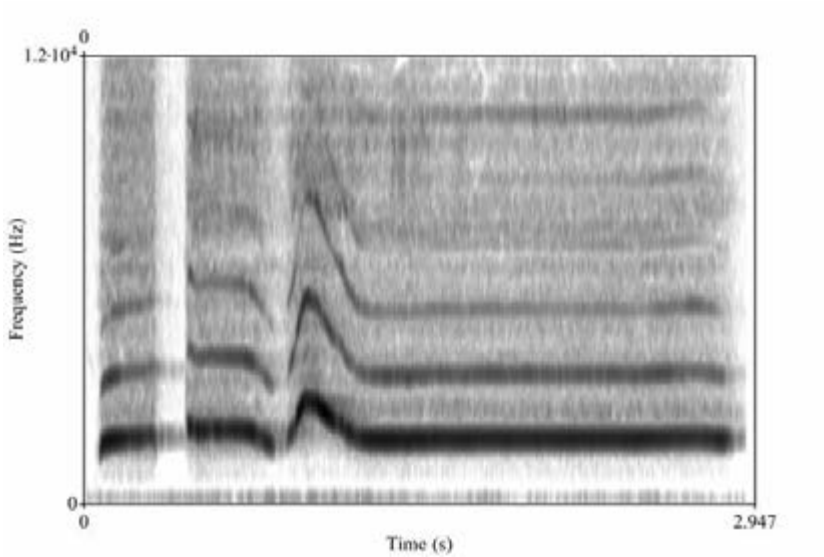

Fig. 2.1: Spectrographic representation of whistled utterances performed by Maestro Lino in the village of La Palmita and corresponding to the Castilian Spanish name 'Octavio' (author's own archive).

One of the authors to disagree with the strict categories of 'acute' and 'grave' vowels is the linguist Annie Rialland, in a 2005 article. In response to Rialland's approach, Ramon Trujillo writes the following:

> [...] within the Silbo Gomero we can only find two 'whistled vowels' or groups of frequencies; two blocks that behave as they would in ordinary language [...] where functional confusion is impossible from a phonological perspective [...] properties that are always distinctive and those that are not consistently distinctive (depending on the context, the situation or what the whistler knows) cannot be considered [...]. Obviously, these latter properties, which Annie Rialland sometimes calls 'optional' [...] do not form part of the structure of the whistled language because they depend on external factors.[5]

When attending *Silbo* classes in the local schools or while recording in the fields with *Maestro* Isidro Ortiz and *Maestro* Lino Rodriguez (*Maestro* is the Spanish word for 'teacher') – two teachers that are part of an older generation of whistlers – I found that whistled languages are in fact highly 'dependent' on what a 'phonological stage' would call 'external factors'. In fact, here it is important to introduce the idea that both *Maestro* Isidro

and *Maestro* Lino are able to whistle and perceive at least two further groups of vowels within the grave/acute separation. To further complete the description initiated above, and in considering the 'phonological stage', the 'acute' and 'grave' vowels should be completed by the addition of two other groups of consonants, the 'acute/grave continuant' and the 'acute/grave interrupted', as suggested by Professor Trujillo and as stated below:

> whistled consonants are nothing more than intonation curves, transitions or interruptions in the 'whistled line' of what we have called whistled vowels. [...] The vocalic lines – between 1000 and 3000 Hz – are altered with the 'help' of the whistled consonants. In these terms, an acute consonant will always point the following vowel to a higher frequency; the opposite will happen when it is preceded by a grave consonant. All of the above 'consonantal intonations', whether continuant or interrupted, correspond to spoken Spanish, except for /s/ (that cannot easily be whistled) while [...] a continuant is transposed into an interrupted [...].[6]

To add to the discussion presented so far, when attending classes for children and teenagers (from six to eighteen years of age) in the different schools of the island in February 2007, one thing that struck me was that both *Maestro* Isidro and *Maestro* Lino did not teach how to whistle the isolated units that we conventionally associate with the vowel/consonant distinction. In their classes, one learns how to whistle words or melodic segments by grasping the contours of different syllables. One also learns that *Lalo* is whistled differently than *Lala*, a distinction that contradicts the assumption that *Silbo* only exploits two groups of vowels: one acute /e and i/ and one grave /a, o, and u/. *Maestro* Isidro and *Maestro* Lino teach students how to appreciate the possibility of whistling and perceiving two more sonorous segments within the presented acute/grave distinction. Also, in discussions with *Maestro* Isidro, I learned that certain words are whistled in exactly the same way, as for example *ballena* ('whale') and *gallina* ('chicken'), an example also given by Professor Trujillo in both publications dedicated to the study of *Silbo Gomero*.

The 'phonological stage' has mostly impacted the design of educational materials created to support the teaching and learning of *Silbo Gomero* within the space of the classroom, as seen in the 2005 study *El Silbo Gomero: Materiales Didácticos* (*The Silbo Gomero: Didactic Materials*) by Ubaldo Brito and colleagues, published by the local educational bureau. However, Julien Meyer's bioacoustic study from 2005 has opened the way for a renewed understanding of the role that intelligibility and the orography of the island

Fig. 2.2: Maestro Lino and the author Sónia Matos recording in the village of La Palmita, island of La Gomera (author's own archive).

might play when learning a whistled form of language such as *Silbo Gomero*. In fact, Meyer's study differs from a phonological approach while expanding the recorded and sampled data and by incorporating and measuring levels of environmental noise and while focusing its object of study on the role of intelligibility. His study is supported by a 2005 neurological study by Manuel Carreiras and colleagues that demonstrates that whistlers exercise regions of the brain in ways that are not exploited by non-whistlers. Combining both the bioacoustics and neurological approaches, one can conclude that the whistler's cognitive milieu is more in tune with that of a musician, an idea that is also proposed by Meyer.

Both bodies of work illuminate an important hypothesis: can we consider the local environment an integral aspect of whistled forms of language such as *Silbo Gomero*? As suggested by *Maestro* Isidro during an informal conversation in 2007: 'you cannot separate the whistler from the environment, they are one.' This idea implies a distinct approach to the study of *Silbo Gomero*, one that delves beyond an analysis of whistled vowels and consonants while focusing on a more integrative approach and where *Silbo* can only be understood while taking into account the orography of the island. As suggested by Meyer, *Silbo* is only the 'tip of the iceberg' of a more complex 'linguistic and acoustic phenomena'.[7]

Language and sonic media

To give continuity to this discussion, a closer inspection of the techno-scientific mediums that have guided the recording and analysis of whistled utterances seems pertinent. This is particularly true if we consider that the main conclusions drawn by the 'phonological stage' are based on recordings that were made on a magnetic tape and then later examined with an oscilloscope[8] and a spectrograph.[9] As suggested by Professor Trujillo himself, the results from the oscilloscope were not very useful; the spectrograph, on the other hand, produced 'clearer visual transcripts' of the whistled language phenomena. It is important to note that in the first study it appears, from the lack of 'visual evidence', that an analogue rather than a digital oscilloscope was used.[10]

Drawing on the evidence that is presented above, one could speculate whether the instruments used in the recording and analysis of whistled utterances are at the heart of the 'disagreement' between linguists and whistlers when referring to the number of whistled vowels. It is therefore relevant to investigate these instrumental appropriations and their underlying knowledge practices in order to consider fully the information provided by the 'phonological stage'. Here it is important to understand the role of scientific data – particularly recorded data – in relation to a given mode of instrumentation that, in this particular case, entails techno-scientific approaches to sound recording and visualization.

Today, most phoneticians are acquainted with the use of the spectrographic analyses – an optimal tool that treats sound as a discrete object prone to visualization and quantification[11]. To better understand this, one has to account for an important contribution made within the history of Western physics and mathematical practice: the development of 'Fourier analysis' and the application of the 'Fourier series' in the study of body heat flows. As suggested by Trevor Wishart in his book *On Sonic Art*, first published in 1985, it was in the nineteenth century that mathematician Jean Baptiste Fourier devised a way of representing 'an arbitrary mathematical function by a sum of (possibly infinite) simpler functions'.[12] Later, physicist and mathematician Georg Ohm would apply the theories devised by Fourier, transferring them from the analysis of body heat flows to the domain of sound.[13] Here, he would use the 'Fourier transform' – a mathematical function that translates one variable into another – to analyze a tone while breaking it into other more simple units.[14] Today, and based on the achievements described above, it is possible to convert information on the variation of amplitude within time into information about the changes

of amplitude within frequency (conventionally measured in Hz, or cycles per second). It is also possible to think of an inverse 'Fourier transform', where information concerning frequency and amplitude is converted into information concerning amplitude and time.[15]

In *The Computer Music Tutorial*, electroacoustic composer Curtis Roads recounts this story while stating that physicist Hermann von Helmholtz further developed Ohm's studies, later inventing a 'method of harmonic analyses based on mechanical-acoustic resonators', a device that oscillates given specific frequencies.[16] Later in the nineteenth century, physicist John Tyndall – influenced by Helmholtz's ideas concerning harmonic stable states (largely derived from Pythagorean mathematics) – would work towards the creation of new techniques of sound visualization.[17] In fact, Tyndall would experiment with the idea of timbre as an added mingling of two or more tones to create 'imaginative experiments' with the intent of actually visualizing sound.[18] These achievements led to the idea that 'instrumental timbre' is largely determined by a steady state spectrum – thought of as the sustained part of an instrumental tone.[19] From these sorts of experiments, various forms of mechanical 'visualization' of sound were developed, further reducing the qualities of timbre to the quantifiable measurements of frequency.[20]

It was only in the 1940s that scientists working with the oscilloscope, an electronic instrument that visualizes signal voltages in two-dimensional wave graphs, would actually apply the principles of 'Fourier analyses' to the visualization of sound, now conceptualized as a 'wave'.[21] The procedure required photographing the image represented on the oscilloscope and then manually tracing it back into a mechanical Fourier analyzer.[22] As detailed by Roads, it wasn't until the development of cybernetics, with Norbert Wiener's 'generalized harmonic analyses', that a shift occurred from the analysis of a harmonic spectrum to incorporate new continuous sounds, here including 'noise'.[23] Building upon Wiener's accomplishment, in 1958 Blackman and Tukey saw the relevance of using Fourier analysis while manipulating diverse levels of sampled data.[24] The method opened the way for the development of the 'fast Fourier transform', releasing the need for vast amounts of computer calculation.[25] A new era of sound visualization appeared –still influenced, however, by the Helmholtz reliance on harmonic structures.

Returning to Wishart in *On Sonic Art*, this connection had its basis in Pythagoras' harmonic universals, where the vibrating quality of a string (the wave-like structure) and the perceived quality are in strict numerical correlation, with the length of string and the quality of tone (now conceived

as quantity) conforming to pre-established ratios.[26] This is most visible in the further development of the Western musical tempered scale but also in that of particular instrumental appropriations of sound as in the Fourier transform.[27] Here, sound was understood through a particular reading of pitch as that which is composed by various Fourier sine waves. By calculating their fundamental frequency, one could locate the fundamental pitch, further relegating timbre to a 'secondary role'.[28] It is important to add to this discussion a critical understanding of timbre as a complex category – an idea that is in line with the work of experimental psychologist Albert Bregman who, in collaboration with Steven McAdams, states that timbre is 'the psychoacoustician's multidimensional waste-basket category for everything that cannot be labelled pitch or loudness'.[29]

The brief history of the Fourier is fundamental to the analysis of *Silbo Gomero* (as presented by a 'phonological stage'), since perceived vowels are here measured and 'translated' from their transient sound qualities (that are first and foremost perceptually audible) to a reading of pitch/frequency. In strict correlation, spectrographic analyses and the spectrogram itself appear as powerful tools, particularly when one considers that the spectrogram provides an elegant representation of transient auditory phenomena.

To further complete this brief historical description, Roads states that the use of the spectrogram or sonogram in speech analyses became pertinent.[30] Often compared to the organic functioning of the human ear, it was soon stipulated that the spectrogram could simulate very accurately the way human beings actually hear sounds.[31] Reading the brief history of spectrographic analysis as detailed by Wishart and later by Roads, it is almost inevitable that both the ear and the 'Fourier transform' would be conceived as approximate perceptual-archetypal models. In fact, and in line with Wishart's critique of the relationship between the Fourier transform and organic ear function, some researchers have now acknowledged that frequency/periodicity or spectral information may not always represent how a sound might actually be heard.[32] This is all the more true if we consider the fact that 'we do not hear, we listen', an idea first proposed by American psychologist James J. Gibson in his timely 1966 contribution *The Senses Considered as Perceptual Systems*.

It might seem redundant to compare the use of spectrographic analyses in the linguistic domain with its impact in the musical domain. However, by taking *Silbo Gomero* beyond its status as a language surrogate, some paradigms might have points in common, particularly when one considers that the development of particular modes of analyses of auditory experience

stem from a similar instrumental history, one that finds a common root with Pythagoras, Helmholtz, and Fourier. This is even more pertinent if we take into account Curtis Roads' idea that 'the dynamic range of music is much wider than speech'.[33]

However, at this point it is relevant to interrupt this discussion and recall the ideas advanced by the 'phonological stage'. It is important to remember the one element that seemed to be contradictory, notably the number of whistled vowels. While some whistlers are able to produce and perceive at least four vowels, a phonological account will only outline two groups of vowels as suggested by Trujillo. We must, in other words, take into account the fact that the 'phonological stage' is determined by scientific data of recorded whistled utterances. Considering the presentation of Fourier analyses – the basis of spectrographic analyses of sound – one might consider this point of disagreement to be inherently influenced by the way in which distinct modes of perception and interpretation interact with specific mediums.

The analytical exercise described in this section in fact resonates with Wolfgang Ernst's discussion of the possibility of a 'media archaeology of sonic articulations', as represented by the following passage: 'The media-archaeological exercise is to be aware of the fact that at each technologically given moment we are dealing with media, not humans, that we are not speaking with the dead but dealing with dead media that operate.'[34] And while Ernst would contend that the '[digital] reproduction of sound succeeds in the same exact way as the original',[35] further inspection might actually allow us to draw a quite different conclusion. In fact, and drawing here on the work of Roads discussed above, one could present the limitation of spectrographic analysis as the inability of a Fourier transform to demarcate two different but very close frequencies.[36] This description points towards a paradox where the properties of the medium itself condition the analyses of an embodied experience of sound. Above all, this parameter arises from a compromise that imposes itself when analyzing complex and situated phenomena and where observed phenomena are further influenced by the techno-material exigencies of the measuring apparatus.

Returning to some of the key ideas proposed by Ernst, I would like to contend that while the human auditory sense might not suffice when performing an archaeology of the acoustic – an idea suggested by Ernst himself[37] – neither will the media that is used for measuring sonic articulations. A true 'archaeology' (in the words of Ernst) will require both. In line with Wishart's and Roads' analysis presented above, one will find the earlier

work of physicist Niels Bohr who, in *Atomic Physics and Human Knowledge* (1958), was able to demonstrate that an analogous paradox is found within the modern representations of the physical theory of light, an idea that is explored by theorist Karen Barad in her 2007 book *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. In chapter three, the author discusses the work of Bohr by highlighting the ways in which the scientist showed that our understanding of light as either wave or particle was intrinsically linked to the qualities of distinct measuring apparatuses. By reading Barad's contribution, the reader is able to conclude that within the domain of physics, this breakthrough offered a new understanding of scientific knowledge as something that is intrinsic to the materialities and performances of measuring apparatuses.

Looking specifically at an analysis of *Silbo Gomero*, the nature of the measuring apparatus has to be considered as both 'inclusive' and 'exclusive', as suggested by the philosopher Alfred North Whitehead (1925). This will open the way for an understanding of the *Silbo* language that is reliant on an analysis of what is whistled as well as on an understanding of what is actually heard. In this light, apparatuses can no longer be conceived of as simple mediating, archival devices that provide a straightforward record of sonic heritage. They are, rather, intrinsic to the formation of this same heritage. As suggested in the passage below, this approach is in line with Ernst's own understanding of media archaeology and its role in our understanding of sonic heritage:

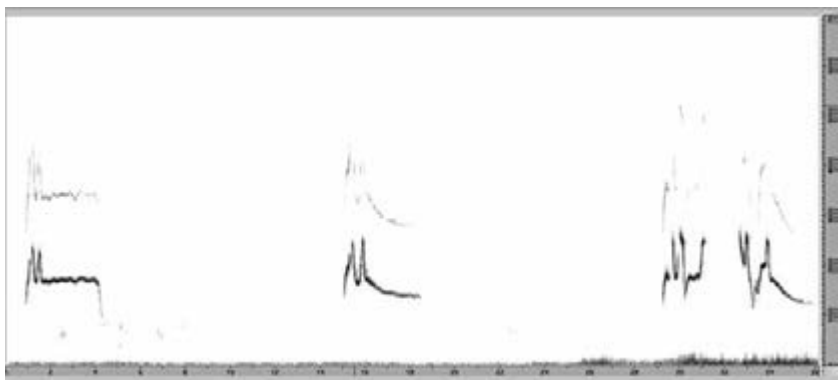

Fig. 2.3: Spectrographic representation of a whistled utterance performed by Maestro Isidro out in the Barranco (valley) de La Matanza, island of La Gomera. It corresponds to the Castilian Spanish sentence: 'a Sonia… cuando te vas…de La Gomera' ('to Sonia…when are you leaving….La Gomera') (Author's own archive).

> True media archaeology starts here: the phonograph as media artefact preserves not only the memory of cultural semantics but past technical knowledge as well, a kind of frozen media knowledge embodied in engineering and waiting to be revealed by media-archaeological consciousness.[38]

Designing didactic materials for Silbo Gomero

It is now time to provide an overview of the ongoing efforts that have been made by *Silbo*'s cultural and educational community when developing didactic materials for the local schools of the island of La Gomera. In fact, and considering the generational gap between teachers and students, *Maestro* Isidro, while tinkering with the written alphabet, was able to design his own didactic approach: the *Silfateo* (see figure 4 below). Designed as a memory aid for children to take home, according to this system, the consonants t, ch, and s used in spoken Castilian Spanish are represented by 'CHE'. Therefore, when learning how to whistle *sientaté* (sit), the word is better understood if written as *chiénchache*. In this way, different whistles correspond to the group of consonants CHE (t, ch, s); YE (d, n, ñ, l, ll, y, r, rr); KE (p, k, f), and GE (b, m, g, j). *Maestro* Isidro uses the alphabet in an onomatopoetic fashion, as if presenting the notes of a musical instrument.

On the other hand, *Maestro* Lino has based his teaching on a conversational interaction between students. Similar to the idea of 'learning by doing', here a refinement of the senses becomes key and uncertainty is exploited to its fullest potential. Even when the student does not know how to fully articulate a whistled utterance, *Maestro* Lino is the first to encourage experimentation with what is yet unknown.

Here, we should also pay attention to the activities taking place in the scholarly context of the *Silbo Gomero* community, namely the activities that are portrayed in the publication *El. Silbo Gomero: Materiales Didácticos* (Silbo Gomero: Didactic Materials) developed by the Canarian Bureau for Education, Culture, and Sports in 2005. Building on the advice of Professor Trujillo and *Maestro* Isidro amongst others, this publication presents several pathways worth exploring when teaching *Silbo Gomero*. The first recommendation refers to an exploration of traditional situations of communication while taking into account the orographic terrain of the island. It argues that such situations are best explored if one can simultaneously reference the topographic maps of the island, visually demarcating the places where *Silbo* was most commonly used.[39]

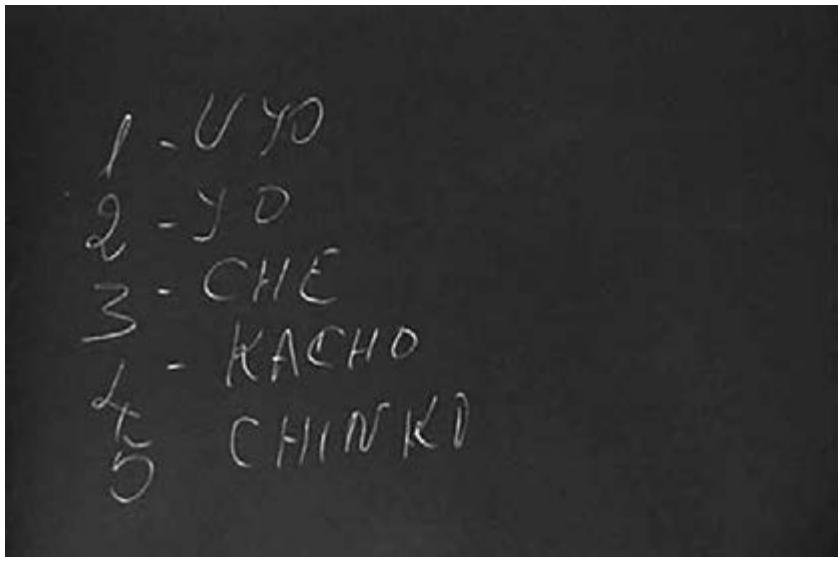

Fig. 2.4: Transcription of numbers one to five using Maestro Isidro's Silfateo (author's own archive).

A second recommendation entails an exploration of bodily configurations required for the performance of this peculiar form of language. This can be done while exploring the position of the tongue and the use of the fingers to modulate different tones and control the interruptions of the emitted utterance. To further strengthen this exploration, the book suggests that the learner should explore other instruments that give rise to similar auditory experiences, such as the local herder's flute.[40] The third recommendation, which largely follows the logic of a 'phonological stage', refers to the close inspection of the spectrographic representations (or spectrograms) of whistled words or, alternatively, to explore *Maestro* Isidro's *Silfateo*.[41]

The publication also recommends exploring the common communicative utterances used in the fields, for instance the various expressions used in salutation; when identifying oneself; when identifying and locating objects and people; when describing, narrating, expressing necessities, quantifying, etc. Following the same logic, a further study of the most typical difficulties encountered when decoding an uttered message – such as strong wind, intense reverberations, or extremely long distances –is advised. These difficulties can be contoured by selecting an adequate and clear vocabulary in addition to using a set of questions and answers to produce discursive redundancy as presented later on – a method commonly deployed by both *Maestros* as I was able to testify while attending their classes. In the same

section, the reader is introduced to the idea that the student should also be able to situate *Silbo* within the vast panoply of whistled languages. And finally, all of these recommendations should be explored with the intent of providing the student with an enrichment of linguistic capacities as an expression of both social and cultural value.

One aspect that is left to be considered is the complex sonic dimension of this form of language – 'the tip of the iceberg', as once suggested by bioacoustician Julian Meyer. This 'tip' is not necessarily located in the brain or in the code as an isolated unit of analysis but rather in the complex interaction between the whistler and the orography of the island as also contended by Meyer. Although mentioned in the first line of recommendations described in the book *El Silbo Gomero: Materiales Didácticos*, the issue seems to have been relegated to a purely visual bias. In this sense, it is important to look at the complex auditory, temporal, and spatial qualities in a space that opens up educational design towards the construction of new auditory artifacts.

One could, however ask: why not proceed with local instruments such as the herder's flute, the spectrogram, visual topographic maps, or even on-site training? The challenge is that the local herder's flute does not sustain the same corporeal relation that characterizes the performance of *Silbo Gomero*, particularly the position of the fingers and tongue, which are essential when learning how to whistle. The local flute might 'tune the ear' to similar temporally dynamic and melodic lines, yet this instrument does not offer the possibility of a more thorough exploration of complex sonic attributes, particularly the characteristic echoes and reverberations that modulate the auditory experience when performing *Silbo* in the mountainous environment of the island. And while on-site training is provided once a year at the annual gathering of all schools in an exterior environment, actual access to the most remote areas of the island where *Silbo* was extensively used is out of the question for most schools due to the complex logistics involved. While this does not mean that new artifacts are always necessary when developing design solutions for the transmission of whistling techniques, it is important to recognize that the required auditory, temporal and spatial qualities open a space for incorporating digital technologies that more readily facilitate exploring such phenomena.

This attention to the multisensorial dimensions of linguistic learning is paired with an attempt to find ways to safeguard an immaterial culture that entails the transmission of a wealth of cognitive skills as opposed to 'frozen' cultural objects as suggested by the United Nations' Educational, Scientific and Cultural Organization in a 2004 publication – an organization

Fig. 2.5: Image of the mountainscape of the island of La Gomera. Here, one can still see the rugged terrain supported by artificial terraces that creates stable land for agriculture. The Silbo Gomero was commonly used by local islanders when working in thus rugged terrain (author's own archive).

that has, in fact, recognized *Silbo*'s value as a form of intangible heritage.[42] Pairing these concerns not only opens up space for 'innovation'; it also demands – particularly from those who design learning materials for endangered languages such as *Silbo Gomero* – a delicate balance between the knowledge transmitted by this ancient form of communication and the new opportunities it presents to young Gomerans when learning a whistled form of language. The design of a new educational platform will therefore require an 'alternative approach', a 'media-archaeological re-enactment' that draws on a distinct 'temporal regime of auditory memory', here drawing once again on the words of Wolfgang Ernst.[43] This is a 'regime' that is not confined to the restrictions of sonic recording and playback but rather takes advantage of computational tools in the design of new educational materials.

Such an approach celebrates what designer and software developer Michael Murtaugh (2008) has identified as central themes when designing for interaction with computational mediums – the themes of 'liveness, plasticity and incompleteness'. 'Liveness' here means that not all possible paths of interaction can be pre-programmed, thus opening up unexpected potentials and paths for exploration. 'Plasticity' means that the designed artifact, medium, or system can be shaped to one's intent,

and 'incompleteness' indicates the degree of openness of the system when incorporating 'unpredictable input'. These are precisely the type of features that the phonological stage would describe as the inconsistent traits of *Silbo Gomero*, traits that are 'dependent on the context, the situation or what the whistler knows'.[44]

El Laberinto del Sonido (the sound labyrinth)

A continuing engagement with *Silbo*'s sonic dimension has become the key underlying component in the design of didactic materials, thus taking the potential to re-enact this linguistic form beyond the preservation of a surrogate code while recreating the ancient body of knowledge and its sonic heritage. This instigated the design of the application *El Laberinto del Sonido*, developed in collaboration with computer engineer Theo Burt at the Music Research Centre of the University of York.[45] The interactive platform was designed for children ranging from seven to nine years of age (the primary school years) and who attend the different schools of the island of La Gomera. The platform, currently harboured by the Canarian government's website as part of the educational project *Abriendo la Escuela* ('Opening the School'),[46] essentially consists of a software application that allows children to develop auditory-spatial virtual worlds while providing a framework for non-linear narrative creation and exploration as the basis of intuitive auditory exploration. The application was designed with the intention of further strengthening the embodied skills of the children who learn *Silbo Gomero*, on the assumption that verbal-auditory and non-verbal-auditory skills are entangled.

El Laberinto del Sonido presents a first-person experience of the creation and exploration of an immersive, auditory, and virtual space. In fact, such 'virtuality' is in line with mathematician and cultural theorist Brian Rotman's exploration of the term, particularly since it transverses different media and since digital media opens a space for embodied forms of exploration while deploying more complex proprioceptive qualities that provide distinct virtual effects. As stated by Rotman – referring to philosopher of mind Andy Clark – 'it is harder and harder to say where the world stops and the person begins'.[47] It is exactly this 'effect' that the application exploits.

In order to explore linguistic and 'audile' spaces (to use a concept borrowed from communication and sound theorist Jonathan Sterne),[48] the application is divided into distinct nodes that are visually accessible to the user/s in a grid-like shape (see figure 6). These nodes become potential cribs

for the creation of distinct scenarios, acts, etc. Within this grid, the user is able to create new nodes or to move and reconfigurate existing ones. Each is accessible for direct sound recording or to be used while importing sounds created elsewhere in the computational medium. To this feature, software developer Theo Burt added an algorithm for the virtual binauralization of sound.[49] This algorithm is best understood within a psychophysical context where theories of spatial hearing acknowledge that the position of our ears on both sides of the head as well as our constant mobility are the base of a peculiar psychoacoustic phenomenon. Hearing in both ears notably occurs with a small time delay, most commonly known as 'interaural time differences'.[50] And this delay constitutes one of the most important features in the configuration of our sense of acoustic-spatiality.

The time-delay of binauralization is further enhanced by the possibility of directly manipulating distinct levels of reverberation while 'painting' each preselected reverb onto the grid of the narrative space. The application also offers the possibility of switching between a dual visual/auditory and an isolated auditory mode – a feature that opens up the potential for the user to exploit distinct perceptual channels when creating narratives that are later explored by other users. Also, and returning to the nodes presented above, these elements are divided into three categories that are readily identified through distinct colours. The first, represented by the colour orange, corresponds to ambient-like sounds that are in constant loop; the

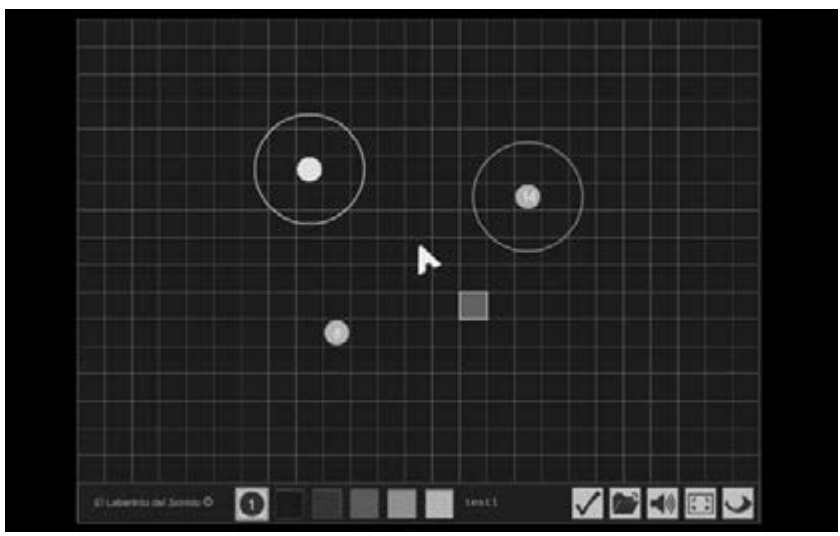

Fig. 2.6: Snapshot of the application 'El Laberinto del Sonido' (author's own archive).

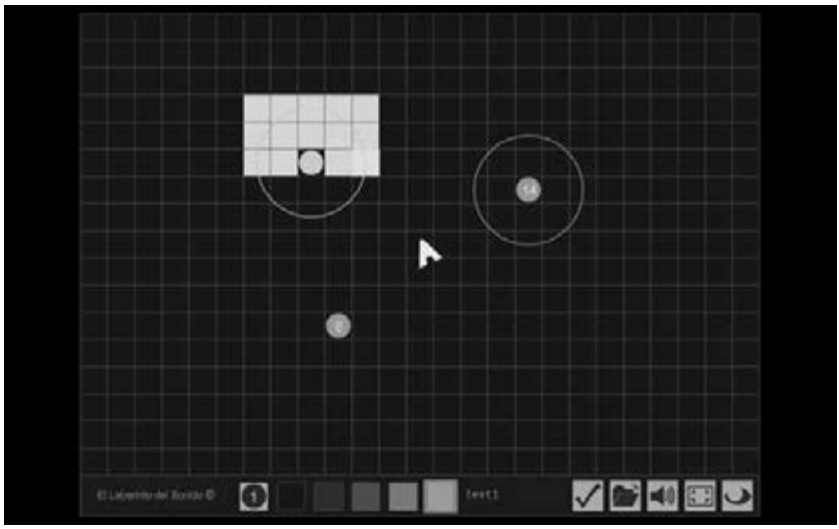

Fig. 2.7: Snapshot of the application 'El Laberinto del Sonido' (author's own archive).

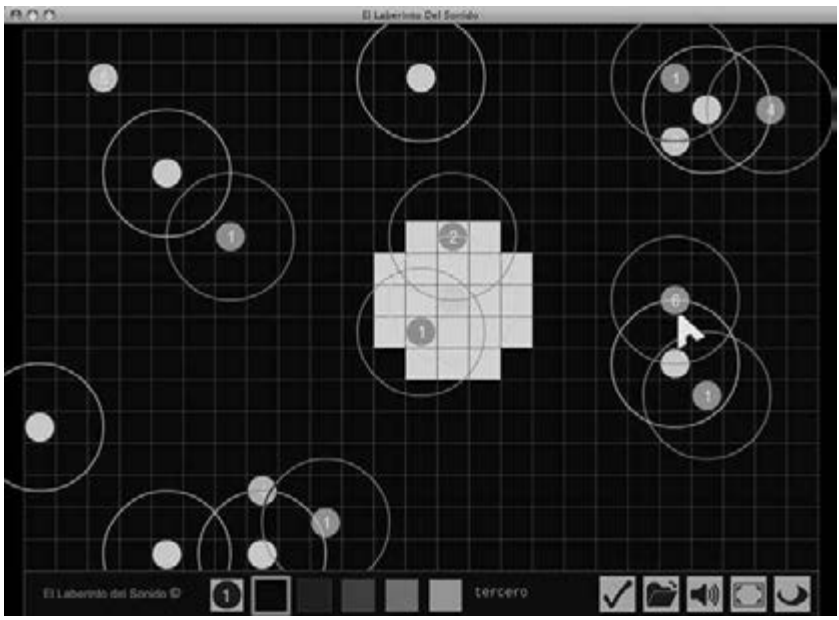

Fig. 2.8: Snapshot of the application 'El Laberinto del Sonido' (author's own archive).

second, corresponding to the colour blue, also harbour ambient-like sounds but with a smaller duration and therefore triggered by proximity. The third, corresponding to the yellow colour, was created with the intention of harbouring recorded whistled utterances, a node that is also triggered by proximity during the navigational experience. Of course, this logic was programmed with a certain degree of flexibility in mind, and each node may be rearranged at any time while deleting the outside circle of both blue and yellow nodes (see figure 8 below). In this way, different scenarios become layered through an interactive exploration of spatial-temporal qualities: the user is driven to explore the intricate relations between nodes while trying to decipher different whistled utterances within the cacophony of a sonic narrative.

Auditory virtual environments

The application *El Laberinto del Sonido* takes into account both the linguistic and sonic heritage of *Silbo* and draws upon the historical development of electro-acoustic tools. In this sense, it stands in stark opposition to other linguistic heritage applications such as 'Little Linguist',[51] developed in an attempt to safeguard and revitalize indigenous language scripts.[52] Because *Silbo*'s wealth of skills pertains to a distinct body of knowledge, it seemed most necessary to gain insight from the invention of virtual acoustic spaces – in distinction to the usual attempt to safeguard endangered languages through the preservation of alphabetic scripts, dictionaries, and other textbooks.[53]

As argued by Barry Blesser and Linda-Ruth Salter in *Spaces Speak, Are You Listening?*, since the mid-twentieth century the development of electro-acoustic tools has formed our understanding of acoustic space through parameters that go beyond rhythm, melody, timbre, and tempo – the key affordances of classical musical instruments[54]. Besides its obvious significance in the fields of 'avant-garde, postmodern and experimental music',[55] these tools have instigated the design of complex 'aural architectures' (a term used by the authors) that exist beyond physical constraints and that expand our auditory imagination. Since space is no longer purely physical or defined by the acoustics of 'real' environments, virtual auditory spaces confront us with material dimensions that were previously unforeseen.

While it might initially seem that *El Laberinto del Sonido* is attempting to replicate the mountainous environment of La Gomera, the design of the application is actually consistent with some of the ideas set forth by Blesser

and Salter, particularly when focusing on the authors' discussion of the simulations or replicas of 'real' physical/auditory structures:

> Aural architecture of virtual spaces becomes the design of a spatial experience for each individual listener, not the aural architecture of the composite space. Space is individualized, with listeners having the same individual control over their listening environments that audio engineers have over their spatial synthesizers. Space becomes an individual experience, rather than a common environment with relatively uniform properties.[56]

We may therefore suggest that the application is not concerned with the actual acoustic environment of the island but rather with the sonic 'effects' that this form of language has on the development of a particular 'audile' culture that is characteristic of *Silbo*'s linguistic community. The concept of the sonic as an 'effect', first proposed by Augoyard and Torgue in *Sonic Experience: A Guide to Everyday Sounds*, suggests that we understand sound as multivarious phenomena. Instead of separating the diverse spheres of knowledge and their interpretations of sound (and let's keep in mind the discussion regarding the number of whistled vowels), we might take into account the ways in which our performative actions and their locations and mediums provide distinct perceptual and conceptual understandings. As suggested by the authors, these effects are not only the products of a physical study of the acoustical source – the 'basic effects' of distortion, filtering, or variation of the propagating medium – or even the study of the effects of each sound's concrete, inhabited space, such as reverberation.[57] They conceal, more precisely, a world of culturally situated perceptions – a verbal-auditory body of knowledge that is a form of sonic heritage in its own right. This transition will allow the study of whistled languages to be situated within a wider frame of cultural heritage, one that is not only linguistic but also sonic, as seen in the design of the language support system for the Gomeran community.

One of the driving forces behind *El Laberinto del Sonido* has therefore been, on the one hand, to fully explore *Silbo Gomero* as a source of sonic heritage and, on the other hand, to instigate a reenactment of linguistic heritage through narrative construction. In this sense, the application has attempted to safeguard a cultural tradition, recreating a collective memory of sound through the constant reappropriation of both past and present media. The fact that digital media may afford new and unique sonic experiences also presupposes a renewed understanding of the archive

in the context of linguistic heritage. *Silbo Gomero* appears in the end not simply as a form of language that is worth safeguarding but as a body of knowledge that traverses time and space. More importantly, it traverses the generational and media divide that endangers many language forms and their attempts to survive the demands of contemporary life.

Notes

1. Discussions of the project and some of the data presented in this chapter have previously been published in Farias et al., *Design Frontiers*.
2. Trujillo, *El Silbo Gomero, Nuevo Estudio Fonológico*.
3. Ibid., p. 11.
4. Ibid., p. 31.
5. Ibid., p. 15.
6. Ibid., pp. 201, 205.
7. Meyer, p. 236.
8. For more information on oscilloscopes, consult Diffenderfer, p. 19.
9. Trujillo, *El Silbo Gomero, Nuevo Estudio Fonológico*, p. 57.
10. Ibid.
11. Ladefoged, 2003 and Gibson, p. 80
12. Wishart, pp. 48-49.
13. Roads, p. 545, referring to Miller.
14. Beyer, pp. 44-45.
15. Roads, p. 1076.
16. Ibid., pp. 545-546.
17. Ibid., p. 545.
18. Ibid.
19. Ibid., referring to the work of Helmholtz, 1863.
20. Wishart, p. 31.
21. Roads, p. 546.
22. Ibid.
23. Ibid.
24. Ibid.
25. Ibid.
26. Wishart, pp. 46-51.
27. Ibid.
28. Ibid., p. 51.
29. Bregman and McAdams, p. 34.
30. Roads, pp. 541, 563.
31. Roads, pp. 563-566; Whishart, pp.51-58.
32. Bregman, p. 485; Gibson, p. 86.
33. Roads, p. 566.

34. Ernst, p. 183.
35. Ibid., p. 175.
36. Roads, p. 592.
37. Ernst, p. 178.
38. Ibid., p. 182.
39. Ibid., pp. 81-82.
40. Brito et al., pp. 83-84
41. Ibid., p. 86
42. UNESCO, 'Whistled Language of the Island of La Gomera' and 'El Silbo Gomero'.
43. Ernst, p. 173.
44. Trujillo, p. 15.
45. For more information on the work of artist and software developer Theo Burt, see http://www.theoburt.com.
46. For more information, see http://www3.gobiernodecanarias.org/medusa/ecoescuela/abriendolaescuela/?p=1049.
47. Rotman, p. 8.
48. 'Audile' is a term that is used by Jonathan Sterne in *The Audible Past* and refers to: 'a person in whom auditory knowing is privileged [...] the term is useful because it refers to the physiological process-based sense of hearing [...] and because it references conditions under which hearing is the privileged sense for knowing or experiencing' (p. 96).
49. For more information about binaural algorithms, consult Roads, p. 469
50. Blauert, pp. 13, 51.
51. Developed by filmmaker Don Thornton in collaboration with the Cherokee Nation tribal council and the Neurosmith Corporation. For more information, see https://itunes.apple.com/us/podcast/ndntv.com-native-american/id88236516?mt=2.
52. Eglash and Tedre.
53. Hirsh, p. 83.
54. Blesser and Salter, p. 164.
55. Ibid., p. 366.
56. Ibid., pp. 186-187.
57. Augoyard and Torgue, p. 15.

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Softwares

Chapter Three

Big Diff, Granularity, Incoherence, and Production in the Github Software Repository

Matthew Fuller, Andrew Goffey, Adrian Mackenzie, Richard Mills, and Stuart Sharples

This chapter will discuss the way in which Github, one of the largest dynamic repositories of software online, can be seen to operate as a mode of archive which in turn re-engineers the question of what an archive is. In very simple terms, Github is a place where software is stored online and from which it can often be downloaded. More expansively, it provides a sense of the archive as simultaneously a site of fine-grained analysis and of incoherence, of storage and of production. To get to Github, we need to start with Git, a 'source code management' (SCM) system designed by Linus Torvalds in 2005.[1] Git was initially based on the characteristics of a file storage system familiar to its author as the initiator of the Linux aspect of the GNU/Linux operating system.[2] Whilst it claims to be 'a stupid content tracker',[3] in practice Git is a highly sophisticated, decentralized, and distributed way of writing code in groups on scales ranging from an individual to that of large organizations. Git encourages branching or multiple versions of the same project at the same time and provides many different ways of merging, tracking, duplicating, and integrating code repositories distributed across many developers. It facilitates and encourages copies and variations as well as the tracking and auditing of changes in almost any kind of digital data. Since 2007, Github.com – a separate organization – has served as a largely public host platform for Git repositories or 'repos'. It has encouraged software developers and programmers to store, work on, and retrieve the source code and texts associated with software projects on many scales, again ranging from individuals to large organizations. It has augmented the many operations afforded by Git with 'social coding' affordances such as 'starring', 'watching', the distinctive 'pull-request' mechanism, various more formal organizational arrangements (teams, organizations, etc.), and visual descriptive devices (graphs in particular). Github has grown rapidly since 2007 to become perhaps the most important online code repository of the moment, hosting around 10 million projects in total with several million people contributing to them, albeit with widely varying levels of activity. We might understand Github as the formal enterprise that organizes – and

somewhat ironically, centralizes – the informal de-centralized organization of Git. Github itself publishes much data about the growth of repos. The public legibility of platform dynamics is typical of contemporary software-mediated culture: things are made to be readable by many. Github.com also produces and encourages the production of various forms of visualization and tabulation of what goes on there. To illustrate this legibility, we could choose important or famous repositories on Github – the Linux kernel, for instance, still led by Linus Torvalds, is a much-vaunted FLOSS project that has become economically and technically central to the development of the Internet – and analyze the flows of meaning, texts, and readers/writers connected to that repository.[4] Relatively quickly, individual contributions could be analyzed, and we could begin to characterize the composition of the group of people who keep this important software object working and up to date. But this work is largely already done by Github.com itself.[5] Indeed, the site is characterized by a high degree of granularity of the data it holds. This is understood to mean the availability of multiple kinds of highly detailed, and to some degree tractable, information of the processes, material, and actors it gathers. Since Github is notable for the 'socialization' of software production, in which the above-mentioned social media forms are built into the archive, there is, in turn, a deep integration of quantification into the working processes of the archive.

Coding processes and architectures

The development of software has entailed a history of self-reflection of certain kinds. The discourse and practices of software engineering, for instance, were born of a need to intensify the quality and standardization of code, in turn stabilizing factors such as the culture of engineering and desirable qualities of personnel.[6] Here, we should also note the strong differentiation between the engineering and software development approaches and the concomitant differences between hackers and engineers that run through them. Software engineering historically relies on the standardization and systematization of work in relation to large-scale projects. Hacking, by contrast, emphasizes informality and virtuosity.

Faced with the explosion of programming and the applications in which it is being deployed, computing has also developed numerous techniques of management or methodology, modularity and re-usability, to stabilize the nature of work and to make it more amenable to enjoyment or at least to management. Programming methodologies develop out of various

formulations such as the need to co-ordinate across often increasingly large-scale projects or, conversely, the need to develop project requirements as the system develops. Echoing such imperatives, examples such as Waterfall (a software development model predicated upon strict division of stages) involve an ordering and hierarchy of projects and products; conversely, Agile methodology is a mode of close collaboration between coders and clients, emphasizing the quality of working life, fast iteration of code, and tight participation of the user. Alongside these organizational systematizations, programmers rework, add to, and link pieces of code. This may seem an obvious statement, but the process also implies the development of languages, programming environments such as IDEs (Integrated Development Environments) or the text editors (such as VIM or Atom) in which programmers work as well as the use of systems of pre-written software at different scales such as frameworks, classes, libraries, and objects. In parallel, and in the wider contexts of digital work, new conditions for the storage and management of files are generated. Music and architecture are related areas that generate thousands of memory-intensive files and variations on those files, implying archival necessities such as version control. In turn, the question of what constitutes a file is reconfigured: objects are now increasingly understood as a particular state space within a matrix of variable data, structured and inflected in turn by the specific qualities of the kind of media that is being worked – as in the difference between a text file and an architectural drawing, or a layer in an animation file. To a certain extent, these version control systems can be seen as part of the general modularity of work in the gloriously undulating fields of the contemporary *Bürolandschaft*, echoing or reciprocating the modularity of paradigmatic computing systems such as Unix.[7] Part of the condition of such systems is a general move towards a relatively high degree of granularity of objects and, concomitantly, of the modes of analysis and use to which they may be put, something in turn effecting the nature of their condition as archive and as engines of production. We will explain this further below. Within the specific domain of FLOSS (Free, Libre, and Open Source Software) code repositories, what is particularly interesting is that they fuse thedistribution, production, and consumption[8] or use of software into the same architecture. They constitute part of the establishment of a code commons that involves some of the means of negotiating over and managing disagreements, and they also provide the means of generating what we propose, following recent work in biology, to call *metacommunities*: sparsely or thickly connected populations of objects, users, producers. However, in distinction to the biological or ecological use of the term, calling these systems 'meta' means

that they also partially draw up the matrix of possible operations that may constitute communities. Here, the software that encodes such operations is of crucial interest. FLOSS code repositories include GoogleCode, SourceForge, Savannah, Code Snippets, and Tigris.[9] Some of these repositories support multiple version control systems. Savannah, for instance, supports CVS (Concurrent Versions System), Subversion, Git, Mercurial, and Bazaar, though many if not most projects use CVS.[10] Some of these systems will be used in parallel, with code being developed on Git, and stable versions of a programme being made available by multiple sources. Equally, an organization may often make use of a public facing repository and have one or more private ones in which the daily work is done. Github, as a company, makes much of its money from providing the latter service on a commercial basis. There are also many smaller, project-specific repositories such as Rastasoft, CPAN (Comprehensive Perl Archive Network), or Python.org that provide the output of a specific group of programmers or, more expansively, the basic materials to work with a particular language. There are also sites that are not repositories but that act as directories of projects. What is crucial here is the question of version control. An example of simple version control for non-software use would be the wiki software that was originally developed for project documentation and collaboration around Agile software development and that now forms the basis for systems such as Wikipedia.[11] Version control allows users of a system to develop more than one version of a project, to have many people working on elements of a project simultaneously without overwriting each others' work, and to archive and make available completed or ongoing versions of a project as they develop. Code repositories act as part of the mix of systems used in software development such as the bug trackers, mailing lists, IRC channels, and messaging applications that particular metacomunities or teams might work with in the development of a programme. These operate by means of creating lists of work to do or by allowing fast means of communication that can be both synchronous and asynchronous. On another scale, code repos can be seen in relation to discussion forums such as Stack Overflow, privately owned operations that in turn sometimes shape and cull conversations according to commercial imperatives. With many FLOSS projects, too, there is a merger between development and marketing, garnering new users and developers that also constitutes the prospective shaping of a scene around the platform and the various constituencies that use it.[12] Equally, these projects often rely upon a legal and discursive framing via the use of free and open source software licenses. These are generally defined and differentiated by the way in which they either attempt to perpetuate the

software as a common good or as a resource free of the encumbrance of obligation to others. As we will see below, this is also something subject to change.

Anatomies of forks

One of the crucial aspects of Github's architecture is that it also upends what is called the 'taboo of the fork' in free or open source software. This is the taboo against splitting or duplicating a project, an act that often potentially breaks apart the community around the code. Git, the system that Github relies on, inverts this established software community ethic by making the fork its fundamental operation, something that in turn reframes the debate around the archive as the focus of storage, conservation, and of communities of research.[13]

FLOSS has developed numerous terms for working with software and practices of copying and changing. *Cloning* a piece of software is to copy it either at code level or at a higher level, for instance in terms of functionality and interface.[14] *Branching* is to make a variant version of an existing body of code within a project, perhaps to create a prototype or for other purposes. *Derivations* are improvements or variations on an existing programme that differ whilst maintaining existing compatibilities. In this chapter, we are specifically interested in the way that Git, and by extension Github, has worked with the question of forking.

Forking is the practice of taking a body of code by making a copy of it and revising that code. Someone who forks some code may do so in order to improve it by making variations; to release a variant version of something modified for a more specific purpose. The term fork has a variable genealogy within computing. In the POSIX operating system, a *fork* is a process making a copy of itself. A *fork bomb* is a work of hacker craftsmanship in which a process is launched to make a copy of itself.[15] As each subsequent process is launched, a further copy is made. One of the characteristics of a fork bomb is that it exponentially uses up the resources of memory of the computer. *Forking* software, as a techno-social operation, is often regarded as having a similar consequence: using up the attention and capacity of all the developers in a community. Unlike a fork bomb, however, such an operation cannot be ameliorated by a simple reboot. In this sense, it has historically been a powerful taboo, since it drains resources and creates a division in what is called the community. For Benjamin Mako Hill, author of a thoughtful text on forking in FLOSS development, prohibitions on forking operate as social

taboo with large costs.[16] An alternate view, offered by artist and programmer Aymeric Mansoux, is that the inability to fully differentiate a project on Github, a situation that arises with the inversion of the forking taboo, leads to other kinds of problems: 'Forking has become so cheap, merging and collaborating became tedious and consensus is no longer such a loved value."[17] The inversion of the taboo – indeed automating it to the extent that there is a button on the Github interface reading 'Fork This Project' – may perhaps deserve a psychological reading which describes the trajectories of communities founded upon a crime (as if they arise any other way). Forking is often studied as part of the field of software engineering, where it is generally analyzed as part of the problem of efficiency, communication, and duplication. Research into the quality assurance of software also typically relates an analysis of forks to the motivation and career-mapping of developers by marking their productivity and through various metrics. The economic analysis of software development projects may also be carried out in these terms. Quantitively based empirical research on these systems is relatively intensive in terms of memory, computation, and network–though involving analytical abstractions as a methodological imperative–has historically tended to involve a close engagement with the problems of network outages and variability in processing power.[18]

Generations of versions

Different version control systems articulate the problems of forking, branching, and cloning in different ways. Along with these variations, they generate variant ideas of the habitus of the programmer or developer, what forms the constitution or the pacing of a project, and what goes into the activity of software development. In order to trace this, before returning to the analysis of Github, we want to briefly describe the different generations of version control systems and repositories.

The first generation of repositories is in many ways epitomized by CPAN, which is simply an index-based directory of software written in the Perl language, alongside software for working in Perl, that has been run since 1995. That it is a directory-based repository implies a high level of familiarity or willingness to attain expertise and mastery as the basic condition of programming. Software repositories of the first generation employ minimal interpretative filters, leading to a certain charm if not always a ready intelligibility to the uninitiated. There is a clear distinction between what they store and make available, the structure that indexes them, and the systems

that are used to produce and work with the software. The second generation of repos was set in motion by Sourceforge, a MySQL-based directory of software projects that became a central resource for FLOSS activity at the end of the twentieth century and after. This repo grew in the first wave of massification and visibility of FLOSS as a social and economic movement alongside the growth of discussion forums such as Slashdot, and is owned by the same company. Sourceforge ties project documentation and release notes into a download site but also brings in project rankings, user reviews of software projects, and user profiles, where users could be viewed according to the languages they used, projects they are involved in, and the stream of their activity. Alongside these, it brings in advertising for tech jobs and other related information. Users also have straightforward permissions as admin or developer as well as team co-ordination tools for concurrency management (in wiki or source code management environments). More recently, Sourceforge has incorporated Git, Mercurial, CVS, and Bazaar as a range of systems that projects may use from its central site. Amongst these, it also includes cross-platform compatibility – allowing projects to migrate from one platform to another or to exist across platforms. As such, Sourceforge now epitomizes both the second generation and the third generation of repositories. This third generation are decentralized version-control systems such as Git, Mercurial, or Bazaar. They are characterized by their speed of operation; the fine granularity of analysis of code, of use, and of users that they allow; and their distributed infrastructure. As software author and developer Joel Spolsky notes, Github tends to follow the requirements of freelancing FLOSS developers.[19] A more corporate, in-house version-control system would imply hierarchical levels of access governed by permissions structures, code reviews rather than promiscuous copying, and most likely a clear prohibition against the sharing of code. The data that is captured, stored, and made addressable in certain ways implies a social, cognitive, or processual order that can make use of it. Amongst others, Philip Mirowski interprets neoliberal economics, particularly in the work of Friedrich Hayek, as the dream or ruse of a perfect information machine. There are certainly accounts of DVCS that have such an inflection, or they make the explicit correlation to idealized markets.[20] The wider question of open data in government may be a parallel here. What is counted as informative and what is not constitute some of the key functions of a social order. Bureaucracy arises, in James Beniger's terms, from the need to control the vast amount of variables, information, and contingencies in running an enterprise.[21] What we see in some sense in the present wave of social media is the adoption of bureaucratic forms in the management of friendship,

dating, music acquisition, and so on. These are all more ostensibly trivial aspects of life when compared with the intercontinental import and export of goods, the movement of armies, and the mass markets of consumers implied by continuous production machines such as the conveyor belt. At the same time, their incorporation into control systems changes the nature of both in different, non-symmetrical ways.

Events in the API

As a typical social media platform, Github also publishes much data about what happens on Github.com through its APIs (Application Programming Interfaces), an interface to provide information about the database and some of its contents to other software. The data provided by the API is indeed mainly intended for software applications and web services built around Github. But the combination of the Events API endpoint, the API that supplies a more or less 'live' feed of events on the Github.com platform (https://api.github.com/events), and the archived copies of events stored since 2011 at the GithubArchive[22] means that Github can in principle be analyzed using what some currents in social science refer to as 'live methods' (research approaches based on the dynamics of experimental and collaborative events across a variety of media platforms).

The tools and devices for research craft are being extended by digital culture in a hyper-connected world, affording new possibilities to re-imagine observation and the generation of alternative forms of research data. Part of the promise of live methods is the potential for simultaneity in research and the possibility of re-ordering the relationship between data gathering, analysis, and circulation.[23] The scale of the platform (only millions of participants, not hundreds of millions) and the existence of archives mean that social researchers can envisage analyzing the whole of Github, not just one month of data or a selected group. There are both great potentials and difficulties in doing so. The fact that we have ready access to the Github event timeline is testimony to this. But what is most available from that data is a set of pre-formed 18 event types.[24] These event types subsume much of the traffic around Github but give us little way of deciding what is an important event and how to elicit – from the hundreds of millions of events in the event timeline – which ones matter and which ones do not. At the same time, we know from ethnographic and other studies of software that the very detailed and fine-grained tracking of work and activity that is inherent to Git means that, in principle, repos and software

projects themselves can be analyzed in great depth. Patterns of work, flows of meaning, borrowing and imitation of constructs and practices, and shifts in interest and importance should be publicly legible in the repos and, importantly, in the flow of code between repos. But the possibilities of perceiving these flows and patterns presuppose capacities to filter and select events in the stream that neither confirm the unsurprising importance of certain high-profile software projects (Linux, Mozilla, node.js, etc.) or overwhelm us with the buzz of transient or ephemeral repositories, a discussion of which we will move to below after also noting some of the other overall features of the system.

'Post-FLOSS' archiving and the archive as engine

So, broadly speaking, what patterns of archiving are there? Users use Github in different ways: in a canonical open mode of use, making all code and forks visible; performing merges and the evaluation of code offline, invisible to others, but keeping what is published clean; and, in a related way, to publish changes in private Gits. There are also multiple hacks of the system, where a repo or a file might be named or entered on the fly by users that then rename a file locally to work on and subsequently reload it without reference to any broader project. Equally, the question of which pull, merge, and commit has priority has to be resolved locally within the work group or organization around the repo. This means that large aspects of even the most well-organized repositories remain inscrutable.

Alongside the constraints on access to data via the API such as those mentioned above, Github works via the encouragement of contribution. Some of this encouragement is achieved through an efficient and useful system – via the extensive adoption of user experience design, contemporary 'flat design' style graphic design, and, of course, a cartoon mascot. Equally, the site operates by numerous types of granularity of access to analytics. There are numerous 'social' features such as letting you view the repos 'people you may know' have starred, (with starring being a mechanism to 'liking' or drawing attention to). Project sites include images, videos, comments, and tags. Such features also extend to a greater metricization of programming culture, allowing users to view the rate at which something is updated, see the number of users following a project, peruse network diagrams of branches of code, and so on. Here we have the archive also operating as a matrix of capture and semiotization devices, driven by the imperatives to rate, share, participate! As an economic factor, such hyperauditing devices

allow the site to become a means of finding and hiring programmers; Git and Github profiles become key to coders' CVs as a means of displaying the productivity, uptake, and significance of the work produced. In this way, as in others, the archive is a site of production, an engine for the development of new software that involutes the sense of the archive as a repository of the unchanging past. Storage becomes the site of production when the form of production is variation. This is not necessarily an entirely easy condition to navigate and one that in turn ties back to the question of the fork. Github tends to encourage the possibility of multiple versions of the same code being developed, often in parallel, which sometimes fails to fully reap the benefits of coordinated action. For instance, in a blog post, Ruby developer Seth B contends that in one version of some code he was wanting to work with, there were seventy versions of the same piece of code with incoherent information about which branch was in which state of development, including information as to where, if at all, a particular bug had been resolved. Github, one can thus say, is an environment for *making* a workflow rather than something that imposes a workflow of a certain kind. This implies that a project needs a certain kind of organization or at least a means of flagging or archiving defunct branches, those with 'dirty' code, experimental branches used for fixing and testing certain approaches, and so on. Discussions of Github online do tend to show the vexed question of how exactly to organize a repo well. Addressing this, quite a number of large-scale organizations with repositories maintain one that is public, where users are able to retrieve the latest versions of code and in general act as public-facing. They will also maintain another that is where the actual development work is done. Concomitantly, our findings from statistically analyzing the Github archive show that the largest repos come accompanied by organizations, i.e. organizations organize Git. Git and other such systems propose a set of abstractions of software development from and in which projects may compose themselves. The speed and granularity of changes is one of the 'innovations' of FLOSS. But within this is a variation in styles: the imperative to 'release early, release often' promulgated years ago by software polemicist Eric Raymond can be compared to the Debian Linux distribution which characteristically takes two years for the gestation of each stable release. Alongside the kinds of software development characteristic of the classical forms of FLOSS, we also see what can here be termed as 'post-FLOSS' forms of development. Post-FLOSS is characterized by a general indifference to the discussions of and loyalty to certain kinds of licences and the sense of ethics (GPL) or business models (Open Source) that these drew upon. Large amounts of the material placed online through

Github tend to be without a licence assigned to it. This is not to say that some people don't use these licences or that the imaginary of software as culture that they map has no traction. Rather, they seem to exist alongside an expanded and incoherent universe of code objects, projects, and practices that is somewhat different from the legendary world of the Unix greybeards, whose insistence on crafted, knowable code with powerful and rigorously applied abstractions and a matching ethos and legal apparatus has been so fundamental to the development of the Internet and of free software. In the majority of cases on Github, code is uploaded to the repository, perhaps to be treated as public domain, or simply abandoned. What relationship this has to the wider ethos of the system and whether it signifies a change in the nature of programming work – showing it to be more or less precarious, perhaps, or marking the 'coming into public' view of another kind of coding practice – is unverifiable. Post-FLOSS inhabits conditions in which code objects, scripts, css, config files, etc. form so much a part of everyday generic *stuff* and thus not worth protecting in the way that the adoption of a license implies, even when that license is available as a drop-down menu.

Diff as infrastructure

Aside from the cluster of large-scale projects with their pattern of high levels of activity around complex software objects and systems, much of what is on Github tends to be of a much more diffuse kind, with high degrees of variation concerning project size, type, and code, including the rapidity and scale of variations. We can say that in just about every parameter where variation is possible, it can be found. And here we note the source of *Big Diff* as this chapter's title. Diff is a Unix command that shows the differences between files. Git is similarly based on a file structure that works on the basis of marking the differences between objects stored in the repository. A diff is based simply on a character-by-character analysis of a file. Every change is logged and is retrievable by choosing the right commit.

Needless to say, this has interesting effects on the notion of the repository as archive. Archives tend to work with exemplars, not variations. With Git, as with all forms of computer memory that always involve making copies of files, objects no longer need to exist uniquely; indeed, they cannot do so if they are to be used within the system. The archive in this case comes into being as a process of structural differentiation rather than as a thing. Overall, Git is a massive graph structure and each code object, each archived file is a set of trajectories across this graph. Based on a file structure that amasses

hashes of symbols and diffs, the archive transitions into a systematization of the archive as an engine of minutely and massively assembled processes of addition and variation. Rather than the archive storing history as a set of exemplary if not necessarily unique entities, history is involuted in the archive rather than stored in it. With a system of versions at the core, versions generate histories and versions become generative. Different kinds of repos, such as public-facing repositories, working repos, and empty repos exist in memory and perhaps in use alongside those that are set up as websites, code deployment platforms, agile infrastructures, and mechanisms for publishing and working on apps and frameworks for making them. This generativity is not simply one of a ceaseless, vitalist overproduction. If we were to phrase it in terms of evolutionary modelling and to draw the archive as a form of fitness landscape, what we find is that there are millions of objects stuck in basins of activity. The phase space of the graph is a constellation of numerous entities, many of which are lonely asteroids drifting amongst thousands of archives of abandoned space junk, themselves giants against the millions of motes of dust that form their background.

Organising incoherence

One of the aspects of Github that echoes the problematic nature of much social media is that within the system it is impossible to have a 'delete' event, so once a file is on the system, there it stays. This is one factor that may lead to an understanding of Github as in many ways positively incoherent. To put this another way, any initial scan of the system as a whole will find a power law distribution for the size of the projects. (Crudely put, most activity clusters around a small group of very large projects, with much of the remainder of the work being in tens of thousands of smaller projects of sizes decreasing in inverse proportion to their number.) Much of this is simply because there are low barriers to entry – a repo is easy to start but harder to maintain. Just as there are junk repos, uploaded only once, modified a few times or less, and left to drift, there are others that continue to gain occasional downloads years after posting. There is an enormously diverse range of patterns of use. Alongside lots of very small but somehow long-lived projects, there are people updating repos to check the differences between pieces of code, bots making various attempts to push changes, and multiple tools for managing and analyzing Git data potentially implying a form of recursive public or a certain kind of narcissistic fiddling that is not without its pleasures. Notably, many people use Github to circulate configuration

files for text editors such as vim and for operating systems such as OSX. Github is used as a platform for sharing machine configurations on a very large scale, and such files are rarely worked on as a project. The transverse movements of such files aren't really captured by the mechanisms of distributed version control, since they are so ephemeral. Equally, some users may also use Github as their mode of cloud back-up, with no contributions sought from others – they simply use additional features such as bug tracker and wiki as a means of interaction with users of their code. Here it's worth comparing this system to other code-sharing systems such as Pastebin, where files are just left alone on the off chance that they might be used or picked up by bots or onsite scripts scanning them for certain kinds of data – credit card information, serials, website layouts, URLs, usernames and passwords, scripts, my little pony porn, and so on. With Pastebin, the 'drive-by commit' is all there is; the system is simply used as a generalized open notepad. Github is a far more variable and multi-dimensional field of entities with high degrees of differential use and relation to the idea of a project and, in turn, to the question of production and sharing.

As an archive, then, Github.com is exemplary in its crystallization of certain aspects of contemporary software cultures. It is a zone of massive, concerted activity and simultaneously a ground for the dumping and drifting of files characteristic of post-FLOSS; a space of atypical formations disparately linked across directory structures and smeared unevenly across timestamps and between users; a social factory of difference founded upon the violation of a communitarian norm that it in turn also constitutes; and a site of perpetual audit and production and an architecture for the free form, the shapeless, and the corporate that is in turn perpetually being built up for a hoped-for but deferred valuation on the stock market. As a site for unearthing the finely grained ambivalence of the contemporary archive, it is indeed something to keep tabs on.

Notes

1. Git, online at http://Git-scm.com.
2. Git uses the MIT Licence, http://opensource.org/licenses/MIT.
3. Torvalds.
4. The Linux Kernel is archived at https://GithubGithubGithubGithub.com/torvalds/linux.
5. One of the aspects of the discussion of archives in the era of open data and of big data is the way in which the archive as a site for the exercise and

communication of expertise can sometimes be quite literally *dumped*—uploaded and then abandoned–following the idea that unspecified emergent forces will sort out the questions of legacy, interpretation, and preservation that are characteristic of the archive as an institutional form. In relation to this aspect of the debate, this chapter, like others in this book, suggests that archival architectures find quite variegated forms and that the archive as structured information, with attached practices of expertise, maintains the condition of being a mutable field in contemporary software development.

6. Ensmenger.
7. Macpherson, 'US Operating Systems at Mid-Century, the intertwining of race and unix'.
8. For instance, in Github.io, which provides the conditions for software to run directly from Github servers.
9. Alongside the FLOSS-oriented systems, there are tens of proprietary source control management systems, and many IDEs include version-control facilities.
10. See Yuill.
11. Labouef and Cunningham.
12. For instance, the Mozilla Foundation's regular Mozillafest.
13. In turn, there are a number of implementations of Git in several languages and that also run on various platforms (Gitorious, Gitlab, Gitprep [a direct clone of Github], etc).
14. The analysis of cloning here is often coded in relation to the question of intellectual property, predicated on the idea that one body of code may contain a direct copy of another.
15. See Cox.
16. Hill.
17. Mansoux.
18. Mockus.
19. Spolsky.
20. Mirowski. See also Mirowski's acerbicly perceptive, if partial, comments on *Wikipedia* in his postscript to Philip Mirowski and Deiter Plehwe's *The Road from Mont Pelerin, the making of the neoliberal thought collective*.
21. Beniger.
22. Githubarchive.org
23. Back and Puwar.
24. Constraints on access to data via the API also take other forms. Events support pagination; however, the per-page option is unsupported. The fixed page size is 30 items. Fetching up to ten pages is supported, for a total of 300.

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Chapter Four

The Post-Archival Constellation: The Archive under the Technical Conditions of Computational Media

David M. Berry

In the present age, the archive is no longer hidden away in national libraries, museums, and darkened rooms, restricted in access and guarded by the modern-day equivalents of Jacques Derrida's *archons* – the guardians of the archive.[1] Indeed, researchers and archivists' hermeneutic right and competence – and the power to interpret the archives – have been transformed with digitalization and the new technics of computational surfaces. Through computation, access to archives is made possible and often welcomed – through rectangular screens that mediate the archives contents or through interfaces and visualizations that reanimate a previously inert collection. We might consider this not only a de-archiving of what we previously understood an archive to be but also as a creation of new archival forms through practices of re-archiving.[2] Indeed, Wolfgang Ernst argues that the original role of an archive was 'to preserve [...] for an indefinite time, or even to bar present access, conserving [...] for later, unexpected, and hence truly informational use'.[3] For Derrida, the 'gathering' of an archive was the 'dwelling in a location' and a place for objects and knowledge to be sheltered. It was a place of classification and putting into order a process of archivization.[4] Indeed, as he argued, 'archivable meaning is also and in advance codetermined by the structure that archives'.[5]

> This is another way of saying that the archive, as printing, writing, prosthesis, or hypomnesic technique in general is not only the place for stocking and for conserving an archivable content of the past which would exist in any case, such as, without the archive, one still believes it was or will have been. No, the technical structure of the archiving archive also determines the structure of the archivable content even in its very coming into existence and in its relationship to the future. The archivization produces as much as it records the event.[6]

The means by which an archive is produced *as* an archive through archival practices and materialities is a crucial aspect of the argument I want to make in this essay. However, the archival materialities and practices that

are generated and reinforced through computation raise important questions about how an archive is mediated when abstracted, delegated, or remapped through software. Archives still tend to preserve the physical record of their production but increasingly the notion of the archive has expanded to include metadata, catalogues, scholarly editions, databases, interfaces, and digital tools.[7] The archive, which is 'traditionally that which arrests time, which stops all motion, [instead] is set in motion in the age of digitization'.[8] In this chapter, I explore how the archive is increasingly linked to the notion of a diagram, such as a database, and how it is mediated through the computational interfaces and surfaces that set archives in motion. By examining the projective nature of computational processes, both in terms of the visibility of the remembered and the dark memory of the forgotten, this chapter explores how the post-archival constellation creates a generalized condition of forgetting. To make something computable requires that it be abstracted twice over: it must be encoded in a symbolic system of digital abstractions and captured in a grammar of actions that can be prescribed back onto physical activity. Abstraction is thus a feature of functionality: Philip E. Agre has argued that the less 'capture' that is operationalized in a computational system, the less functionality the system has. By capture, Agre indicates the process of acquiring data which is passed along to a database as well as the creation of an 'ontology' (or formal schema) that models a physical system.[9] These procedures are fundamental to the creation of a model of the underlying processes as well as the objectification of this model in the physical world. Procedures of abstraction make different knowledges comparable, calculable, and subject to re-engineering and reconstruction: they radically reshape the world in terms of the model that was originally abstracted and most likely in the shape of strategic-instrumental rationality.

Abstraction thus raises the possibility of a technical derangement of knowledge, practices, and artifacts, and it is from this perspective that I view the emergence of a new 'post-archival' constellation. I will tentatively trace the implications of abstraction for the concept of social memory and a new social organization of knowledge. The archive is changed in the sense that it 'transmits the social bit by bit, transforming it technologically and becoming its key stimulus for evolution and industrial revolution'. Through its digital remediation it is put in a condition of performativity and, thereby, accelerated.[10] Thus, culture itself, understood as a kind of tertiary formation, is remade when materialized in a digital form.[11] By the post-archival, I am gesturing towards the notion of a 'post-digital' re-materialization of digital technology and its integration into physical environments but also the idea

of a historical phase of development that comes after the digital and changes the concept of the archive as a means of memory storage.[12]

A new dimension has been added to the archive, now that its velocities support not just storage but also innovation: the archive must 'erase information not only through economic reality but in order to be able to remember – even if delegation of "reading" to machines working at the speed of light allows for the sheer mass of memorisable material to be significantly increased'.[13] We are here confronted with a process in which the links between the contents of archives and their internal structure are increasingly lost or hidden, while a computerized ledger abstracts the archive from its representation. This changes the frameworks of social and individual memory – a fact that becomes manifest in epistemic communities that form around archives but which cannot always decode what is written or may even be overwhelmed by the sudden increase in archival materials previously subject to the constraints of access and storage. It also becomes manifest in the techniques and practices used in social reproduction such as teaching, learning, and specific literacies as well as in the problems of access that arise once memory is stored and transmitted in non-human readable forms. Could it be that the computational transformations in the structure and use of archives may act as a canary in the coalmine for wider changes in knowledge in society more generally?

To explore this question, I will first look at the idea of 'de-archiving' the archive through processes of computation. In the next section, I turn to the question of materialized abstractions and the way in which these abstractions mediate the archive through interfaces that function as a newly mobile resource. Finally, I draw these strands together to discuss the way in which these elements represent a new constellation, a post-archival situation that not only problematizes the very notion of a (relatively) static archive but that also sees computational opacity as the very ground of the archive's form and institutional structures.

De-archiving the archive

The traditional pre-digital structure of archives and practices of archivization were captured and stabilized through memory institutions such as museums, national libraries, universities, and national archives, often funded by the state. These institutions provided an organizational form and institutional structure that made possible a political economy for archives as such and hence an economic stability to the archive in question. Institutions provided

a decision-making centre around the collection of archives, in essence an institutionalized archivization process that delivered judgment in combination with curatorial functions. Indeed, the archive became 'defined as a given, preselected quantity of [artifacts] evaluated according to their worth for being handed down'.[14] The structure of traditional institutional arrangements around the archive was legitimated through a complex chain of practices and institutionalizations that authorized decisions to be taken about which parts of the present (and past) should be kept and what should be discarded.[15]

In contrast, in an age when digital technologies are delegated greater responsibility for a collection, computational rationalities are also increasingly granted the task of archiving and re-presenting materials: through computational analytics and user data, the archive creates a second-order archive.[16] This reflexive database (metadata) of the archive's use and motion can be used to fine-tune, curate, and prune the archive algorithmically, and in some cases also literally, in the sense of discarding artifacts that are not needed or which do not appear to have the cultural value initially expected. The ability of softwarized archives to make visible previously 'hidden' archives also serves as a justification for how an archive might be judged, such that 'increasingly, materials that are electronically inaccessible are simply not used'.[17] A paradox of digitality is the way in which its convenient surfaces serve to conceal that which is not digital.

We are indeed faced with new archival machines that demand not just a different social ontology but also different ways of exploring and interacting with archives. These new gateways to social memory are manifested in algorithms that instantiate a new archival imaginary – a post-archival constellation that is constantly modulated and 'augmediated'.[18] This is not a deterministic claim; rather, it requires the (re)building of new strata of organization that couple humans and non-humans in new and complex assemblies. As Christopher J. Prom argues, 'archivists should not treat [archival systems] as magic bullets. They will only prove to be effective in encouraging processing and descriptive efficiency if they are implemented as part of a strategic management effort to reformulate processing policies, processes, procedures.'[19] In Ernst's view, in 'the age of technology-driven media, both material archaeological strata and the symbolical order of the archive are progressively being conceived as essentially *processual* by nature'.[20] This processuality changes the way in which the archive functions, not least when it comes to selection: the quantification that comes with digitalization and the concomitant production of metadata feeds back into the qualitative judgments about what should be stored. This is often seen as a useful outcome of digitization, since the ability to track usage statistics,

etc. may lead to the development of precise qualitative and quantitative measures for the evaluation of special collections.

With the increasing interpenetration of computational systems and processes, we are thus witnessing a dramatic change in the material structure of memory institutions – in part due to technical changes but also due to the social ontologies that computational logic seems to produce. The digital creates a different kind of collection: digital archives are malleable and reconfigurable in multiple ways and do not necessarily need to conform to the organization structures and systems of traditional archives. The new archival management systems have been claimed to 'play a role in making archives more efficient and collections more visible',[21] yet the possibility of 'infinite archives' creates a new set of problems, particularly in born-digital and digitized collections where huge quantities of articles, texts, and data are suddenly made available. Now we are offered the possibility of generating comprehensive and exhaustive archives rather than curated ones.[22] Crucially, such archives are 'deeply computational in structure *and* content because the computational logic is entangled with the digital representations of physical objects, texts and "born digital" artifacts'.[23]

Computation therefore threatens to *de-archive* the archive, disintermediating the memory institutions and undermining the curatorial functions associated with archives. Many of the concerns of humanists have reflected an uncertainty about what the loss, or change, of archives might mean (although of course this could also reflect a decline in paper-based cultural capital), especially where medial changes imply epistemic change.[24] Indeed, the logic of digitization implies that rather 'than being a purely read-only memory, new archives are successively generated according to current needs' – thanks to the use of computational searches, aggregations, collections, and application programming interfaces (APIs) that facilitate the interoperability and networking of archives.[25] In other words, digitization 'tends to move the archive toward an [informational] economy of circulation: permanent transformations and [constant] updating' which can also paradoxically result in a static archive of physical artifacts.[26]

To explore the assemblages that create the conditions under which computational systems are operative requires an understanding of the way in which algorithms structure not just knowledge but also space and time. Computational systems utilize feedback in the sense that they operate on their own algorithms and metadata to improve their processing, complexity, and structure. The fundamental programmability of computational media thus raises new questions for storing knowledge and culture: the archive 'is no longer simply a passive storage space but becomes generative itself

in algorithmically ruled processuality'.[27] Basic principles of computation – modularity, iteration, abstraction, optimization, etc. – are applied across the multiple levels of the computational system's operation. The question of the archive is therefore increasingly linked to new digital spaces and microtemporalities and the way in which they structure, organize, and mediate archival systems, institutions, and political economies.

In changing the structure of archives, and the memory institutions that curate and store them, computation renders them anew through a grammatization process that discretizes and re-orders. This process can be as simple as the infinitely re-orderable process of creating a database. It is also amenable to spatial planning and algorithmic analysis that presents the opportunity for a logic of objectification: through computational mediation, new approaches and methods are made objective and thereby instrumental. For example, the Internet is an archive that represents an open-ended 'aggregate of unpredictable texts, sounds, images, data, and programs' but that is nonetheless navigable and open to traditional archival practices. However, when the Internet is transformed into an archive, it is also subject to technologies such as search engines that make its commodification possible.[28]

It is this process of objectification that I am interested in. Here, I am using objectification in Adorno's sense of the term: taking the concept as the source of reconfiguration for the object or allowing the concept to require a reordering of the 'real' so that the real will conform to the concept.[29] Such objectification is what Adorno calls *identity thinking* – highly prevalent in a computational logic that tend towards strategic-instrumental forms of rationality. For Adorno, identity thinking is understood as a *style of thought* that subsumes particular objects under general concepts and as a result the particular is absorbed into the universal. Reality is abstracted and closed when we think we have succeeded in framing reality within our conceptual systems, which today are increasingly materialized in computational machinery. This is compounded by the reifications of commodity fetishism – that is, when social relations between people are transformed into or misunderstood as relations between things. The Frankfurt School instead provided a model of the relationship between social processes, social institutions, and consciousness by providing a sociological explanation of the socially determined yet relative autonomous emergence of new social forms. Such an approach critiques a political economy that automatically assumes the economic determination of the social and the cultural. It asks us, rather, to examine the way in which, for example, a phenomenon such as social memory might be crucial for explaining the emergence of certain social formations and the processes of capitalism more generally.

In other words, computation recasts the material world into the shapes dictated by computational analysis or computational processes in a process of objectification. With archives, the first move has been upon us for a while, observable in large-scale digitalization projects (sometimes understood as digital humanities type projects) and in the use of encoded archival description (EAD) software and standards.[30] Following this initial process, with its emphasis on the digital overlay or mediation of the artifact, new techniques of control and management become possible such as re-ordering, searching, discovery, optimization. New tools of analytics, data visualization, dashboards, and information management systems are then often deployed to examine the previously latent forces of the archive. Indeed, 'the archive as the condition for our knowledge of history becomes dependent on the media of its transmission', which is increasingly mediated by computation forms.[31]

Digitalization puts pressure on the need for the storage of originals, and many objects are sent off to less-expensive locations far from the centres of population. But it also raises the question of the need for originals as, sooner or later, the access or footfall (which is tracked) shows a declining access rate for the original materials. In some cases, the digital versions are considered superior to the originals due to the quality and resolution of the scanning processes. New digital formats also present the materials in new interfaces such as PDFs, HTML5, ePUB, and other storage formats. Some of these are remarkably plastic compared with the original materials and also amenable to computational self-analysis – reinforcing the move towards a logic of distant reading. This derangement in the organization of knowledge is critical to the functioning of computation but potentially at the cost of human intelligibility.

To the extent that social memory is understood as an artifact of the organization of media, the entire process outlines a new modality in our engagement with culture. Such a perspective gets support from Bernard Stiegler's idea of *tertiary memory* as a site of materialized memory beyond the human brain. The question of storage is transformed by the computational: most notably when the long memory chains of temporally connected artifacts that are stored by institutions and media are rebuilt around the requirement of short memory chains that are continually refreshed and updated. These procedures are not always human-readable, nor human-centric. For example, in Amazon's equivalent of an archive, multiple objects are packed tightly into a warehouse space that is computationally managed through a technology stack.[32] Here I am interested in the spatial dimension of reorganization through computational processes – more developed in capitalist warehousing systems but also reflected in library and archive storage facilities that have

the same pressures on cost, labour, and funding. Amazon uses a principle of simplicity and an idea of 'flatness' to create a computational archive of physical objects. All objects are treated as records to be entered into a database, and they are processed through a grammatization framework which flattens the object not only into the data store but also within the warehouse space: the singularity of the object is, in other words, abstracted away by the technology. Objects are retrieved using computer-controlled robots from Kiva Systems, which glide swiftly and quietly around the warehouse. To do this, Amazon uses a so-called 'chaotic storage' algorithm that optimizes storage through mediating databases. For example, if Amazon receives a shipment of 500 copies of a specific book, they do not store the 500 copies together in one location. Rather, they distribute the books to different areas of empty shelf space across the warehouse and record the locations in the database through barcodes on the shelves and on the objects. This is very different from human-centric notions of archival cataloguing and organization, where one tends to group similar items together.

This storage and optimization is done computationally: Amazon knows the exact dimensions of every product in its warehouses and the exact dimensions of vacant shelf space. The robots glide the objects to be stored to the most efficient places. This is reminiscent of Ernst's claim that the Internet itself adopts a similar chaotic storage method – an anarcho-archive – such that so much information today is 'chaotically shelved – leading to archival phantasms of disorder'.[33] From the outside, the Amazon system looks horribly disorganized and illogical. In fact, the warehouse represents the *objectification of the chaotic storage algorithm*. It is constructed with the logic of objectification such that due to the computational mappings that technology makes possible, neither the range of artifacts to be archived as a whole nor the number of particular artifacts need to be known or planned in advance. The warehouse is in effect a reification of the code into the materials of stone, metal, plastic, and human labour.[34] The system functions at the highest rates of efficiency in the retail industry and relies on humans being separated from the act of stowing things and relegated to the role of 'picking' objects as dictated by the computational system. Storage capacity and its cartographies of space are delegated to algorithms.

Materialized abstractions

In order to explore these changes, we need an approach that can map the multiple levels of activity and complexity that computation creates.

Additionally, it is important that the principle of irreducibility is brought to bear on the problem of computation. If not, we fetishize silicon rather than giving attention to the appropriate abstraction layer – crucially the *materialized abstraction*. In *Critical Theory and the Digital* (2014), I undertook some of this preparatory work by developing an implicit understanding of the way in which abstraction layers functions within the design, implementation, and execution of computational systems more generally such that software becomes 'deep'.[35] I want to briefly summarize this typology to provide a number of abstraction layers that can serve as a means of analyzing the materialized digital. The aim is to ensure that analysis takes place at the right level of abstraction: one should take into account the principles of computational thinking that takes place in that layer yet still be able to drill deeper into the computational framework if required.

A useful way of exploring how computation is expressed across multiple layers is through the heuristic notion of a *laminated system*. By laminated system, I am referring to the work of Roy Bhaskar who uses this notion to draw our attention to the problem of the levels of ontology when studying things. This approach can help us 'develop a language for understanding and describing our object(s) of study at an "appropriate" ontological level'.[36] However, as this approach tends to present an unnecessarily static model that misses the interaction and interoperability between layers in software implementation, it may be better to understand these layers as elements in a constellation of technologies that make up the technology 'stack'. Adorno argues that one must create constellations by 'assembling the whole out of a series of partial complexes that are, so to speak, of equal weight, and concentrically arranged on the same level; their constellation, not their succession must yield the idea'.[37] By the term 'stack', I am referring to the way in which technologies are brought together to create computer systems such that they build upon each other and create a vertical stack of technologies. For example, one stack might include the operating system, the database technology, the middle-ware, and the applications. The specifics of the technical implementation, such as GNU/Linux, MySQL, node.js, and Chrome indicates one specific example of the materialized technical stack, whereas Microsoft Windows, SQL server, .net, and Internet Explorer gives another.[38] It is, however, crucial to understand that these technologies do not need to form such a vertical structure and may also be organized in a more open-ended horizontal or rhizomatic structure; hence the attraction of the notion of constellation.

A stack constellation contains six key moments: (i) *physical*: the material and transactional level (of the hardware), (ii) *logical*: the logical, network,

Individuational	Stratification of embodied personality (the psychology of actors, the user, etc.)
Logistical	Social and organizational structure (at the level of institutions, economies, culture, etc.)., social ontology, socialities, etc.
Interactional	Surface/interface level (between human beings and non-humans mediated through code)
Codal	Textual and coding logics (level of code, algorithms, software as text and/or process)
Logical	The logical, network and informational transactional level (level of software as diagram or platform)
Physical	Material and transactional level (of the hardware)

Fig. 4.1: Computation expressed across multiple levels through a heuristic notion of a laminated system (See Berry, 2014, p. 58).

and informational transactional level (level of software as diagram or platform), (iii) *codal*: the textual and coding logics (level of code, algorithms, software as text and/or process), (iv) *logistical*: the social and organizational structure (at the level of institutions, economies, culture, etc.), social ontology, socialities, etc., (v) *individuational*: the stratification of embodied personality (the psychology of actors, the user, etc.), (vi) *interactional*: the surface/interface level (between human beings and non-humans mediated through code). The moments presented here are ideal types and may simply help us understand the complexity and composition of computational systems. Each moment has to be explicitly designed, implemented, and structured within the computational system under construction – they require (often hidden) work to bring them together and ensure they function as a system. Due to the modularity of computational systems, however, it is not necessary to build from scratch for each system. Indeed, many layers are now available as software services that allow for the majority of these levels to be bought off the shelf, accelerating the development of stack-based systems.

Due to limitations of space, I am going to focus on only one of the moments mentioned above – the interactional in relation to the post-archival

constellation.[39] I have chosen to focus on the interactional in order to highlight the problematics of the interface and the surface. I particularly want to shed light on what has grown to be called *design thinking*; the idea that design is embedded in all aspects of production rather than being an ornamental or final stage of a process.[40] This wider notion of design, articulated by Buchanan as 'the conception and planning of the artificial', points to the inherent multidisciplinary nature of design work and the complexity of communications across multiple fields of knowledge.[41] It also points to the idea of *deep design* that is increasingly informing the design thinking that goes into computational systems and which means that the interface as a material and conceptual system influences and determines decisions made in the design and implementation of the archival system.

In the post-archival constellation, we see the application of certain logics of computation in the interactional moment itself. This is located in the organization of knowledge but also in its display, interactivity, and so forth. Here, I want to explore two competing metaphors which become obdurate in the interactional interface designs that are selected in particular design grammars. My argument is by nature speculative due to the fact that many archival management systems predate the new design grammars that are emerging within the design and technology fields. However, the speed at which these paradigms are taking hold of the models of interface design in computing will inevitably push on the archival systems, at first as an abstraction away from the legacy systems that are based on relational databases and textual screens until their 'simple' design philosophies begin to penetrate the underlying codal and logistical levels of these systems.[42]

The two systems I want to focus on are Apple's new design grammar, which has become known as 'flat design', and Google's competitor design grammar called 'material design'. I focus on these firstly because they are increasingly hegemonic interactional patterns, and secondly because their organization and logic bear their computational origins in their visualization, etc. As we increasingly read archives computationally, these display metaphors – foregrounding simplicity, minimalism, and lightweight approaches to complexity – structure the way in which knowledge is presented and manipulated.

These two new competing interface paradigms are deployed in the latest version of Apple and Google's operating systems but more notably as regulatory structures to guide the design and strategy related to corporate policy. The first, 'flat design', was introduced by Apple through iOS 7/8 and OS X Yosemite as a refresh of the ageing operating systems' human/computer interface guidelines. The strategy was essentially that stripping

the operating systems of historical baggage related to design techniques intended to disguise the limitations of a previous generation of technology both in terms of screen resolution and processor capacity. For example, visual interfaces would use techniques such as anti-aliasing to deceive the eye into thinking a higher resolution was being shown than technically possible – mainly through the careful use of light and shadow. The second, the 'material design' introduced by Google in its Android L, now Lollipop, operating system, also sought to bring some sense of coherence to a multiplicity of Android devices, interfaces, OEMs, and design strategies.

It is, however, important to note that Apple avoids talking about 'flat design' as its design methodology, preferring to talk in terms of platform specificity, that is, about iOS's design or OS X's design. More generally, 'flat design' is 'the term given to the style of design in which elements lose all the stylistic characters that make them appear as though they lift off the page'.[43] As Apple argues, one should 'reconsider visual indicators of physicality and realism' and think of the user interface as 'play[ing] a supporting role': the idea is that techniques of mediation in the user interface should aim to provide a new kind of computational realism, presenting 'content' as ontologically prior to, or separate from, its container in the interface.[44] This approach contrasts with rich design, which has been described as 'adding design ornaments such as bevels, reflections, drop shadows, and gradients'.[45]

I want to explore these two main paradigms – while acknowledging the flat-design methodology initiated as 'Metro' in Windows 7 and the (since renamed) 'Microsoft Modern' interface – by looking at Apple and Google's comprehensive attempt to produce a rich and diverse *umwelt* or ecology, linked through what Apple calls 'aesthetic integrity'.[46] The attempt is a response to a growing landscape of devices, platforms, systems, apps, and policies but also aims to provide a sense of operational strategy in relation to computational imaginaries. Essentially, both approaches share an axiomatic approach to the construction of a thought system, reflecting a primitivist predisposition that draws from a neo-Euclidian model of geons (such as circles, triangles, and polygons for Apple), as well as notions of intrinsic value or neo-materialist emphasis on essential characteristics (such as shadow cast from objects for Google). Such approaches then encapsulate what I think of as *flat theory*. Both Apple and Google are trying to deal with the problematic of multiplicities in computation and the requirement that multiple data streams, notifications, and practices have to be combined and managed within the limited geography of the screen. In other words, both approaches attempt to create what we might call aggregate interfaces by combining techniques of layout, montage, and collage onto computational surfaces.[47]

The 'flat turn' has not happened in a vacuum, however, and is the result of a new generation of computational hardware, smart silicon design, and retina screen technologies. This has been driven in large part by the mobile device revolution which has not only transformed the taken-for-granted assumptions of historical computer interface design paradigms (e.g. WIMP) but also the subject position of the user, in particular as structured through the Xerox/Apple concept of single-click functional design of the interface. Indeed, one of the striking features of the new paradigm of flat design is that its design philosophy is geared towards multiplicity and multi-events. The flat turn is about modulation, not enclosure: it is a processual form that constantly shifts and changes and that could be seen to act as a signpost for future real-time algorithmic and adaptive surfaces and experiences. It is easy to see how the language of flows and interactivity might be seductive to archivists seeking to make their archives more interesting, relevant, and mobile. Indeed, the structure of control for the flat design interfaces could be said to follow that of the control society in the sense that it is 'short-term and [with] rapid rates of turnover, but also continuous and without limit'.[48] To paraphrase Gilles Deleuze, humans are no longer in enclosures, certainly, but everywhere humans are in layers.

Apple uses a series of concepts to explain a notion of flat design that includes aesthetic integrity, consistency, direct manipulation, feedback, metaphor, and user control.[49] Reinforcing the haptic experience of this new flat user interface has been described as building on the experience of 'touching glass' in order to develop the 'first post-Retina (Display) UI (user interface)'.[50] The concept is based on the idea of layered transparency, or better, layers of glass upon which the interface elements are painted through a logical internal structure of Z-axis layers. This laminate structure enables meaning to be conveyed through the organization of the Z-axis, both in terms of content and in terms of its place within a process or the user interface system itself.

In a similar way, Google has reorganized its computational imaginary around a flattened, layered representational paradigm centred on the concept of *material design*. Matias Duarte, Google's Vice President of Design, has declared that this approach is based on the notion that it 'is a sufficiently advanced form of paper as to be indistinguishable from magic'.[51] However, it is magic that has constraints and affordances built into it, since 'if there were no constraints, it's not design – it's art'.[52] Indeed, Google argues that the 'material metaphor is the unifying theory of a rationalized space and a system of motion':

> The fundamentals of light, surface, and movement are key to conveying how objects move, interact, and exist in space and in relation to each other. Realistic lighting shows seams, divides space, and indicates moving parts… Motion respects and reinforces the user as the prime mover… [and together] they create hierarchy, meaning, and focus.[53]

This is a weird notion of materiality in as much as those at Google

> steadfastly refuse to name the new fictional material, a decision that simultaneously gives them more flexibility and adds a level of metaphysical mysticism to the substance. That's also important because while this material follows some physical rules, it doesn't fall into the techniques of skeuomorphism, which represented digital interfaces as if they were similar to physical objects. For example, an audio recorder might look like an old tape player in the interface to help communicate the affordance or functionality of a design element. The material isn't a one-to-one imitation of physical paper, but instead it's 'magical'.[54]

Google emphasizes this connection, arguing that 'in material design, every pixel drawn by an application resides on a sheet of paper. Paper has a flat background colour and can be sized to serve a variety of purposes. A typical layout is composed of multiple sheets of paper'.[55] The stress on material affordances – paper for Google and glass for Apple – are crucial to understanding their respective stances in relation to flat design philosophy.

> **glass (Apple)**: translucency, transparency, opaqueness, limpidity and pellucidity.
> **paper (Google)**: opaque, cards, slides, surfaces, tangibility, texture, lighted, casting shadows.[56]

In contrast to the layers of glass that inform the logics of transparency, opaqueness, and translucency in Apple's flat design, Google uses the notion of paper remediated as a digital material, since this 'material environment is a 3D space, which means all objects have x, y, and z dimensions. The z-axis is perpendicularly aligned to the plane of the display, with the positive z-axis extending towards the viewer. Every sheet of material occupies a single position along the z-axis and has a standard 1dp thickness.'[57] One might think then of Apple's design as painting on layers of glass and Google's design as thin paper objects placed upon background paper. However, a key difference lies in Google's use of light and shadow, so that a light source, located in a

similar position to the user of the interface, may produce shadows of the paper objects onto the objects and sheets of paper that lie beneath them.[58] Nonetheless, a laminate structure is key to the representational grammar that constitutes both of these platforms.

Interestingly, both design strategies emerge from an engagement with, and reconfiguration of, the underlying principles of the Swiss style in design, sometimes called the International Typographic Style.[59] This approach emerged in the 1940s, and

> mainly focused on the use of grids, sans-serif typography, and clean hierarchy of content and layout. During the 40s and 50s, Swiss design often included a combination of a very large photograph with simple and minimal typography.[60]

The design grammar of the Swiss style has been combined with minimalism and the principle of 'responsive design', placing emphasis on the fact that the materiality and specificity of the device should be responsive to the interface and context being displayed.[61] Minimalism is a 'term used in the 20th century, in particular from the 1960s, to describe a style characterized by an impersonal austerity, plain geometric configurations and industrially processed materials'.[62] Robert Morris, one of the artists associated with this tendency and author of the influential *Notes on Sculpture,* used 'simple, regular and irregular polyhedrons, influenced by theories in psychology and phenomenology' which he argued 'established in the mind of the beholder "strong gestalt sensation", whereby form and shape could be grasped intuitively'.[63]

The implications of Apple and Google's competing design worldviews are far-reaching in that much of the world's initial contact, or touch points, for data services, real-time streams, and computational power flows through the platforms controlled by these two companies.[64] In addition, they are also deeply influential across the programming industries, and we see alternatives and multiple reconfigurations emerging in response to the challenge raised by the 'flattened' design paradigms. In other words, both represent, if only *in potentia*, a form of power that places a particular ideological veneer on computation more generally. With the proliferation of computational devices and their associated screenic imaginary, a new logic appears that underpins, justifies, and legitimates these design methodologies.

It therefore seems to me that these new flat design philosophies produce an order of precepts and concepts that gives meaning and purpose not only to interactions with computational platforms but also, more widely,

to everyday life. Flat design and material design are philosophies that offer alternative patterns of creation and interpretation: they are meant to have an impact not only on interface design but also on the practices and the experiences of computational technologies more broadly conceived. One could think of these moves as a computational foundation that generates or provides arguments for an axial framework of building, reconfiguration, and preservation.

As an instance of the materialization of the interactional in the post-archival constellation, the analysis of flat design helps us examine the

> history locked in the object [...] mindful of the historic positional value of the object in its relation to other objects – by the actualization and concentration of something which is already known and transformed by that knowledge. Cognition of the object in its constellation is cognition of the process stored in the object. As a constellation, theoretical thought circles the mode of thinking it would like to unseal, hoping that it may fly open like the lock of a well-guarded safe deposit box, in response, not to a single key or a single number, but to a combination of numbers.[65]

Focus on stack constellations go beyond the specificity of the device as privileged site of research and reorient critical attention toward the complex computational layers that constitute them. For example, interface techniques are abstracted away from the specificity of the device, for example through Apple's 'handoff' continuity framework, which also potentially changes reading and writing practices in interesting ways.[66]

These new interface paradigms, introduced by the flat turn, have very interesting possibilities for the application of interface criticism and allow us to unpack and explore the major trends and practices of 'the Stacks'. 'The Stacks' are my term for the corporations that increasingly rely on computational technology stacks for profit and power such as Google, Apple, Facebook, and Amazon (sometimes called GAFA) – but also the technical imaginary formed through the diagrammatics of stacks. By diagram, I am indicating an abstraction speculatively determining the future: Wolfgang Ernst uses the term to highlight the generative dimensions of technical diagram, which may also be understood as a modality of power.[67] The notion of layers are instrumental when trying to mediate the experience of an increasingly algorithmic society (think dashboards, personal information systems, the quantified self, etc.): it may provide an interpretative framework for a world of computational patterns in addition to constituting a grammar for building such systems in the first place. The

concept of the post-digital may perhaps be useful when questioning the link between archives, computation, and knowledge given here.[68] Yet the concepts of materiality deployed by archivists working within flat design and material design paradigms – whether of paper, glass, or some other 'material' substance –are even more important for our understanding of these systems and their relationship with social memory.[69]

Flat design provides and more importantly serves as a translational or metaphorical heuristic for re-presenting the computational, but it also teaches consumers and users how to use and manipulate new complex computational systems and stacks. Thanks to a striking visual technique, flat design communicates the laminate structure of the computational stack on which the Stack corporations are themselves constituted. In this organization, history is indeed locked within the object.

In an age in which archives become computational, they are themselves subject to the frequent rearrangements and reconfigurations of a new medium of inscription and new sites of control. The question of how these computational paradigms connect to the archive itself remains a key critical question and one that must be distinguished from the perspectives of technological determinism. Principles of instrumentality are embedded not only in computational systems but also in a neoliberal order that legitimates through principles of performativity, efficiency, and a political economy of value and that forces the archive to conform and interoperate. It is here, crucially, that the humanities must learn to provide critical approaches that contest and make visible archival systems and their embedded logics.

The post-archival constellation

One way of thinking about computational archives and new forms of abstraction they produce is the specific ways in which they manage the 'derangement' of knowledge through distance.[70] I can only gesture towards this derangement by way of the theological concept of the coincidence of the opposites that 'comprehends all else in undifferentiated and unlimited unity'[71] – the notion that, from the standpoint of infinity, all difference is reconciled (in contrast to the dialectical notion of *aufhebung*). This is similar to the notion of the aesthetics of singularity that Fredric Jameson describes as particular to postmodernity.[72] Flat design could, for instance, be said to place the user-subject in a similar position of infinity/singularity: it enables the reconciliation of multiple fragments not by having one element replacing all the others but rather by using a metaphor, such as

glass, in order to allow palimpsest-like inscriptions to be stacked in an infinitely thin laminate of computational surface. This particular technique of ordering extends to many aspects of computational design that facilitates the collection of diverse objects as well as their ordering, calculation, and reconfiguration. As Derrida argued, archival technology 'conditions not only the form or the structure which prints, but the printed content of the printing: the pressure of the printing, the impression, before the division between the printed and the printer. [It] has commanded that which even in the past instituted and constituted whatever there was as anticipation of the future.'[73] Indeed, through the new modes of computational ordering, a new de-archived archive emerges, one that is tightly coupled to information systems and instrumental principles of making things 'stand by'.[74]

Notes

1. Derrida, p. 10.
2. By de-archiving, I am gesturing towards the transformation of the archive from a static space into one that is informed and interpenetrated by computation that restructures space through formatting, structuring, and classification. We should also note that archives can be multi-layered and their structural organization may have deeper and shallower forms of archive. That is, that some artifacts may be more amenable to access than others, and there may be archives within archives which may require access and order codes before they are available. However, even so, computation reaches into the depths of all archives, and in doing so reorganizes knowledge, artifacts, objects, and systems on the principle of computational knowledge.
3. Ernst, 2013, p. 93.
4. Derrida, p. 11.
5. Ibid., p. 18.
6. Ibid., p. 17.
7. Palmer, p. 404.
8. Røssaak, p. 12.
9. Agre, p. 744.
10. Stiegler, 2010, p. 151.
11. Stiegler, 2008, p. 42.
12. See Taffel for a useful discussion of the notion of the postdigital.
13. Stiegler, 2008, p. 128.
14. Ernst, 2013, p. 86
15. Ibid., p. 122.
16. Archives would previously have had a second-order documenting system associated with it, but it would have been paper-based and not subject

to the same degree of calculability of a digital records system or archival management system.

17. Jones, quoted in Spiro, p. 2.
18. For a discussion of the concept of augmediation, see Mann.
19. Prom, quoted in Spiro, p. 5.
20. Ernst, 2013, p. 27.
21. Archival management systems are a kind of software that typically provide integrated support for the archival workflow, including appraisal, accessioning, description, arrangement, publication of finding aids, collection management, and preservation. See Spiro, p. 1.
22. Berry, 2012, p. 2.
23. Ibid., p. 13.
24. By 'paper-ish', I am gesturing towards Eisenstein's notion of 'bookish' culture, Eisenstein, p. 10.
25. Ernst, 2013, p. 81.
26. Ibid., p. 99. But see also the documentary film *Cold Storage,* co-written by Jeffrey Schnapp and Matthew Battles, which explores Harvard Depository, Harvard's off-site library storage facility. *Cold Storage* (1991) Directed by Cristoforo Magliozzi [Film], USA: metaLab at Harvard, available from http://librarybeyondthebook.org/cold_storage.
27. Ernst, 2013, p. 29
28. Ibid., p. 29
29. Berry, 2014, p. 102.
30. Berry, 2012. Encoded archival description (EAD) is an XML-based standard for representing archival finding aids, which describe archival collections. EAD allows the standardization of collection information in finding aids within and across repositories.
31. Ernst, 2013, p. 42
32. Greenfield.
33. Ernst, 2006, p. 120.
34. Kitchin refers to this process as 'transduction'.
35. Berry, 2014.
36. Ibid., p. 58.
37. Adorno, 1977, p. 126.
38. Terranova offers a political reading of the importance of the notion of the technology stack and the possibility for contestation in the shaping of these stack-based structures.
39. Although the interactional is the focus of this chapter, it is clear that the protocols and standards (codal level) around archival systems, such as the encoded archival description software, would also be a productive site for further critical analysis.
40. See Rowe.
41. Buchanan, p. 14.

42. There are already abstraction layers and technologies that present the underlying data or archive in a form more conducive to the simplicity and speed demanded by flat design, for example node.js, MongoDB, Cassandra, redis, and the JSON data format. In many ways, flat design can be seen as the natural outcome of the performative requirements of complex network systems that require simple axiomatic protocols, data formats, communications channels, abstraction layers, and modularities to enable them to be built rapidly. What is new and interesting in relation to flat design is the underlying material metaphor for the components, e.g. glass or paper.
43. Turner, 2014.
44. Apple, 2014.
45. Turner, 2014.
46. Apple, 2014.
47. Berry, 2014, p. 70.
48. Deleuze, p. 6.
49. Apple, 2014.
50. Cava, 2013.
51. Bohn, 2014.
52. Ibid.
53. Google, 2014.
54. Bohn, 2014.
55. Google Layout, 2014.
56. The choice of paper and glass as the founding metaphors for the flat design philosophies of Google and Apple raise interesting questions for the way in which these companies articulate the remediation of other media forms such as books, magazines, newspapers, music, television, and film. Indeed, the very idea of 'publication' and the material carrier for the notion of publication is informed by the materiality, even if only a notional affordance given by this conceptualization. It would be interesting to see how the book is remediated through each of the design philosophies that inform both companies, for example.
57. Google, 2014.
58. Jitkoff, 2014.
59. Ashghar, 2014; Turner, 2014. One is struck by the posters produced in the Swiss style that date to the 1950s and 60s but which today remind one of the mobile device screens of the twenty-first century.
60. Turner, 2014.
61. For an example, see Bootstrap, 2015.
62. MoMA, 2014.
63. Ina Blom has pointed out 'there are contradictory 'effects' of minimalism and the Gestalt theory of influence in Morris's early work is only one aspect of the minimalist legacy in art—the phenomenological dimension of minimalism (also explored in Morris's writing) produces a rudimentary form of context awareness in the spectator, who is confronted with him/herself

given the minimal work's absence of internal relations or tensions. Minimalism thus initiates the type of awareness that produced phenomena such as institution critique in art, site-specific art, 'context art', etc.' For more on the topic, see Foster, p. 35-70.

64. MoMA, 2014. There are also some interesting links to be explored between the Superflat style and the postmodern art movement founded by the artist Takashi Murakami that is influenced by manga and anime, both in terms of the aesthetic but also in relation to the cultural moment in which 'flatness' is linked to 'shallow emptiness' (see Drohojowska-Philp, 2001).
65. Adorno, 1973, p. 163.
66. Hattersley, 2014.
67. See Parikka, 2011.
68. Berry and Dieter, 2015.
69. There is some interesting work to be done in thinking about the non-visual aspects of flat theory, such as the increasing use of APIs, such as the RESTful api, but also sound interfaces that use 'flat' sound to indicate spatiality in terms of interface or interaction design.
70. By distance, I am thinking in terms of near and far.
71. Stanford, 2013.
72. Jameson, 2015.
73. Derrida, p. 18.
74. Heidegger, 1977.

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Lives

Chapter Five

Planetary Goodbyes: Post-History and Future Memories of an Ecological Past

Jussi Parikka

If there is a material, technological, and industrial pollution, which exposes weather to conceivable risks, then there is also a second pollution, invisible, which puts time in danger, a cultural pollution that we have inflicted on long-term thoughts, those guardians of the Earth, of humanity, and of things themselves. If we don't struggle against the second, we will lose the fight against the first. Who today can doubt the cultural nature of what Marxists used to call the base?
– Michel Serres[1]

All techniques for reproducing existing worlds and artificially creating new ones are, in a specific sense, time media.
– Siegfried Zielinski[2]

When Does the Future Begin?

In a live chat organized by *The Guardian* newspaper in November 2014, science fiction author William Gibson was asked the rather blunt question by one of the web participants: 'When does the future begin'? One could easily have answered in a sarcastic or ironic way, but Gibson refrained from such negativity and took the question seriously. He observed how the question includes the reference to the future in lower case; it comes without the modernist twentieth-century idealization of one big Future waiting for us. Perhaps, meditated Gibson, we are merely in anticipation of lower-case futures, which has lost the vibrancy or energy that was around in the 1980s. He continued:

> It might represent a kind of very wide cultural maturation. Americans, for instance, no longer believe in the future as some completely other place. Europeans never believed in that, because in Europe the evidence is all around us that the future is built in the past. We're surrounded by the past in Europe. The American vision of the future was over the hill, down the highway, we'll build a new world. Americans have gotten the message. I

> think that Blade Runner was very important in that, in its wonderfully European depiction of a future Los Angeles that grew perpetually out of its own ruins. A very un-American vision, radically un-American. Something came from that.[3]

Whether it is maturation or just melancholic disappointment remains to be decided. In many ways, the lack of a future has been raised as a dilemma of temporal politics that is haunted by a persistent memory of the past as a sort of a block of imagination; this is what Mark Fisher notes as the hauntological tendency of contemporary popular culture and also what is articulated in political philosophies such as Fredric Jameson's. For sure, this cannot be resolved through a nostalgic reiteration or reattachment to a past and yet it raises the question: what sort of a future and memory of a future are we then able to produce?

Futures are being constantly imagined, but the emphasis on ruins is as visible in the midst of such narratives of future projection. Much of the contemporary imaginary is full of speculations, images, and narratives of the earth before/after humans; the scientific cartographies of the sixth mass extinction are complemented with the political cartography of an audiovisual kind: the cinema of catastrophes, of the extra-planetary, of futures and future pasts without humans.[4] Philosophy and cultural theory also engage with the non-correlated world without us – possibly partly triggered by the certainty of not merely a past preceding us but also a future without us.[5]

Following Gibson, one can continue to speculate: is it that the other side of this spatialized history – the future that is still somehow tied to this planet – is not anymore imaginable in the midst of the encompassing ecological crisis? Is this imaginary instead something that needs to be rethought in relation to the automated infrastructure that encompasses the planet? But the question to Gibson had actually one potential meaning that remained unanswered. It was perhaps not so much a question about the future as such as it was about *when* it might begin. This already places time out of its joint by referring to imagined futures, which turn the historical notion of the trace on its head. If the trace refers to the past, the business of archaeologies of the future, to paraphrase Fredric Jameson, is one of utopias, their difficult ontological balancing of the existence and non-existence of the future in the present, and the reminder that despite this apparent defiance of logical order, the 'not yet being of the future' has to be considered 'no less worthy of the archaeologies we are willing to grant to the trace'.[6]

So the future might as well be the now in its uncertain existence, a fact that is underscored by the literal non-existence of a future for specific forms of life including humans. Research projects and bodies are already speaking of the sixth mass extinction under way, illuminating that instead of speculation, such a trend is rather visible.

I will continue with two parallel narratives that structure the argument of this chapter concerning the possible situations in which the escape velocity of the ecocrisis might unfold as one temporal axis to anchor our discussion in relation to memory, time, and the so-called political. Both of the narratives talk of the future and a future past that is determined in the contemporary scientific and technological imagination. In one way, this imagination could be considered a sign of the post-historical; not an epistemological determination that history has ended (as Francis Fukuyama[7] had it) but a recognition of the role of history becoming a programmable object, a mediated narrative, and a media-technological context for understanding notions of time that cannot be reduced to the linearly written.

The post-historical comes out in different versions of contemporary media and cultural theory. This can be seen as a reference to Vilém Flusser's thoughts in the collection *Post-History*:[8] we will return to them after having presented the parallel narratives that structure an idea about different temporalities and what constitutes the present as a form of contemporaneity[9] that sustains the past and future as creative potentialities, not merely the dead rhetorical weight of an inert, spatialized horizon.

The concept of post-history, or 'programmed history', is also used in this text to underline the way in which media-technological contexts are part of the memory of future pasts and how this envelops scientific knowledge production and narrativization in a technological culture facing a cataclysmic collapse due to ecological crisis. While the intellectual trope of the 'end of history' has its nineteenth-century precedents in Hegel's philosophy of world history reaching its apex,[10] it is also a mode of thought that pertains to the contemporary situation of geopolitics and the memory of and from the future, in the context of the planetary era. In the 25 years that have passed since the fall of the Soviet Union and the collapse of the binary world system, the end of history has come to refer less to the 'victory' of the liberal order[11] than the sinister feeling of the liberal world order being unable and unwilling to tackle 'the end' of natural history.

But the post-historical also can be understood in terms of Steven Shaviro's notion of the post-cinematic[12]. Shaviro's focus on understanding the aesthetics and politics of audiovisual expression through new forms of cultural dominants can be also tweaked to address the question of the

post-historical. If one cannot claim that history has disappeared, it may no longer be the culturally dominant way of making sense of time or memory. It might, in fact, be in the process of being replaced by modes of thinking that interconnect natural history and social/human history, connecting the future with the past and the political imaginary with technological fabulation. Besides offering a particular narrative framework, it is also a way to address the variety of temporalities that pertain to a reality conditioned by increasingly sophisticated technologies.

Furthermore, the perspectives presented in this chapter indicate a shift in the use of the term 'archive'. Displaced from the contexts of cultural heritage institutions and the protocols and materials of bureaucratic and historical documents, it now pertains to discussions of geology, the earth, its natural history, and hence this scale of the supra-historical. This realization has found expression in recent cinema culture through films such as *Into Eternity - A film for the future* (2010) and Patricio Guzmán's documentary *Nostalgia de la luz/Nostalgia for the Light* (2010). It has also been the topic of a number of media art projects as well as theoretical discourses: a key example here is the concept of the Anthropocene discussed in Dipesh Chakrabarty's 'The Climate of History'[13] – a text addressing the joining of global social history and natural history. What all of these projects have in common is a line of argument that reframes the question of the archive and memory in planetary terms.

In short, the Anthropocene refers to the discussions in the field of geology about whether human involvement on the planet merits a new geological term that follows the Holocene. The discussions have been wide and varied over the past 10-12 years, but they have already had an impact in the humanities and arts, offering, among other things, a new conception of human and technical agency and their uneven, unequal global natures. Such perspectives displace the past and the future from the more limited horizon of historical time, relating them also to the geological time of future. We will return to this idea later, particularly related to the notion of the 'carbon-combustion complex', which offers a political-economic angle on the issue.

Post-planetary

The first narrative of post-history summons a future. In one of the odd moments offered by Erkki Kurenniemi, the Finnish media art pioneer, he gazes back from the year 2048 without a physical body, without a slimy existence of the flesh. This strange fantasy is itself not without a body

but recalls the specific historical context of 1980s cyberfantasies, where after the singularity, AI, and the quantum computer, the future is able to reproduce the past as memories for a future mankind that lives in outer space in a digital format.

If the brain is software, it has the temporal span of a different sort of a future than the one limited to our embodied existence. 'Software can be pretty much immortal in that good programming solutions and algorithms are really sustainable', to quote Kurenniemi's account from an interview with the film director Mika Taanila. Kurenniemi's vision of cultural heritage is determined by this:

> … but one clear reason is that we as humans are interested in history. We have museums and we're interested in strange things like archaeology and old music using the original instruments and arranging medieval plays using authentic costumes. We're constantly trying to reawaken the past and IT is a great tool for that, because in fifty or a hundred years when people are interested in the past they will be able to create virtual models of the entire human history. We will be able to transport ourselves into historical reconstructions of different eras in our everyday life. If we'll be able to make the reconstructions work and truly virtual it will also become an important tool to plan for the future instead of just following some new technology blindly. We can create virtual models of how society will work once it spans the entire solar system and in time, the whole Milky Way. A cloud of golf-ball-sized quantum computer servers, which 10 billion living people could inhabit.[14]

Kurenniemi jokes that by 2048 he could be one of those resurrected artificial intelligences looking back. One wonders. What happened? Why did we abandon the Earth? Why should the escape velocity discovered in the twentieth century become a vector for a whole narrative of civilization wanting to escape what became perceived as a claustrophobic trap of a planet? The emergence of planetary computation works in parallel to the modern desire or necessity of leaving the planet for other worlds, so often articulated in science fiction in the past but also in more recent productions such as Christopher Nolan's *Interstellar* (2014), a film set in an eco crisis-ridden Earth where the dust storms of the planet trigger a film-length meditation of cosmic dimensions.

Kurenniemi's vision does not give much in terms of technical detail, cultural contexts, or political and economic conditions. It's premised more on his technical and scientific view of the human being and the brain as a

finite automaton that evolution created in its specific slime-based way but that artificial intelligence would show as only one among many possible evolutionary genealogies. Fantasies of reanimation become embedded in storage capacities. They resonate with the 1980s visions, but we are constantly reminded that this belief in the technological determination of history has not in any way disappeared. It's an AI-determined way of thinking about time but also a form of reflection that takes into consideration a time of events – a temporal mode that defines future perspective in terms of technological imaginaries where intelligence is deterritorialized from human capacity to machinic entity.

The idea is not determined as part of science fiction, but the escape velocity of intelligence to synthetic intelligence is in operation across the industries of search and networking. In *Wired*, Kevin Kelly, a later contemporary of Kurenniemi, presents his vision of a future Google that is not based on search but on artificial intelligence, enabled by three major technological breakthroughs: 1) cheap parallel computing where neural network models are seen as neurons of the brain, 2) big data and the vast collections of quantified information that constitute an understanding of social life by way of collating massive data in search of patterns that surpass individual volition, 3) better algorithms to process the data.[15] If one wants to consider Kurenniemi in the context of the contemporary archival mania, one should also expand that investigation into the political economy of the algorithmic AI, since this is becoming yet another way of prescribing the conditions of memory.[16]

However, there is one interview in which Kurenniemi pursues further the rhetorical trope of leaving the planet. This short meditation complements his long-term vision of 2048 but in ways that offer a political economy of the limited resources in the planetary context. In Kurenniemi's 'premature self-obituary' entitled 'Oh, human fart', he discusses the resource basis of a post-planetary future. Kurenniemi's odd relation to environmental thinking produces the idea of turning the planet into 'Museum Planet Earth',[17] a fully-fledged planetary preservation programme that stops population growth, biosphere changes, etc. In politically and technologically enforced ways, it sees the end of change, a sort of fabulated end of history, as the solution to the material issues of the planet. The nineteenth-century birth of the museum as a preservation of non-European/Western cultures is here extended to the planetary condition.

Kurenniemi's post-welfare-state science fiction economy includes transporting all forms and dynamics of change to outer space: 'economic expansion, population explosion, genetic science and nanotechnologies

of unimaginable power, warfare'. Only a limited amount of Earth licenses allow selected people to stay on Earth. Instead, human life as we know it will be continued in data forms and in space. In a rather fragmented way, Kurenniemi explains the logic of the licenses:

> In 2100, for example, print 10 billion 'Earth licences' [sic] and distribute them to all the then-living humans. No more licences will ever be printed. Licences can be sold. This way, the people who want long life and long-lived children can have them, but only by migrating into space. This will be cheap, because there will be people wanting to stay down here, purchasing Earth licences at a price that will amply cover the price of the lift to orbit for the seller.[18]

In other words, the mythological desire of leaving the planet – a key feature of Cold-War-era science fiction too[19] – is offset by the ones desiring an unchanging sustainability of the planet, which of course is a parody of the idea of sustainability without change.

A future nomos

The second narrative also imagines a future but deals with the geopolitical changes that follow from *staying* on the planet. It is written from a different position as well, despite the somewhat similar future-past perspective. *The Collapse of Western Civilization* is a short, fact-based fabulation, a science-fact story of sorts written by Naomi Oreskes and Erik Conway, two historians of science. Subtitled 'A View from the Future', this short book offers a view of an imaginary future written by a 'future historian. Living in the Second People's Republic of China, he recounts the events of the Period of the Penumbra (1988-2093) that led to the Great Collapse and Mass Migration (2073-2093).'[20] These events are seen as milestones in a new world order catalyzed by climate change, where the shifting of land and water fronts is the key force of political changes that Carl Schmitt would have referred to in terms of the 'nomos', notably the division of the land in political-legal-economic power relations, which in European legal history was above all a question of troubled relations with the sea and with water.

Since the Renaissance and early modernity, new technologies of measurement from the compass to techniques of mapping were instrumental to the nomos of understanding and capturing global space,[21] yet they were always bordering on and negotiating the problem of water, which remained more

difficult to measure, map, and divide than land. Hence there is a certain geopolitical irony in the fact that industrially produced global warming is leading to rising sea levels and the (re)capture of the politically and economically significant dry lands, thus shifting the nomos once more. The once-mythical water now returns in the form of changing legal and governmental borders.[22]

The narrator of *The Collapse of Western Civilization* is in China, where he observes the chemical aspects of the industrial revolution. One of the most remarkable features of the Anthropocene discussions that have been going on for the past decade has been the recognition that this geological era is also one of massive chemical dosages. Oreskes and Conway remind us that the planetary placements of CO_2 have also been the industrial hot spots of the past 200-300 years: the United Kingdom (1750-1850); Germany, the United States, the rest of Europe, and Japan (1850-1980); and China, India, and Brazil (1980-2050).[23] The geopolitical order is determined by modes of production but also in terms of the role that geology and chemistry have played in establishing modern society. This order comes with its own set of temporal shifts, with multiple chemical modernities creating hot spots of production and pollution. Placed in the contemporary context, one can also delve into the differential tempos of the ecological crisis that are evidenced in the geopolitical distribution of waste. This distribution does not necessarily follow the borders of nation-states but becomes visible in statistics demonstrating that the majority of emissions come from a limited number of companies belonging to the 'carbon-combustion complex'. Among the familiar names of Chevron, Exxon, and BP, one finds the information that 'the 90 companies on the list of top emitters produced 63% of the cumulative global emissions of industrial carbon dioxide and methane between 1751 to 2010, amounting to about 914 gigatonne CO_2 emissions.'[24] This demonstrates the impossibility of talking about the Anthropocene in the singular as if it was one uniform drive; it is, rather, embedded in the accentuated actions of certain agencies, corporations, and nation-states and in the uneven impact across spaces where legal protection is less efficient or where the companies anyway have such strategic interests as to find ways to bypass legal, political, and ethical frameworks.

The geopolitical stakes of the planet are readable through the chemical levels, which also affect the heat absorbed in the atmosphere, as we know through various techniques of measurements. The narrative escorts the reader through general facts concerning the political, scientific, and policy-related determinations of environmental issues, from calculating the capacity of the planetary sinks – i.e. the places where wastes and pollutants

end up – to the emergence of practices and the idea of 'environmentality' or 'sustainability'. Different political systems respond in different ways, and the narrative reveals the sudden efficiency of the centrally governed Chinese system:

> There were notable exceptions. China, for instance, took steps to control its population and convert its economy to non-carbon-based energy sources. These efforts were little noticed and less emulated in the West, in part because Westerners viewed Chinese population control efforts as immoral, and in part because the country's exceptionally fast economic expansion led to a dramatic increase in greenhouse gas emissions, masking the impact of renewable energy. By 2050, this impact became clear as China's emissions began to fall rapidly. Had other nations followed China's lead, the history recounted here might have been very different.[25]

The planetary temperature rise of up to four degrees had a significant effect in terms of water levels and massive areas of land flooded by the Arctic sea. Yet the main thrust of the text is not yet another narrative of catastrophic proportions but a meditation on the paradoxical scientific discourse that produced such a situation. Instead of the assumed controversy concerning the interpretation of scientific data, the results concerning causalities of climate change had for years shown a one-sided result as to the causes and impact of what was to come. Oreskes and Conway introduce the term 'carbon-combustion complex' as a way of making sense of this context in terms of the political economy of the Anthropocene:

> a network of powerful industries comprising fossil fuel producers, industries that served energy companies (such as drilling and oil field service companies and large construction firms), manufacturers whose products relied on inexpensive energy (especially automobiles and aviation, but also aluminum and other forms of smelting and mineral processing), financial institutions that serviced their capital demands, and advertising, public relations, and marketing firms who promoted their products.[26]

The short book's narrative evaluates the role of public discourse on science in the post-WWII United States and its effect on political decision-making in the context of what is labelled market fundamentalism. Since the 1970s and 1980s, neoliberal policies have produced an attitude of scepticism towards

scientific positions, which from an economic perspective undermines the specific knowledge perspectives produced by research. This was a radical break with Friedrich Hayek's philosophical neoliberalism,[27] which was founded on a close relationship with the insights provided by research and scientific methods.

The future memory that is being written is at the same time a mix of the most obvious– we knew that this is happening so what's so special about it? – and the most complex: the political, scientific, and economic determinations of the geopolitically specific and yet planetary dimensions of the sink(ing) ecology. From this perspective, Félix Guattari's 'three ecologies'[28] – the idea that there is in addition to a natural ecology also a social and mental ecology – sounds almost too innocent a way of addressing the suicidal neoliberal capture of future perspectives. The collapse of the Arctic ice cap is an ecological event in an ecology of multipliers or active forms[29] that have catalytic impact on the sea, land and air as well as on the economy, urban planning, global politics, security policies and more. The water that was understood as anomalous or difficult to control/define in the political space of old Europe[30] becomes once again a determining factor of the geopolitical earth, but this time because rising ocean surfaces flood coastal areas and metropolises.

Oreskes and Conway's bestseller narrative is parallel to, but also clearly different from the framing of the planetary in Kurenniemi's visions.[31] Both raise the question of the future memories of the contemporary technological and scientific forces that determine our epistemological and ontological sense of the planetary. However, their differences have to do with accentuated takes on what the planetary as a geophysical entity actually means, and how the temporality of the future determines the ecological crisis as a point of reference that defines the contemporary. Hence I want to turn to a discussion of the contemporary and the post-historical as significant temporal-political concepts. For it is through these concepts that future-past perspectives gain currency in the evaluation of the political agenda. In short, Oreskes and Conway's short meditation on the issue of climate change produces an interesting juxtaposition to Kurenniemi's. The future memory produced by the duo and their short novel offers a political economic account of the Anthropocene, even if they choose not to use this specific term. Kurenniemi's vision is still politically undeveloped in contrast to the specific geopolitics that Oreskes and Conway offer and which – in contrast to Kurenniemi's post-planetary dreams – is based on staying in the changing planerary biosphere and geosphere. Their different narratives trigger different ways of thinking about the presence of the future in contemporary cultural discussions.

Politics of chronoscapes

In the context of this book, the alternative conceptualizations of social memory proceed by way of an explicit reference to Gabriel Tarde.[32] If Bruno Latour has used Tarde's sociological theories as a resource for rethinking the social, we should be able to think about memory and temporality in ways that offer similar effects. Latour's key idea was to abandon the blanket use of the term 'social' as if referring to a particular type of substance whose nature can be separated from, say, 'the material', 'the biological', or 'the economical'. Instead, in Latour's use of the term, the social is simply 'a movement, a displacement, a transformation, a translation, an enrollment' – a perspective becomes clearer when he refers to it as 'an association between entities which are in no way recognizable as being social in the ordinary manner, *except* during the brief moment when they are reshuffled together'.[33]

If social science becomes refashioned as a science of associations, links, and transformations, how could we use this insight to think about that other term that is so often attached to 'the social', notably memory? How is social memory to be understood once memory is understood to be fundamentally premised on a multitude of temporal determinations, situations, and techniques? We could then also address memory in terms of the various productions of figures, materials, and techniques of time. Cultural history is full of different techniques for keeping time – almanacs, calendars, clocks, and more.[34] But we can also approach the abundant techniques and associations of time as design strategies that introduce conceptual shifts in our management of temporal categories.

This work of 'design' includes narratives that are part of the material effects of design: the various techniques and technologies in which memory is embedded and which complicate linear sets of past-present-future coordinates. Instead, the contemporary moment seems to be increasingly defined by a multiplicity of times and the various ways in which we are trying to make sense of these multi-temporalities, or chronoscapes, to use Sarah Sharma's term.[35] It is against the backdrop of such a chronoscape that the entities of a 'politics of nature' – most notably the various expressions of climate change (from global warming to changing chemical balances in air, soil, and oceans to the threat of mass extinction) – are to be judged. The key premise of this chronoscape is, as already noted, the fact that the ecocrisis is not just a present dilemma but a future that acts on the now.

In terms of the notion of the contemporary, the narratives presented above are ways to get us thinking about the multitemporal stakes of this political category, so significant for modern politics.[36] They involve

implicit and explicit ways of dealing with ideas of programmed futures, future pasts, and the agenda of post-history that have penetrated the political scene since the 1990s at least. In the post-communist era – after the fall of the Berlin Wall, the Soviet Union, and other institutions and symbols of the Cold War era– discourses regarding the end of history also emerged.[37] This popular, and neoconservative populist, sense of temporality paralleled the rise of various projects, discourses, and corporations of global digital culture. Kurenniemi's ideas were partly a product of the same historical period, whereas the more recent, ecological narrativizations are the next phase of an approach that may be called 'post-historical': it ranges from popular culture examples such as the documentary series *Life After People* (History Channel, 2008), the scientific discussions of the Anthropocene, and such critical insights in fiction and scholarly work as *The Collapse of Western Civilization*. In some popular cultural narratives, such as the film *Interstellar*, commentators such as George Monbiot perceive a melancholia of political helplessness that he labels a 'politically defeatist fantasy of leaving the planet'.[38] One could easily see this relating to key features of Kurenniemi's thought and to part of a longer history of science fiction of underground and extra-planetary life.[39] However, to be clear, *Interstellar*'s view of the temporality of the planetary condition is not actually about a future perspective of leaving the planet (the future as an alternative place to be occupied): it is a twist on the familiar Spielbergian meditation on the crisis of the family system, seen in terms of the cosmic dimensions of the eco catastrophe and time-critical relativity theories.[40]

But a key argument of this chapter is the fact that the concept of the post-historical refracts into multiple historical and temporal directionalities. At this juncture, discussions of time and its involvement in the planetary political crisis is one of the most important theoretical issues to consider. One would imagine that recent debates on accelerationism could work in this direction, for at some implicit level, the 1990s cyberfantasies of Nick Land respond to the future-oriented singularities of Kurenniemi. The difference is mainly that Land produces a more explicit thematization of the 'forward investment in the future'[41] and the cybernetic mutation of the body. The post-historical comes out also in the versions of accelerationism that try to execute a determination of the contemporary moment through fabulations about a capitalist future of non-human, cybernetic artificial intelligence. These latter and more sober developments of accelerationism are premised on a temporal scheme that thinks in terms of future pasts while taking into account climate-crisis-ridden, economically stagnating

capitalist contexts[42] as well as the crises that ensue post-9/11 and the series of economic crashes and austerity measures marking the last decade.[43]

But this is not the only sort of temporal determination that is able to engage with a governmentality of the planetary or a politics of time and the political imaginary of a future memory. The current discussions concerning the Anthropocene or the microtemporalities of media culture refer back to an idea of the variety of temporalities that are constantly synchronized in relation to a horizon that we could call the contemporary and that might inform our way of understanding the present. It is in relation to this body of theory that Wendy Brown[44] articulates her concise theory of the highly significant temporal determinations of the political. Notions of genealogy, hauntology, and other temporal concepts emerging in works of cultural theory from Freud to Benjamin, Foucault, and Derrida are indispensable for the political vocabulary of modernity.

The importance of the genealogical has been already incorporated into much of contemporary media theory – especially media archaeology[45] – in ways that resonate with Brown's articulation of the task of the genealogical method: 'to denaturalize existing forces and formations more thoroughly than either conventional history or metaphysical criticism can do'.[46] But if the genealogical method opens up the past in terms of 'faults, fractures, and fissures',[47] as critical media histories have done to demonstrate the scientific and technological determinations of the now, might there be a way to expand this focus to take into account the multitemporality of our contemporary moment? Such a possibility is already implied in the genealogical method in the sense that it is a 'political ontology of the present'[48] (as Brown states referring to Foucault.) But the contemporary can be seen as a further elaboration of the immanence of temporality to both a material context as well as the 'questions, meaning, or projects'[49] that invest it. Brown draws on Walter Benjamin's theses on history as a way to develop a political notion of time that is all at once a critique of notions of linear progress, Rankean objectivity (approaching history 'the way it really was'), and other reductionist approaches to the temporality of the contemporary. But implicitly it also raises the question of how to further develop a political theory grounded in complexities of time with respect to a situation when our relation to the future is also proscribed by science, technology, and media culture.

It is no wonder, then, that recent political and cultural theory has increasingly turned to acknowledging such aspects of the future as significant for a post-9/11 world of media-informed cultural politics: I am here referring to Brian Massumi's work on the future anterior, Richard Grusin's concept

of 'premediation', and, for example, Greg Elmer and Andy Opel's work on preemptive security strategies. Albeit with different emphases, all work upon the same terrain of the future that is constantly present whether as an atmosphere of fear (Massumi) or as constantly premediated, prescribed, and through narrative techniques of controlled potentiality (Grusin).[50]

With reference to Brown's theoretical elaborations and Sharma's ethnographic research, I want to underline the possibility of thinking about the contemporaneity of the present as informed by multiple temporalities and synchronization across the time scales. The rethinking of social temporalities and memory proceeds by way of an entanglement of narratives, material contexts, and a recognition of the different ways in which the future imagined becomes a questioning of what the present-contemporary actually is. Sharma's emphasis on power chronographies becomes a way of accounting for the differentially existing timescapes that are produced in relations of labour, gender, ethnicity, and, broadly speaking, the geopolitics of contemporary capitalism. Critics who claim that homogenization of time is one of the characteristics of capitalism miss out on this more nuanced perspective on capitalism's multitemporal operational logic.

Sharma's ethnographic methodology offers ideas for a wider cultural analysis of time, media, and capitalism. It also brings a different angle to discussions of social memory. In many ways, the contemporary context for imagining future memory has been heavily influenced by the presence of a variety of concepts of *longue duree* that prescribe futures of apocalyptic proportions. The environmental crisis in particular unfolds as a production of discourses of sustainability and apocalypse, and yet both are unfulfilling when it comes to handling the complexity of the situation. A rhetoric of sustainability which dominates current policymaking is not able to question the more fundamental political and economic stakes in the situation. An apocalyptic rhetoric is, for its part, in danger of undermining all sense of agency, producing melancholic forms of subjectivity deprived of capacity for action.[51]

It's clear that we need more effective ways of making sense of the contemporary, drawing on an imaginary future and its pasts. A more satisfying solution is to think of the uneven and multiple overlapping temporalities that help to determine the otherwise broad concepts of *the political contemporary*. Indeed, in the context of discussions of the planetary and the Anthropocene, one is constantly reminded that the narratives of the contemporary technological condition have to do with the multiple temporalities they produce. It is clear that Kurenniemi's type of narrative differs from the more ecologically minded narrative of Oreskes

and Conway, despite the superficial parallels. Indeed, the concept of a sensitive co-existence of many times is a way of approaching a political imaginary of time where the projections of the future that derive from computer simulations of climate crisis and its effects (say, the changing temperature of the planet) is *already* acting on levels that all entail different temporalities: the time-critical operations of computerized epistemologies, the narrative prescriptions of possible futures, the political decisions based on such data, etc. Instead of the cyber critique of homogeneous cyber time or the homogenization of time in policy, one should actually emphasize the multiciplities of time as a way of grasping the relationship between the planetary and the computational.

Wendy Chun speaks of the (computer) modelled aspect of time in terms of the software ontology of our programmed knowledge of the future. This is most clearly stated in her analysis of the simulations concerning global temperatures and carbon emissions, where projections build on existing historical data. In her words: 'The weirdest and most important thing about their temporality is their hopefully effective deferral of the future: these predictive models are produced so that, if they are persuasive and thus convince us to cut back on our carbon emissions, what they predict will not come about.'[52]

Indeed, one can reveal a range of micro and macrotemporalities that govern the future-past temporalities of the post-historical. Any determination of the 'post' of history has to become true to the understanding of technologies and techniques of time relevant to our sense of historicity. The post-historical reveals itself through instances other than the historical writing and production of time. Hayden White's concept of 'metahistory' was important for understanding writing as a media technology that was as essential to the historical epistemology informing modernity. But it is equally important to understand Wolfgang Ernst's media-archeological emphasis on the microtemporal dimension of machinic time.[53] The various concepts of time that result from a close analysis of the circuits of cybernetic machines show us that there is a fundamental difference between the older techniques of keeping time (calendars, watches, etc.) and machines that automatically produce their own timings.

Vilem Flusser's idea of post-history might then be the necessary link between the various approaches to the future past, even if it entails taking Flusser beyond the original framework of his thinking. The idea of the programmed dimension of post-history is not envisaged as a postmodern collage but is identified in the various applications and platforms of computation, in which time is bent and twisted in a variety of ways that

resurface as distinct alternatives to history writing.[54] The post-historical is a concept of time and politics that arises once we pay attention to the actual functions of a technical apparatus removed from the programmer's intentions, argues Flusser. We can develop this claim so that its concept of 'post-history' becomes a key epistemological framework for the future past as well. Flusser notably reminds us that in order to understand the programmability of time/history/memory, '[w]e must neither anthropomorphize nor objectify the apparatus'.[55] In other words, approaching the issue of the future past and the geopolitics of capitalism does not necessitate a perspective of monorail temporality but careful analyses of multiple temporalities that in technical and in epistemological ways narrate[56] the future as an archaeological existence of projected spaces of potentiality.

Conclusions

In Maurice Halbwachs' accounts of memory, he reminds us that memory always takes place in and across collectives.[57] Memory is never determined as an individual affair but always takes place among strangers: the collective practices, techniques, and technologies of passing on cultural repetition is a way of sustaining a sense of the collective. Memory and its collective basis are, in other words, co-individuated. It is, however, extremely important to underline that the list of strangers making up memory is longer than we might imagine: with new forms of communication media, it becomes extended to new platforms, techniques, and habits. The strangers who are our memory and who help to propagate it exist in the middle of a circulation of information, goods, and people – governmentalities that extend far beyond those of the nation-state or other institutions of planetary significance (whether security and intelligence agencies, NASA, or some standard bodies of global governance).

When discussing any contemporary analysis of techniques of memory – whether platforms, practices, or technologies – one is forced to ask how this contemporaneity produces its own pasts, presents, and futures. In this chapter I have tried to address this issue through two alternative narratives of a future present engaging the contemporary moment of ecocrisis and technopolitics. Those narratives compel us to consider the cultural politics of time as one of geopolitics and temporal multiplicity, from the imaginary of outerplanetary technological futures (Kurenniemi) to tightly narrated ones that form part of the changing nomos of the planetary and of climate change (Conway and Oreskes).

Indeed, in the sense that temporal concepts such as the genealogical have become important for a politics of and out of history (to use Brown's phrasing), we are facing the crucial ecological task of creating vocabularies of the future that will help us make sense of the contemporary post-9/11, post-2008-bank-crash, post-catastrophic ecological crisis, and post-capitalism.[58] All of these events may to some extent defy traditional notions of history and instill in us the necessity of returning to the terminologies of a natural history that addresses geological periods and durations without humans. This is not in order to naturalize the contemporary cultural or economic situations but to demonstrate how the cultural politics of time is also prescribed through its relations with the non-human. To return to the point made earlier: cultural heritage, cultural memory, and social memory are increasingly debated in relation to the planetary, the geological, and the Anthropocene–scenarios involving chemical, geological, and biological processes that displace the concepts and frameworks that are normally associated with 'the social'. These are powerful reminders of the various ecological materialities that determine the times we are living in and living towards, and they sustain the idea of memory as an actively producing force, an archaeology of the future. The contemporary shift in the conceptualization of the 'archive' – from governmental instrument and cultural heritage institution to a wider understanding that comprises geophysical, ecological, and even chemical storage – is emblematic of a social memory that increasingly finds itself bound in and by nature.

Notes

1. Serres, p. 31.
2. Zielinski, p. 31.
3. William Gibson Webchat, http://www.theguardian.com/books/live/2014/nov/21/william-gibson-webchat-post-your-questions-now.
4. In the 1980s, Giuliana Bruno's early reading of postmodern culture and Los Angeles/Blade Runner already spoke of the '[t]he postindustrial city [as] a city in ruins' characterized by a loss of history in the modern sense of the trope that gives a structured sense of place, agency and meaning ('Ramble City', p. 65). Imagined futures were starting to be embedded in a state of melancholy of the imaginary surrounded by a sense of the post-historical loss of grand stories.
5. Quentin Meillassoux' key work, *After Finitude*, offers the philosophical idea of the *arche-fossil* that signals a world before humans. Besides such a temporal figure at the centre of contemporary philosophy discussions,

one finds a wider set of arguments for non-human realities in speculative realism. In parallel to such temporal figures as Meillassoux, Ray Brassier speaks of the 'truth of extinction' that triggers the necessity to address 'time altogether without thought' (Shaviro 2014: 74). In addition, Eugene Thacker summons in his dark philosophical take the occult quality of reality as one that 'is indifferent to human knowledge' (2011: 53-54).

6. Jameson, 2005, xv-xvi, fn. 12.
7. Fukuyama.
8. Flusser. Flusser's notion is one of civilizational thresholds, referring to the ontological regimes of agrarian and industrial society with their specific relations to time.
9. See Brown, p. 171.
10. See Jameson, 2003.
11. See Fukuyama.
12. Shaviro, 2010.
13. Chakrabarty. See also Parikka, 2015.
14. Taanila and Kurenniemi.
15. Kelly's ideas about the emerging AI world do not, however, make the same rhetorical mistake as Kurenniemi; he emphasizes that these are not dreams of the singularity but more enhanced smart services that proceed by way of algorithmic reasoning and massive investments, quoting the figures: 'According to quantitative analysis firm Quid, AI has attracted more than $17 billion in investments since 2009. Last year alone more than $2 billion was invested in 322 companies with AI-like technology. Facebook and Google have recruited researchers to join their in-house AI research teams. Yahoo, Intel, Dropbox, LinkedIn, Pinterest, and Twitter have all purchased AI companies since last year. Private investment in the AI sector has been expanding 62 percent a year on average for the past four years, a rate that is expected to continue.'
16. On Kurenniemi and social media culture, see Røssaak.
17. Erkki Kurenniemi.
18. Ibid.
19. Beck and Dorrian.
20. Oreskes and Conway, p. X.
21. See Siegert, pp. 65-120.
22. 'Law precedes science and perhaps engenders it; or rather, a common origin, abstract and sacred, joins them. Beforehand, only the deluge is imaginable, the great primal or recursive rising of waters, the chaos that mixes the things of the world—causes, forms, attributions—and that confounds subjects.' Serres, p. 53.
23. Oreskes and Conway, p. 2.
24. Goldenberg, 'Just 90 companies caused two-thirds of man-made global warming emissions'; the article is referring to Heede, 'Tracing anthropo-

genic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010'.

25. Goldenberg, p. 6.
26. Ibid., pp. 36-37.
27. Ibid., p. 43.
28. Guattari.
29. Easterling, p. 95
30. See Schmitt.
31. Kurenniemi's world is closer to the familiar discourses of the singularity in science fiction; the idea that technological progress will produce a threshold moment when artificial intelligence will rapidly emerge as a significant new sort of world-changing entity that has major impact in terms of the human world. Writers interested in the singularity include Ray Kurzweill, Vernor Vinge, and also Charles Stross, and it has been discussed since the 1980s. Having said that, an earlier context for the term emerges in the work of John von Neumann and his concern for the singularity, as narrated by Stanislaw Ulam: 'One conversation centered on the ever accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue.' (Ulam, 'John von Neumann, 1903-1957', p. 5). It is this earlier computer science context that was Kurenniemi's reference point too.
32. It is worthwhile remembering that Gabriel Tarde wrote his own short science-fiction story, *The Underground Man* (English translation published in 1905). Tarde's novel reflects on the epochal change that the natural event brings about, crossing any social-nature division. The novel's first line is already an indication of this threshold event: 'It was towards the end of the twentieth century of the prehistoric era, formerly called the Christian, that took place, as is well known, the unexpected catastrophe with which the present epoch began, that fortunate disaster which compelled the overflowing flood of civilisation to disappear for the benefit of mankind.' The novel is available online at http://www.gutenberg.org/files/33549/33549-h/33549-h.htm.
33. Latour, p. 65.
34. See, for example, Kassung and Macho.
35. Sharma. Also the notion of 'contemporary' in contemporary art discourses triggers the problematisation of linear time models; it acts as a marker of time that distinguishes contemporary art from modern art and also implies a nesting of multiple layers of time, as Peter Osborne demonstrates in *Anywhere or Not At All: Philosophy of Contemporary Art*. In other words, there would be a bigger parallel discussion between the temporalities in contemporary art projects and what I present here, but it has to wait for another context to be addressed.
36. Lindroos and Palonen.

37. Fukuyama.
38. Monbiot's notes resonate on some level with the political critique summoned by Jameson: 'Confusion about the future of capitalism – compounded by a confidence in technological progress beclouded by intermittent certainties of catastrophe and disaster – is at least as old as the late nineteenth century, but few periods have proved as incapable of framing immediate alternatives for themselves, let alone of imagining those great utopias that have occasionally broken on the status quo like a sunburst.' (Jameson 2003: 704).
39. See Beck and Dorrian.
40. In terms of biopolitics, one is reminded that perhaps the departure had already happened. As Michel Serres puts it in *Natural Contract*, we are anyway living as astronauts, governed in relation to atmospheres and biospheres and other ecological conditions of life. 'All humanity is flying like spacewalking astronauts: outside their capsule, but tethered to it by every available network, by the sum of our know-how and of everyone's money, work, and capacities, so that these astronauts represent the current highly developed human condition.' (Serres 1995: 120).
41. Mackay and Avanessian, p. 42
42. Ibid., p. 43.
43. Williams and Srnicek.
44. Brown.
45. See Elsaesser. See also Parikka, 2012.
46. Brown, p. 103.
47. Ibid.
48. Ibid., p. 104.
49. Ibid., p. 161.
50. Massumi, Elmer, and Opel, as well as Grusin.
51. Indeed, this risk pertains to at least some forms of accelerationism. Especially Nick Land's odd version of Deleuze and Guattari offers a version of world history determined from the future perspective of the AI Capitalist World Order or the dissolved human cultures that are emerging in the forces of inhuman cognition and technosentience, to use Land's terminology (Land 2014: 255). Land's ideas seem to resonate with Kurenniemi through the rhetorical gestures acknowledging the deterritorialization from the thinking slimy human body to technology as (self-)cognizant. Despite the future past of this vision and quasi-radical rhetorics, it remains short of offering a complex notion of time that would account for the uneven and constantly contested distribution of time and planetary resources alongside exhaust. It becomes a monorail approach to the distribution of time and other planetary resources, without acknowledging the differential status of how the contemporary is being allocated. See also Massey.
52. Chun, p. 107.
53. Ernst, p. 30.

54. See again Ernst, p. 30.
55. Flusser, p. 26
56. On narrating as counting, see Ernst, chapter 1.
57. Halbwachs.
58. See Terranova.

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Chapter Six

Video Water, Video Life, Videosociality

Ina Blom

For me it seems a time to understand limpets, barnacles and alaria rather than lawyers, circuits and marketing.
– Paul Ryan[1]

In 1976, Avery Johnson, a neurophysiology researcher at MIT who was in close dialogue with the *Radical Software* circle of video pioneers, took a moment to write a personal letter of complaint to social philosopher William Irwin Thompson. The object of his annoyance was a critique of TV culture that Thompson had published in the 10 June 1976 issue of *The New York Times*.[2] In this article, Thompson deplored a televisual paradigm that 'can expand around the world spatially but that conflates everything with the present and the codes of 'presentation'. The gist of the critique was that the televisual present destroys not just history but also a productive imagination of the future, which is guided by mythology. Johnson turned the very terms of this critique against Thompson himself, angrily attacking him for having written text that 'intellectually reflects what you deplore in TV: making past and future meld into an instant world'. In his view, the article itself evoked a 'specious present' which obliterates memory.

Yet the memory loss identified by Johnson was of a different order than Thompson's concern for historical memory and the cultural archives of the past. Johnson was concerned with memory in the biological sense of the word: the physical preservation of the past in the present that is the very condition of the survival of genetic traits. Since the introduction of molecular biology, the capacity for memory has notably been established as that which defines life and that separates it from the non-living.[3] It was this concept of memory that made Johnson state that the critical obsession with the televisual present does not recognize us – inhabitants of TV culture – as 'biological organisms that can move and struggle'. His advice to Thompson was to stop 'attacking institutions with elegant rapier jabs' and instead engage in the work of the biologically oriented '1/2 inch porta-pack video freaks' (sic).[4]

Johnson's anger turned on a crucial point in the reception of TV's reality. The ability of live television to capture attention and format the world according to its logic of presentness was apparently not just something that afflicted the general public. It seemed to format most of the critical approaches to the social and political reality of television as well. Richard Dienst accurately sums up this tendency in his 1994 *Still Life in Real Time.* Right from television's beginnings, 'flow' was put to work as a critical concept. Thinkers as different as Rudolf Arnheim and Dziga Vertov saw televisual liveness and simultaneity as a totalization of the social field that might provide the basis for new economic utopias – capitalist for the one, socialist for the other. Jean-Paul Sartre, for his part, understood the same phenomenon in terms of suppression: the totalizing simultaneity of television attested to a power collusion between state, elite, and capital that served to disarticulate social groups and their differences thanks to TV's emphasis on a form of pure presence where nothing is said and everyone is happy.[5] Televisual presence and liveness was tantamount to ideology, a technopolitical configuration of reality whose social powers should be the object of scrutiny and intervention. If television's flow relies at once on a specific technology and a cultural construct comprising a wholly new structure of visibility, one must, as Raymond Williams noted, not just read existing television through the mutual determinations of technology and cultural forms but *also* rescue both technology and culture from the embrace of present-day television.[6] Television seems to survive precisely through flow, whose transmission washes away the particularity of messages along with the reception of them, draining perception of the resistant holding powers of memory.[7] Countering the ideal of direct speech that underpins William's argument, Dienst reframes the very centrality of the concept of 'flow' in television criticism. The term seems to have a strange kind of grip, as if it were an aesthetic fetish figure, a sublime object.[8] Liveness and presence apparently have the capacity to stun and fascinate at all levels – which is why the critical emphasis on television's live flow is perhaps not just an exercise in materialist analysis but also a *symptom* of unresolved metaphysical impulses in the theorization of television. If TV produces new abstractions covering up the contradictions of everyday life, it does so no less in the thinking of its major critics.

Against this fixation on the televisual present, the association between video and a concept of televisual 'life' is of some consequence. In early video art, the question of life hinged less on a general obsession with the signal as an index of living presence than on more tersely formulated questions of memory and

its physiological basis – memory as a feature of biological life. This perspective contrasts with Williams' rather traditional qualification of memory as that which in principle *resists* flow, the cultural particularities whose relative stability provide platforms from which critical distance may be exerted. In fact, video's distancing of both television *and* the kind of critique it produced was an all-important factor in the emergence of an entirely new set of actions and preoccupations. Avery Johnson's diatribe against William Irwin Thompson is symptomatic of this reorientation. Focus on the totalizing TV presence too easily views the human body in equally totalizing terms, i.e. as passive relays in a global electronic network. But to Johnson, biological bodies are never passive relays but independent capacities for action. Hence television must be understood in terms of its specific ways of interacting with such centres of action. Here, 'televisual liveness' was not a key term in a relatively abstract theory of the new infrastructural organization of reality and politics but a concept that opened onto the analogies and complicities between the technical particularities of video systems and the dynamics of living systems. Once the agencies of video became part of new, unruly composites, freed from the strictures of broadcasting institutions that had initially adopted televisual technologies as a way of adding images to radio, video seemed to make people rethink the tenets of televisual life. For one, it enjoined them to test new camera-monitor relations. If distributing preformatted cultural content was no longer the key issue, why not just turn the camera to the monitor that displayed the real-time flow of images? If a journalistic or cinematographic representation of the world was not on the agenda, why not explore how video memory would function – what video memory would actually *b*e – if it were forced to relate to its own circuits only? In a 1984 article in *Physica* journal, James P. Crutchfield, a research physicist at the University of California with close connections to video art pioneers such as Steina and Woody Vasulka, affirmed the early intuitions about a connection between video and biological memory.[9] In his article, video feedback was presented as a space-time simulator or, more precisely, a space-time analogue computer that made it possible to approach a number of problems in dynamical systems theory, such as iterative image processing, cellular automata, and biological morphogenesis.[10] Video feedback could, in other words, function as a cheap and fast simulator of the type of complex behaviour that was at the time being introduced as a possible model for the very dynamics of life.[11] It seemed, in other words, to model processes of emergence that second-order systems theory describe in terms of 'operational closure'. The individuation of a technical system in its complex processing of matter operated on the same principles as natural systems.

An autobiographical life form

In the early 1970s, then, analogue video emerged as a quasi-biological entity, an instance of the memory at work in basic life processes. This was quite a step for a technology that had been designed in order to provide television with something that it seemed to lack: a proper memory, a cultural archive of its programming. The problem for early television was that 'analog systems are so dumb they can't store any information, so the stuff's got to come out as fast as it goes in'.[12] Nothing remained beyond the moment of transmission. TV simply could not store its emissions within the framework of its own electronic circuits but had to resort to 'outside' technologies like the kinescope that would film TV images off the screen. Hence, in 1951, David Sarnoff, chairman of the board of RCA and founder of NBC, challenged his engineers to invent a 'videograph', a 'television picture recorder' that would make it possible to 'reproduce TV programs from tape at any one time, in the home or elsewhere'. [13] Yet it was Ampex that came up with a solution that was sufficiently speedy and compact for realistic archival purposes: a nifty four-headed recording mechanism that used a transverse, tape-saving scanning principle for light and linear scanning for sound.[14] This was in 1956: from this moment onward, television could store and retrieve 'live' moments cut out of the flow of time, according to a principle reminiscent of the film or photographic archive. What was perhaps not planned for was the ways in which analogue video – television's modest supplement – would problematize the very question of information storage: it would not so much hold on to as critically re-view the tenets of televisual time. And ultimately, video would come to embody a type of memory that had little to do with the dynamics of archiving and document retrieval.

The emergence of 'biological' video coincides with video's relative technical and economic independence from the broadcasting framework, facilitated by the introduction of portable video cameras for the private market and the intensive development of tools for experimental work on scanning patterns and signal modulation that followed. Yet the phenomenon was also almost instantly registered at the level of social ontology, the way in which the 'social' as such is defined and understood. Video's self-differentiation – its shift away from its designed role as television's archive, its emergence as a quasi-living entity – was an aspect of a technopolitical event whose force reverberates in contemporary efforts to grasp a post-archival culture in which social memory is increasingly tied to electronic transfer and updating functions that accommodate and track the movements of fleeting communications and passions on a massive scale.[15] Today's anxious obsession

with storage may above all be a symptom of a technological regime in which collectivities are no longer so easily grasped in terms of stable documents, images, or representations and in which 'the social' increasingly emerges through real-time recursive dynamics that complicate traditional efforts to model it as a 'fact' or a 'field'.[16]

The ontologizing thrust of video initially affected the sphere of 1960s and 70s art production. Yet art history or art criticism may not really have been equipped to register its impact. The overarching focus on artistic subjectivity and aesthetic reception tends to cast technology in a subservient role as a tool in the theatre of human experience and social organization. And hence the agency it seemed to exert – traceable in numerous artistic documents from the time – somehow got lost. Media archaeology – the detailed study of the generative principles of machinic functions that occupy a realm beyond the human sensorium – is indispensable for retracing this agency yet cannot on its own account for the associations or events that emerge as a result of technical performance in a particular situation. Only a transversal movement tracing the *specific* associative effects of technical agency – in this case, video memory's trajectory across different material strata – may bring out the full scale of the event in question.[17] A strategic choice may therefore be to view video as a quasi-subject: 'Video' in this context is the name of an *autobiographica*l life form exploring its own memory capacities and their ramifications. Such an 'autobiography of video' traverses the field of early video art: if artists could be said to 'deploy' video for a variety of existential, aesthetic, and political purposes, one could equally well say that video technology 'deployed' art institutions, materials, and individuals in a reflexive unfolding of its memory powers.

The displacement of the televisual archive was the catalytic event in video's association with biological life. But by the same token, analogue video also placed itself at a certain remove from early computing discourses, where insight into the volatility and contingency of information processing (its dependence on constant updating fuelled by a stream of analogue signals) was suppressed in favour of the notion of stable storage for future use.[18] To video, memory was not a 'concern'. The emphatic, anxious question of memory was, to paraphrase Wolfgang Ernst, undermined by an implicit emphasis on *memorizing*; a dynamic process based on a network of micromemories and interacting micromemorial hierarchies.[19] The live microtemporal procedures of video took precedence over safekeeping of macro units on tape, what Bill Viola disparagingly referred to as an 'magnetic city dump'.[20] This was how video memory approached the operative

memory of living beings in action. And this also accounted for a major catalytic effect: a video that did not just pose as a quasi-biological entity but, more specifically, as an ecopolitical actant with particular abilities to share and distribute perceptions of a nature in crisis. Ultimately, it was through this identification with the nascent environmental politics of the 1960s and 70s that video came to posit a process-oriented ontology of the social, informed by technical capacities for connectivity and contagion across all types of material composites. In other words: the first systematic exploration of the powers of video life took place in an atmosphere of risk, crisis, urgency, and failure in which biological life could for the first time no longer just be taken for granted.

The water crisis

It was, above all, a question of water. Water – the primary medium for biological life and the established signifier for televisual 'flow' – came to mediate the questioning of collective memory that marks modern media culture.[21] Video would, generally, be 'with' water: as a 'creature of feedback patterns' it would, as Warren Brodey put it in a text on biological optimizing systems, not make you 'build dams and causeways to stop the waves' but 'build active surfboards'.[22] At a more precise level, video allied itself with water in order to reconfigure the role of perception. On the one hand, the association between video and water evoked the distracted or 'memoryless' perception that is usually seen as the unfortunate by-product of a perpetual present marked by informational overflow and a constant production of events.[23] But on the other hand it also evoked a preoccupation with the perceptual and technical conditions of attentiveness, a preoccupation that Jonathan Crary has described as the flip side of the modern culture of distraction[24]. Now the question of attentive perception was brought to bear on a situation where water was not just a token for televisual flow in general, but, more specifically, for ecological crisis, systemic breakdown.

Acid rain – the object of much observation and research in the late 1960s – was just one part of the story. On the American West Coast, water had become an urgent political issue due to an imbalance between precipitation patterns and population concentrations that threatened to turn the entire Los Angeles area into a desert. 'In California, feelings about water run high', observed Paul Ryan, one of the founders of the Raindance media collective; he himself used video to handle his feelings for what happened to water in a number of places, including the coast of Cape Ann (south of

Boston), the Hudson River in New York, and the Passaic Watershed in New Jersey with its constant flooding problems.[25] Flowing water had, in other words, become a figure for a vast and dangerous realm of contingencies and toxicities that called out for new levels of human engagement and action. A similar imagination was still at work in Félix Guattari's 1989 text *The Three Ecologies,* where the 'waters of Venice' were said to be 'invaded by monstrous mutant algae', just as 'our television screens are peopled and saturated by "degenerate" images and utterances'.[26] Filthy water flows equated filthy signal flows: what was needed was an ecological operator able to move transversally between the different registers of flow that seemed to suffuse the natural, mental, and social worlds.[27] In such a situation, video became an ecological activist, a set of affordances that could be a crucial aid to human memory when it came to keeping track of the problematic flows and perceiving their various types of dynamics. Yet this ability to 'get' water also came to define video itself. In a situation of ecological crisis, the capture of a set of properties named 'water' became a form of activity that allowed video to explore how its particular memory capacities could be implicated in the production of a shared environment.

The six-channel video installation named *Symptomatic Syntax* is paradigmatic. Produced in 1981 by Frank Gillette, another Raindance founder, it encapsulates some of the more fundamental aspects of the 'media ecology' that was promoted in Raindance's 1970-74 publication project, the *Radical Software* journal. In this work – a perpetual close-up image world without indication of context – water is actually the only instantly recognizable thing. One simply assumes it must be water, unless there is some other translucent fluid that will catch the light and put objects in motion. Not that the movement is very dramatic: whatever natural phenomena are seen on screen – ferns? small buds? a butterfly wing? torn petals? – seem to feel no obligation to provide any sense of action, much less to explain themselves. On first impression, they come across as minor contingencies on a picture plane. A tangle of billowing red and white shapes remain locked in a sort of vibrating standstill until interrupted by a brief flickering darkness imposed by the video editing system. As the image returns, some crumpled red objects float sideways across the monitor, ceremonially swirling toward each other before darker and more complicated stuff takes over, stuff with hard edges, sharp protrusions, and shiny surfaces, bulging armours that might put some alien military division to shame. A horseshoe crab, evidently – but at this moment of screen exposure it is mainly a piece of terrifying organic machinery that just sits there, exposing greyish, slimy

insides. The water pushes tiredly against its lower end. The camera angle shifts, but no new information emerges.

To view the multiple-screen set-up of *Symptomatic Syntax* is to be implicated in a project of monitoring – the mode of perception that Stanley Cavell identified with television and its specific conception of the world. In film, we perceive a world recorded and separate from us, even if we may want to be part of it and secretly hope that it cannot exist without us. In contrast, televisual perception is anxiety-ridden: its constant stream of live signals keep us connected to a here and now that is understood as *this* world, *our* world, no matter the distances of transmission or the temporality of programmed contents.[28] The monitoring facilitated by signal streams constructs the world as a precarious entity whose survival seems to depend on our constant watchfulness: the much-discussed deficiencies of the modern capacity for attention comes to light precisely in a televisual context where every critical instant seems to count. The Worldwatch Institute, founded in 1974, seems to precisely encapsulate this modality of environmental perception. In fact, the growing ecological sensibility of the 1960s and its propagation of the image of a fragile little planet threatened by excessive human activity could also be seen as a by-product of television's 'global' monitoring and televisual modes of keeping track of life itself through technologies that seem to attain the status of living entities.

The point of view in *Symptomatic Syntax* is not monitoring in the more abstract or general sense of the term but, very emphatically, that of surveillance. A still camera takes in the scene below, registering its events in a disinterested manner. Electronic disturbance intervenes as the image or angle shifts abruptly, as if produced by a closed-circuit multi-camera system and a set of automated switches. Surveillance systems are, as we know, intensifications of the general condition of televisual monitoring: as a concentrated mode of attentiveness, they make evident its inherent association with anxiety and control. Still, video's construction of life, nature, or worlds in this work is far from obvious and enjoins us to see the peculiarities of the type of environmental monitoring that became one of the key formats of early video art. For here, the reduction of the world to a precarious object – the crisis version of McLuhan's global village – is counteracted by the contingencies of interaction between monitoring systems and the world. These might, of course, be the normal effects of monitoring, since surveillance cameras tend to capture strange passing shapes that are often hard to make out. But in Gillette's work, the strangeness of what is monitored is of a different order. The video takes on another life as if engaging a set of uncategorizable forces that explode normal gauges of mediation

and measure: at exactly what distance will the objects of this world start to make sense to us? In what time frame? Related to which preconceived patterns, which memory systems? A biologist might have precise ideas about this and might choose a microscope or a satellite depending on the scientific argument at stake; if collaborating on a television nature documentary, she would make sure the natural objects were clearly identified and inscribed in a coherent narrative. But a video surveillance system is not a biologist and bases its environmental engagement on technical properties that seem quite random compared with the established scientific, journalistic, and artistic disciplines of nature representation. One of them is sound: *Symptomatic Syntax* relays a constant wavering between the 'realistic' sound of running water and the type of indefinite ambient noise that only recording with a microphone will produce. What we encounter here is a natural world that is explicitly multifarious and expansive –even monstrous. Paradoxically, video here seems to use monitoring in order to demarcate a *distance* to human perception, to refuse the televisual idea that video is simply a kind of extended human eye/body. The almost abstract video biotopes of slowly shifting shapes and colours seem to take on the autonomy of percepts, Deleuze and Guattari's term for the blocs of sensation and perception that may be produced in artworks and that exist as such, i.e. as instances of a desire to exceed the lived and the momentary that add themselves to the non-human landscapes of nature.[29] It is fitting, of course, that the soundtrack also includes scattered references to John M.E. McTaggart's *The Unreality of Time* (1908) – a philosophical argument against any unified ontology of time. For to monitor an ecology where biological organisms and percepts are part of the same continuum is to confront, head on, the fact that this ecology is also invented by the velocities of the monitoring technologies – invented, that is, by microtemporalities and techniques of frequency modulation at odds with any human sense of time or, more significantly, any human capacity for attention or watchfulness.[30]

This was the type of realization that emerged at that particular intersection of cybernetics and dynamical systems theory called video feedback. Frank Gillette was one of its pioneers: his 1969 *Wipe Cycle*, created in collaboration with Ira Schneider, was celebrated as a groundbreaking case of video being used to alter television's one-way flow of transmission so as to make viewers part of complex temporal and informational circuits. And this again gave a whole new twist to the idea of environmental responsibility.[31] As perceptions *of* nature take on the objective status of entities that live on and add themselves *to* nature, humans would no longer oversee nature as if from the outside but would be forced to see themselves as part of all sorts of

continuities and recursions. In recent years, such insights have led to calls for the abolition of the very concept of nature: as Timothy Morton argues, the focus on 'nature' as such is symptomatic of a form of ecological piety that refuses to take into account the many agencies or instances of mediation that are part and parcel of the emergent biological/technical world. The love of 'nature' actually holds nature at arm's length, as an object apart.[32]

If the work and writings of the Raindance media collective and their many associates did not exactly spell out this last argument, their attachment to the feedback loops in which a 'nature in crisis' was at once monitored and produced implied a mode of direct involvement in nature that was material, technical, and pragmatic through and through. Paul Ryan used the term 'video perception' in order to underscore that whatever was produced by the video camera was not a representational image but an immediate and live 'taking in' of the world shaped by the technical/perceptual apparatus – just as the human nervous system always already shapes the visions that seem to just 'hit' the eye. Such perspectives complemented Gillette's repeated meditations on the future-oriented dimension of the memory apparatus, against all nostalgic tendencies to fixate the past through historical representations.[33] The 'nature' of video was neither an original 'condition' to which one should return nor a separate entity whose need for protection could simply be proven with accurate scientific representation. Rather, both the imagination of crisis and the means to crisis management lay in constant perceptual and aesthetic involvement, a non-stop innervation of the sensorial apparatus that, so to speak, enforced a new and explicit type of feedback loops between industrialized humans and their larger biological world. Environmental responsibility could not be imposed on humans from without, as a moral obligation anchored in transcendental principles, but had to be a function of a heightened sense of involvement in the reflexive continuities that exist between the human sense apparatus and its environment.

The attentive mode produced in video monitoring did not just turn around the quest for knowledge and understanding. With reference to Gabriel Tarde, one might more accurately describe it as an effort that springs out of *desire* and that aims at 'the specification of a nascent *sensation*' – with the proviso that this specification is as much an effect of video production as of human psychology.[34] Getting efficient environmental action from risk-averse, affluent, and protected First World individuals would depend on precisely such a form of specified sensitization so as to trigger basic survival impulses at work in the organism/environment feedback loop. A first move towards such a goal would be to explicitly restage the inhabitants

of a post-industrial world of information and media technologies as Avery Johnson's 'biological organisms that move and struggle'. And such a restaging could not take place by pointing to some nature 'out there', beyond the modern technological world. It would, in contrast, have to take place *in terms of* the specific affordances of their electronic network environments.

Belief in belief

This may or may not have been a viable strategy for a new environmental politics; in any case, it is too early to pass judgment on what was just the first steps of a broader technopolitical reorientation. From another perspective, however, Gillette's work allows us to see how video technology deployed a situation of environmental crisis as a way of qualifying the type of liveness that was routinely ascribed to it. Environmental monitoring quite simply became one of video's key autobiographical modes. It was a set-up through which it could discover its sympathies with the generative dynamics of life systems and explore the consequences this had for the modelling of a new type of live memory or living archive. But, even more significantly, video's association with environmental monitoring in a situation of ecological crisis also placed the collective or distributed dimensions of its live memory in sharp relief. If video poses as a living subject of sorts, it is here, in this pragmatic political context, that one is confronted with the collective dimensions of its subjectivity. For the whole point of its form of memory was its obvious capacity for distributing sensations and for engendering concerted action between multiple actants. It was this aspect of video that made Frank Gillette speak of 'the divisible' as ontological and of a 'collective subject tracking the objective'.

These formulations emerge in the opening passages of *Between Paradigms,* a 1973 essay preceded by over 30 pages of drawings of patterns evoking various states of flow or turbulence. The text itself picks up on Buckminster Fuller's call for a new metaphysics or *meta-technics* that will help make new technology a constructive and globally integrated tool rather than the destruction machinery it seemed to have become.[35] At stake here was a redefinition of the very dynamics of collective memory, and Gillette's efforts to produce a 'meta-technics' seem directly informed by experiences with a technical system where synchronizing pulses – a new and distinct technical invention – are essential to keep the flows of volatile signals coordinated and on time: in this sense they are also indicators of the way in which the energy flowing through the system is also easily lost

or dissipated.[36] Video signals were then always already a 'collective body' in constant movement – defined by regulatory cohesiveness yet through that very regulation always susceptible to unpredictable or 'unruly' crowd behaviour.[37]

In a biological context, distributed or collective memory has sometimes been discussed in terms of the controversial science of memetics, which describes cellular behaviour in informational terms and understands ideas to be no less biologically 'real' than neuronal activity. A typical claim of memetics is that memories are not stored in the brain cells themselves but distributed in the gaps of the neural networks that make up the brain's synaptic plasticity: as a consequence, memory is also distributed among the cultural agents that shape the brain and constitute its environment. Analogue video of the 1970s could, however, not as yet mirror itself in neo-Darwinian theories of the feedback loops between biology and culture and had to waver between physical/technological and more sociologically oriented formulations about the contagious or distributed dynamics of its form of memory.[38] The terms ultimately used by Gillette were 'mood' and 'belief'. *Between Paradigms*' subtitle was *The Mood and its Purpose*, and a chief target of the text was the damaging effects of a modern history that sacrifices the productive powers of mythological imagination. History is here vested in a distinction between true and false that fixates the past as an undisputable reality that, in turn, determines the future. An extremist example of this mode of thinking might be scientific socialism, which defines a precisely delimited collective – the proletariat – *in terms of* such a historical truth and is hence able to extrapolate the inevitable revolutionary future of this collective. Yet, as the actual practice of Stalinist or Maoist socialism shows, this predetermined future tends to work as a self-fulfilling prophecy in the sense that it is carefully managed and controlled by the guardians of historical truth, at the expense of attention to actual events and conditions of change.

The dynamics of belief is wholly different: neither true nor false, belief is a type of mental formatting or infrastructure that organizes the intuitions through which the future acts on the present. It is essentially a navigational tool, which is why Gillette speaks of a 'self-organizing topology of beliefs' and associates belief with the relational logic of cybernetic models.[39] But, as importantly, belief is per definition collective in the non-contained or distributive sense of the term: it attests to the contagious dynamics of imitation and invention that, according to Gabriel Tarde, defines the social as such.[40] In fact, the video-informed conception of collective life forms in Gillette's writing is closer to the basic tenets of Tarde's sociology than to the

discipline of memetics that Tarde's work is often said to have anticipated. Memetics is caught up in a discussion of how 'a' meme is to be defined and in what ways it could be said to be the cultural counterpart to 'a' gene – a notoriously difficult question, since the physical substratum of memes is hard to define: is it sounds and images? or the acts of communication? And what exactly does it mean to say that they are replicated in culture? Tarde's approach, unconcerned with the gene/meme parallel of neo-Darwinist science, is different. What is imitated is not specific expressions or behaviours but beliefs and desires: we take on the beliefs and desires of others, and these provide patterns for judgments and actions that in turn affect the structure of belief.[41] Here is, in short, the sociological parallel to Gillette's cybernetic description of belief as a 'self-organizing topology'. The 'meta-technics' of video developed (in fragmentary form) in *Between Paradigms* is then a theory of being in which the principle of emergence that characterizes both biological and technical life now explicitly opens onto a model of social memory.

Again, the political context that provoked this particular meta-technics is all important. In a situation where technological, economic, and ecological concerns converged in a scenario of imminent crisis (dehumanization, overpopulation, pollution), video presented itself as a subject-like monitoring system capable of unprecedented intimacy with the endangered ecologies – an ecological activist countering the narrative of increasing loss of control over a future dominated by destructive machines. To this end, it presented itself as a finely tuned perceptual/sensorial apparatus capable of both taking in and sharing the specific 'intuitions', 'moods', and 'concerns' of life systems under threat, making them the connecting points of a wider social topology. It was, in fact, as if video took it upon itself to rehabilitate the seemingly lost capacity to act by also producing a *belief* in a new dynamic of change – a dynamic that would be based on shared situational perception and in this way would undo the authority of historical archives and their predictive grip on the future. Video's meta-technics quite simply set out to produce a belief in belief, an imagination of the political potential of new collective imagination.

Such belief in belief seems to have informed Avery Johnson's final riposte to William Irwin Thompson's lament about the decrepitude of television: 'C'mon man, stop ZAPping us. Let's move together.' (sic)[42] It might sound like simple hippie jargon, and to some extent it was, of course, exactly that. Yet it also expressed the way in which the attitudes and behaviour patterns that mobilize others was the very object of imitation and sharing. This trust in the 'motions' of belief also informed the kinaesthetic strategies through

which video could also establish intimacy with natural phenomena – for instance in situations when still-camera surveillance was not an option. In Frank Gillette's *Quidditas* (1974-75), seven distinct places or 'phases in natural process' (as Gillette called them) – a pond, a lake surrounded by woods, scrub pines, salt marshes, tidal flats, dunes, and the sea – occasion a particular type of video gesture or kinaesthetic experience. Rather than simply 'recording' these uninhabited spots of Cape Cod woodland and coastal landscape, video seems to imitate the perceptual acts of the landscape itself, as if in sympathy with its intuitions, its own approach to the environment. It is above all the camera movement that enacts this imitative behaviour – and once again, the contrast with nature documentary could not be greater. In nature documentary, the camera invariably works as a stand-in for the curious human eye, spying on other species. Hence the most common movement is a wide angle shot that zooms in on particular details. The camera establishes the place or context in which the observer finds herself, before focusing on specific objects of interest that are seen as natural components of the place. *Quidditas* completely reverses this movement. Again and again, the camera produces rapid gestures of zooming out from some small detail, a constant rhythm of rapid outward expansions. The *things* of the natural world – branches, rocks, leaves, flowers, tufts of grass, waves, patterns in the sand – are barely established as visual facts before the camera suddenly widens its angle of vision. These are, in fact, imitations of the imagined perceptions *of* these natural objects, *their* attitudes or reflexes: it is as if each of them are casting series of rapid glances that serve to establish their immediate environment. They are presented as cognizing, sensing beings taking in the world around them; video does not so much observe them as imitate *their* powers of observation.

In a paper presented at the 1974 *World Man* conference in Moltrasio, Italy, Gillette described the video network as a connection between the world and a perceptual system terminating in the prefrontal neocortex: through a kinaesthetic signature, the loop between eye/body, the technology, and the process of recording are individuated, so that random information becomes a pattern.[43] This statement attests to what had become something of a truism in the late 1960s, notably the idea of video as an extension of the *human* nervous system. Yet if video is allied with the human nervous system, Quidditas presents this system mainly in terms of its capacity to imitate the intuitions or desires of other bodies, to take on and internalize *their* 'kinaesthetic signatures, *their* specific ways of 'reaching out'. But then again the title hints at precisely such relations of commonality. In scholastic philosophy, 'quidditas' was the Latin term for the essence of an object – its

'whatness' – yet with the twist that this essence denotes properties that it also shares with others of its kind (in contrast to the term 'haecceity', which indicates the qualities that make an object different from all others). The quidditas referred to in this work are, then, not just the natural objects caught on tape. It is, more precisely, the shared capacity for perception and memory typical of the collective body of cognizing beings that, in this particular historical and political context, came to call itself 'video'.

The politics of sharing perceptions

Crisis, however, tends to call for mobilization on multiple levels and at widely different scales. 'Getting' water was fine, but as an ecological activist/collective, video faced a problem of organization: how to make its particular topology of belief politically evident and effective at the more pragmatic level of everyday information processing? How to get to the point where thousands – or even millions – of individual nervous systems might be made to share and feel ecological concerns in real time?

Symptomatic Syntax, *Quidditas*, and the series of other works in the same vein may have functioned as models or test beds for such sharing, but video was more ambitious: it wanted something more systematic and more explicitly distributed. The medium of this ambition was first and foremost Paul Ryan, who had already attempted – and failed – to produce a new 'tribe' of video makers sensitive to ecological concerns. This failure could, in Ryan's view, be attributed to his own mistaken approach to ritual. Following the sudden death of his father in 1971, he had produced a 12-hour-long work in which video footage of his living father was overlaid by his own family-related laments mixed with ranting about the problems and possibilities of video and its technical and epistemological corollaries: the work was then made available to audience viewing in Ryan's apartment for days on end, as a profane version of the Catholic wake.[44] 'It was a bust', Ryan stated. The technology may have been video, but it was harnessed to a project that was too rooted in the idea of criticism and examination. According to Ryan, his attempt to create a 'complete and consistent set of ultimate sacred proposition that would be recorded for all to see' failed due to its inability to intuitively catch on. Forty years earlier, Kurt Gödel had formally proven the impossibility of constructing a complete set of unambiguous propositions: for propositions to be taken as true in the ultimate sense, they must be believed without questions. To invite people to examine statements on tape undercut that possibility.[45]

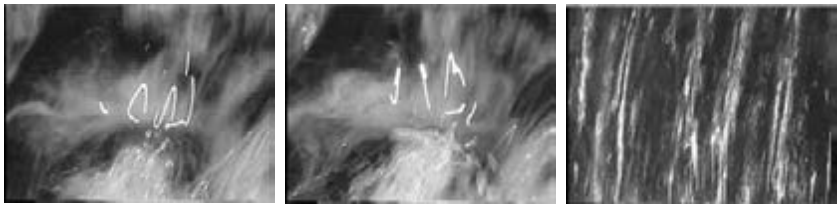

Fig. 6.1: Paul Ryan, video stills from *Earthscore: Bronx Falls*, 1989. Courtesy of Jean Gardner.

Fig. 6.2: Paul Ryan, video stills from *Earthscore : Nature in New York City*, 1989. Courtesy of Jean Gardner.

The first inkling that the ambition to realize collective perception at a larger scale might actually be possible came in the form of the first outline of Ryan's *Earthscore Notational System* – a model that would be continuously developed during the years to come: in 1985-86 it formed the basis for Ryan's *Ecochannel Design* for a television-monitoring project. Again, water was key. Water functioned as a sort of priming material, a means through which Ryan would first attempt to integrate video into his own perceptual system. During a prolonged stay in the Shawangunk Mountains, he spent much of his time in a nearby stream with a video camera strapped to his body, training himself to do continuous half-hour taping without stopping. He would subsequently watch the recorded interactions of the water patterns and his own bodily movements over and over until he could recreate them as events in his mind without watching the videotape.[46]

The result of this intensive discipline was a non-verbal catalogue of behavioural patterns: 'bubbles-foam, drops, sheets (stretching between edges, bent over edges), folds in sheets, water channelling through rock, water poured from rock, poured water capturing drops, rushing water split by rock, rushing water fantailing over impediment, water splashing on water, water splashing on rock, rushing water curled back on itself, raindrops on water. These patterns were actually what biologist C. H. Waddington called *chreods* or 'necessary pathways' – the specific ways in which life systems

deal with discontinuous phenomena or the events that occur when an equilibrium is broken.[47]

A more formal understanding of the emergence of such patterns was introduced with mathematician René Thom's catastrophe theory, a topological modelling of the four dimensions that supports any equilibrium surface and hence also any rupture of the equilibrium. Thom had shown that there are only seven possible forms of discontinuities or catastrophes in nature. For Ryan, who was sufficiently enthusiastic about Thom to send him a nervous letter of appreciation alongside the paperback version of his 1974 book *Cybernetics of the Sacred,* these rupture forms might be seen as a set of elementary notes that made it possible to see nature as an evolving musical score that could be instantly understood – if, like a musically educated person, you knew the notational system.[48] In this context, water was not just a key symbol of crisis but a pedagogical object that allowed you to learn a new sign system.[49] While numerous catastrophe patterns are too slow or too quick for the human eye, water flow – now allied with signal flow – allowed you to learn natural change patterns at the speed of televisual events. It is, of course, of some significance that many of the water patterns caught on Ryan's tape have superficial visual resemblance with the live video feedback patterns running non-stop on Skip Sweeney's page on the *Video Free America* website.[50] Water was, in other words, the strategic gateway to video's ecoactivism, the telegenic mediator through which it asserted its basic alliance with life.

Individual readings of the score of water patterns or other natural phenomena would not be of much use, however: they would be too random and biased, not sufficiently reflective of the individual's own position in relation to the course of events. This is why *Earthscore* was formulated as an ambitious organizational project – a method for systematically sharing the intuitions and perceptions in nature and *of* nature. Ryan imagined three-person teams of videographers who would constantly broadcast from a select number of natural locations: an early idea for a channel named *W* (*Your Wire to the Watershed*) was supplanted by the more general *Ecochannel* design.[51] Over time, the video teams would pick up behavioural patterns or chreods of the individual ecosystems: the identification of such chreods would produce an intuitive notational system through which to interpret an emergent natural world in real time. As notational systems go, *Earthscore* was essentially a perceptual syntax: the whole point was to facilitate a veritable 'orchestration' of perceptions, so that a collective of TV viewers would start to intuitively see and feel both regularities and critical changes in the environment.

Fig. 6.3: Paul Ryan, video stills from *Triadic Tapes*, 1975. Courtesy of Jean Gardner.

If the project depended on TV's capacity to transmit real-time events, it would also transform broadcasting in fundamental ways. The key to the project's difference lay in the design of the camera teams. Ryan's insistence on the three-person team model had to do with his effort to install a dynamics of emergence at every possible level of operation. If the viewers were to actually share and act on the percepts of nature, and not just passively consume representations of natural sites, the very production of video images would have to be ecological through and through. It had to be systematically diverted from the simply subjective point of view, become part of 'inhuman nature' itself. It had, in other words, to be connected to the feedback systems that characterize all life or, more precisely, nature's own way of communicating with itself. Even if the feedback possibilities of video technologies might attest to their general complicity with life systems, an *institutionalized* usage of video could easily just slide back into the superficial attachment to the present seen in most broadcasting. Hence dynamic feedback processes would have to be extended to the level of social organization as well, and to this end Ryan drew on yet another formal model. The three-person camera teams were above all a means to work in terms of the relational or triadic logic of mathematician and philosopher C.S. Peirce – i.e. a logic that is not based on a set of axioms but on the divisions and definitions that characterize the functioning of signs and that pertains to the performance of actual entities in the real world.

Any such real-world action is seen in terms of the relations between a first set of immediate perceptions or expressions, the reaction or resistance they provoke, and, finally, the principles or rules that govern the relation between the first and the second moment; this understanding functions as a guide to future behaviour and may itself become a new first-level phenomenon. This process of constantly shifting perspectivation was a key to all understanding of nature – hence it seemed sensible to use the shifting relations and perspectives that necessarily emerge in groups of three as a point of departure for producing perceptions. Once a specific natural

site would be repeatedly recorded in terms of different takes on firstness, secondness, and thirdness and organized in rhythmically alternating patterns, the combined perceptual result would take on a form of facticity and independence that would also be a measure of its potential for sharing.[52]

While Peirce provided the logical foundation, a more direct inspiration came from Warren McCulloch's late intuitions that his binary 'computer model' of brain functions was missing something essential about living entities – from the neuronal level and up:

> The problem I am up against is the problem of organization of many components, each of which is a living thing, each of which, in some sense, senses the world, each of which tells the others what it has sensed, and somehow a couple of million of these cells get themselves organized enough to commit the whole organism. We do not have any theory yet that is capable of handling such a structure. [53]

McCulloch's efforts to conceptualize a 'calculus of intention' based on a triadic relationship caught the imagination of Ryan as well Avery Johnson, who spun this idea over several articles in *Radical Software*. If McCulloch had ultimately left it to 'the youngsters' to recognize the possible answers to this problem, Johnson and Ryan doubted that he would 'have expected a relational calculus to reduce happily to words on paper, with or without diagrams'. 'He would', as Johnson confidently stated, 'more likely have turned to videotape with its facility for infolding and self-reference as the appropriate medium for thinking and teaching about it'.[54] As a non-scientist, Ryan was consistently modest about his ability to work with these problems on a mathematical level. But, with additional inspiration from Thom's topology, McCulloch's intuitions seemed to justify allowing video to become the super-ambitious mediator through which the 'problem of organization of many components, each of which is a living thing' could be taken from the neuronal level to the social level. Only in this way could 'perceptual imperialists' like CBS anchorman Walter Cronkite be effectively challenged in their top-down handling of crisis information.[55] Only in this way would the *Earthscore Notational System* and its alternative broadcasting networks function as a truly 'relational circuit' – Ryan's term for the implementation of ecological modelling at every possible level of organization. The rather complicated triadic production procedures were, in Ryan's view, 'a short cut to ecological sanity by way of aesthetics': knowledge about possible damages to the ecosystem would no longer be disembodied facts hurled at one by specialists and activists or more or less convincing representations

of catastrophic 'realities'. They would be the actions and reactions of a shared sensorial apparatus that did at least have a shot at connecting with the actual complexity of living systems in general. Once they were properly perceptually integrated and shared, subtle but symptomatic changes in water flows, plant growth, or spawning behaviour might become as much of a conversation piece as a sudden hailstorm and perhaps also generate as much hurried action.

Postscript to a failed movement

It was perhaps an ambition doomed to fail. For one thing, the level of practical organization demanded was just mind-blowing. Preliminary studies by Ryan may well have demonstrated the feasibility of organizing perception according to the triadic logic of relations: in the 1989 *Nature in New York City*, six-second passages of shifting relational positions alternate rhythmically in the production of each of the four chosen urban spots. Instant impressions of phenomena like horseshoe crabs laying eggs or a dismal clay pit pond surrounded by trees, grass, and abandoned cars alternate with more precise encounters with the concrete details of their complicated existence and the overarching rules or patterns that characterize such behaviours and habitats. More than anything, these recordings attest to the way in which video seemed to quicken Ryan's unique sensitivity to the rich confluence of psychological, social, and political registers that inform any environment. Yet no teams of three were actually involved in these productions, and Ryan's vision of the wider organizational context of such teamwork certainly never came to fruition. For Earthscore was notably also imagined as the blueprint for a more encompassing community project in which each one of a total of thirty-six video makers would be part of three different triads: one occupied with caring for community members, one with finding economic support, and the third with producing video. A monastic system, more or less, conceived on the ruins of Ryan's three-year-long effort to develop a video community with Steven Kolpan and Robert Schuler – a project in which a 'stabilized repertoire of triadic behavioural patterns' and a 'triadic decision-making process' had not yet been established.

But also, as Ryan dryly notes, the money ran out. Following the 1969 budget expansion from two to twenty million dollars, The New York State Council on the Arts started supporting the entire video scene – alongside numerous social change advocates who rubbed shoulders with artists in competing for funding from this welfare-state-type institution. But in

1976, support for Ryan's work on video and nature dried out, and with it, apparently, the most openly organizational ambitions of video. Ryan soon conceded that his understanding of how to use video to interpret ecological systems was now so formalized it could be accomplished directly in the world of work, where it would no doubt have to negotiate numerous other economies and feedback circuits.[56] In addition, in a situation in which activist projects – community cable projects, alternative TV – often received both sympathy and funding, the project may have failed to hit the general political imagination. Given the ever-more monolithic channelling of TV perception into the feedback loops of entertainment capital, the concept of a video-based perceptual collective may have come across as a particularly high-minded form of utopianism. Attention was mainly understood in terms of an economy of scarcity – mental time measured in clock hours of leisure time – and the battle over mental time access seemed decided in advance. A project built around precisely the type of aesthetic attachment to the real-time apparatus that was also the driving force of capitalist media did not have much political leverage. It simply did not gel with the guerrilla tactics of much of the 1970s counterculture – attacking institutions and corporations at the macro level, feeding off antagonisms.[57]

Today, however, *Earthscore*'s mode of action and reflection (if not its technical and organizational solutions) may seem less quixotic. As 'Kyoto' and 'Copenhagen' have become depressing shorthand for the failure to produce political and legal consensus on efficient environmental action, thinkers as different as Gernot Böhme and Bruno Latour have argued for the need for increased aesthetic and perceptual sensitization to the issues at stake: facts need feelings in order to mobilize, atmospheres in which to expand.[58] And today we know, for better and for worse, the technologies of tracking and coordinating the most microscopic sensibilities, the 'likes' and 'dislikes' that make up vast intuitive communities. No political theorist in her right mind would today fail to take into account the tangible reality of these volatile clouds of psychological attachments and the various environmental systems they belong to.

Yet, by the same token, the very concept of media ecology – highlighting feedback loops between technical systems and life systems – no longer presents itself as an alternative to the dominant understanding of real-time technologies and their modes of disciplining and organizing. The recursive processes of invention and emergence that result from the messy associations across separate domains of sensing, knowing, and doing are at the heart of today's electronic networks.[59] As demonstrated through the wide selection of examples in Matthew Fuller and Andrew Goffey's *Evil Media*,

entirely new forms of political awareness and strategizing are needed in order to maintain degrees of freedom and self-determination within a diffuse or 'gray' realm of databases, group-work software, project-planning groups, or other discreetly participatory media that access habits, passions, and relations on a large scale.[60] In short, all this means that the specific force and meaning of video's association with life-as-memory was a function of a precise historical situation: one in which capital still appeared to be on the side of mass production and the task of making life one-dimensional, serial, and manageable. Capitalist real time media – television – seemed to prove the point by reducing time and memory to an eternal present, a non-genetic quasi-life that was easily equated with passivity and death.

With hindsight, it is easy to see how the emergent information economy of the 1960s opened towards a far more variegated exploitation of life forces. And the *Modular Video Matrix* that Frank Gillette, Ira Schneider, Paul Ryan, and John Riley designed in 1969 for the American Can Company might also have provoked some intuitions about this, given the way in which it confronted them with the need for strict control over feedback software. This elegant assembly of 56 Plexiglas-encased monitors and stainless steel supports provided all the positive feedback opportunities of Gillette and Schneider's groundbreaking *Wipe Cycle*: camera input for live presentation or playback and programming for mixing live, delayed, and pre-taped materials. Yet, since American Can had decided that the software should be assembled by the more commercially oriented multi-media company Harvey Lloyd Productions, the ecological circuit in operation at industrial trade shows essentially just added a bit more 'life' to a commodity and its most obvious apparatus of production and distribution. In the word of the disappointed designers, it 'consisted mainly of bald-headed men touting American Can products intermixed with men (live camera) gawking at cheesecake hostesses'.[61] Video life was, in itself, neither good nor bad: as Gregory Bateson had pointed out, 'there is an ecology of bad ideas, just as there is an ecology of weeds'.[62]

Even so, to Paul Ryan and his collaborators in Radical Software, video presented itself – against media capital – as a set of affordances in which life was defined as 'variety and diversity, quality not quantity, differences that make differences'.[63] In this context, video was attributed with considerable, almost limitless powers and a level of generality that belied its extremely specific technical and material foundations. Not only would video apparently help sorting out mathematical problems of the highest order, it was *the* exemplary instance of a 'technological life form' – a strange composite being that drew its powers from making directly accessible, as

processes, the generative dynamics of physical, perceptual/psychological, and social/distributive systems. Hence it figured as the key to harnessing collective powers of invention that would operate across domains that modern science and culture had artificially separated. For a brief moment, the 'living force' that was video held the stage as the most convincing facilitator of complex, reflexive continuities between one form of material life and another. Contra the presumed institutional strictures of official television and media capital, it seemed to promise that social memory would not be at the service of pre-formatting and serializing identity but of diversifying life. Hence, video staged itself as a biopolitical agent well before it emerged as an instance of modern biopower in general.[64] And during this brief moment in the activist limelight, when real-time technology first met real-world crisis, video was the name for a distinct effort to rethink social dynamics from the ground up – so as to transform the very notion of political action.

Notes

1. Paul Ryan, Letter to Rhoda and Carole, 6 July 1980, The Paul Ryan holdings at the Smithsonian Institution Archives.
2. William Irwin Thompson, '"What's Past is Prologue" The Past – What's That?' *The New York Times*, 10 June 1976.
3. This point is underscored in Lazzarato (2006: 183-184).
4. Avery Johnson, Letter to William Irwin Thompson, 14 June 1976. Copy of letter (sent by Avery Johnson to Paul Ryan) in the Paul Ryan holdings at the Smithsonian Institution Archives. It is worth noting that a number of people in the early video milieu around the *Radical Software* journal came from hard science backgrounds. Ira Schneider studied experimental psychology and neurophysiology, and Dean Evenson had a background in molecular biology. Peter Campus, who was not directly associated with the journal but a central figure in the early New York video scene, also had a background in experimental psychology.
5. Sartre also saw a liberating potential in television, to the extent that its simultaneity might also be used for a 'total' distribution of popular culture, cultural forms whose particularity might lead to the production and articulation of new groups as well as a radicalized totalization of the nation – at least as long as such live synthesis was not confused with a permanent and frozen image of 'the collective'. See Dienst, pp. 3-12.
6. Raymond Williams as summed up in Dienst, p. 13.
7. Ibid., pp. 32-33.
8. Ibid., p. 33.

9. The website of the Daniel Langlois Foundation for Art, Science and Technology describes Crutchfield as 'a well-known intermediary between artistic and scientific circles, respected for his ability to establish links between the concepts of chaos theory and those found in the electronic avant-garde'.
10. In 1970, mathematician John Horton Conway devised the cellular automaton entitled *The Game of Life* or simply *Life.* This is a zero-player game, in the sense that its evolution is determined by its initial state and requires no further input.
11. In video feedback, Crutchfield found a dissipative dynamical system – i.e. a system in which the energy flowing through its various interacting components is lost to microscopic degrees of freedom. This involves a spatial interpretation of the system's temporal behaviour, meaning that its time-dependent behaviour is best described in terms of *state space,* in which the temporal evolution of the system is defined as a trajectory through a sequence of points in the state space. Crutchfield's discovery was that at certain control settings, true unpredictability (temporally aperiodic image sequences) emerged. Importantly, such aperiodicity was not just temporal but also spatial: space itself was now behaving in unruly and unpredictable ways. This feature, which made video different from other systems with complex dynamics such as chaotic nonlinear oscillators, might put you on the track of a theoretical understanding of the complex dynamics of a natural world. Crutchfield, pp. 229-245.
12. Dan Sandin, quoted in John Minkowsky 'Design/Electronic Arts: The Buffalo Conference March 10-13, 1977', in High, Miller Hocking and Jimenez, p. 399.
13. Wolpin, pp. 53-62.
14. This was the Ampex VRX 1000, the first commercially viable video recorder. RCA and BCE had demonstrated preliminary models in 1953 and 1955. Between 1952 and 58, BBC developed a high-speed linear videotape system (VERA) that in the end did not prove feasible.
15. Ernst, 2007.
16. Ernst (2013: 99-100) has described the way in which the archive is being transformed to support permanent transfer rather than storage. A key element in this process is the fact that archives are no longer separated from the actual infrastructure of web-based data circulation; it dissolves into electronic circuits, data flows.
17. The basis for this assertion is the idea that agency is 'overtaken', to borrow Bruno Latour's expression. An actor is here not the source of an action but the moving target of a vast array of entitites swarming toward it. Action is, in other words, distributed among agents, many of whom are not human (Latour 2005: 43-62).
18. As Wendy Chun (2011: 137-174) has shown, early computer theory produced a conflation of the concepts of storage and memory, thanks to a certain level of disregard for the material substratum of both computers and neuronal operation. Warren McCulloch and Walter H. Pitt describe neuronal

events and the relations among them in terms of the on/off logic of digital switching devices. Conversely, John von Neumann chose to describe the computer as a 'memory organ' – i.e. a brain of sorts – despite the fact that computing theory did not actually need a biological concept of memory in order to account for the capacity of the machine to store the numbers and functions necessary for computing. The effect was that the concept of memory itself was conflated with purely logical operations at a safe remove from the contingencies of the material world (including the contingencies of the analogue signal flow that underpins all computing): algorithms need to read and write values, and this is the simple reason why the digital paradigm reinterprets memory as storage. Hence, the dynamic and regenerative dimension of memory was suppressed in favour of a mode of thinking preoccupied with the safekeeping of a stabilized stock of pure information, reinforced by the constant references to more permanent archival media such as documents, files, and folders.

19. Ernst, 2013, p. 100.
20. Viola, p. 125.
21. TV early on associated with aquatic life: in the many non-commercial channels of early European television, the concept of infinite contentless presence was often buttressed by showing close-up views of aquarium fish swimming around. One of Nam June Paik's early actions was to set up closed circuit feeds between fish tanks and monitors, displaying not presence as such but the ecological systems at the heart of the televisual networks (see for instance *Video Fish,* 1975). Over the years, Paik played this ecological metaphor to the hilt, with TV sets hung from the ceiling as live electronic skies or placed like shimmering flowers in lush garden environments (see *TV Garden*, 1974 and *Fish Flies on Sky*, 1985). In *Liberation Sonata for Fish,* performed during Charlotte Moorman's 1969 Avant Garde Festival, Paik distributed envelopes filled with tiny dried anchovies that were to be returned to the sea. The fish were presumably to take on new forms of life at the behest of random mediators.
22. Brodey, pp. 34-36.
23. In 'The Work of Art in the Age of Mechanical Reproduction', Walter Benjamin famously associates cinema with distracted reception (but with a revolutionary potential); Irwin Thompson for his part saw television as producing a present without memory.
24. Crary, 2001, pp. 11-79.
25. Paul Ryan, 1992, p. 120. Not incidentally, this collection of text from Ryan's long publication career is 'dedicated to the waters of planet earth' and focuses specifically on the video/water relation explored in his early video exercises as well as a number of later works such as *Coast of Cape Ann* (1985), *Ecochannel Design* (1985-86), *Five Waterfalls* (1988-89), and *Nature in New York City* (1989).
26. Guattari, p. 135.

27. Guattari's call for a mode of thinking that no longer accepts that 'action on the environment, the psyche and the socius' must be separate is very much in accordance with the concept of ecological operation associated with video, particularly through the work of Paul Ryan and Frank Gillette (Guattari 1989: 134).
28. Cavell, pp. 192-218. See also Doane.
29. Deleuze and Guattari, pp. 163-168.
30. Similar questions related to monitoring nature emerge in a number of other works by Gillette. Key examples include *Track/Trace*, *Tetragrammaton*, *Subterranean Field*, *Terraque*, and *Gestation Growth* – all constructed for his 1973 exhibition *Video: Process and Meta-Process* at the Everson Museum of Art in Syracuse, New York. Each presents variations on the combination of live video technologies and living systems (human or animal) installed in the exhibition spaces, each expose different temporal ecologies and produce specific technical/natural permutations. A final monitoring work named *Integration Matrix* remixes information from all the different ecologies on ten monitors for a more intensive comparison.
31. The vol. II no. 5 issue of *Radical Software,* devoted to the theme *Video and Environment,* documents Gillette's Syracuse exhibition of that year and also includes several of Gillette and Schneider's individual designs for feedback video environments. It is interesting to note, however, that the issue is actually not significantly more focused on the environmental dimensions of video than a number of the other issues: environmental themes in every sense of the word run through the journal project as a whole.
32. Morton, 2007.
33. In the text part of Frank Gillette's 1973 book *Between Paradigms: The Mood and its Purpose,* the critique of historical thinking is a key point, particularly to the extent that historical thinking predicates the future on a 'preservation of the precedent', a fixated, archived past. In such a system, prior patterns of identity impose themselves on the elusive swarm of unfixed data experienced in the present. As an alternative to this model of thinking, Gillette enjoins us to see that 'the history of a thing is the demonstration of its impermanence'. He wants a 'model of no-model' in which the future resides in the present (Gillette 1973: 4-6, 11, 13, 17).
34. 'So without attention, no sensation … now what is attention? One can answer that it is an effort that aims at the specification of a nascent sensation. But it should be noted that the effort, in its psychological guise and abstracting from the concomitant muscular action, is a desire'. Gabriel Tarde (1895) quoted in Lazzarato 2006: 185.
35. Gillette, 1973, p. 2.
36. Wolfgang Ernst (2012: 223-227) has underscored the media-archaeological significance of the various synchronization processes in television systems: they teach us that what happens in the TV image is always a microtemporal media event subjected to strict and always critical negentropic processes.

37. On a different level, such perspectives might find additional inspiration from the research on what Laura U. Marks (161-176) calls the 'herd behaviour' of electrons: quantum physics has shown that the behaviour of a single electron may in fact be seen as a function of its entanglement with the other electrons joined with it in a common wave (if one electron moves, it affects all the others). It is, in fact, this collective behaviour that makes it possible to understand how electrons 'remember' – i.e. how they are able to actually act across time and space. Marks draws on David Bohm's development of Louis de Broglies' pilot wave theory in which Bohm argues that a single electron is a member of a whole of many electrons joined on a common wave. Each electron on a given wavelength has the wave function encoded into it. It remembers where it came from and thus remains linked to other electrons sharing the same wave even when they are physically distant. This means that the photons of sunlight that warm our faces are physically connected to the star that emitted them, arriving on a common wave.
38. Memetics was only popularized in the years after the publication of Richard Dawkins' *The Selfish Gene* (1976). The modern memetics movement dates from the mid-1980s onwards and was significantly reinforced by the publication of Daniel Dennet's *Consciousness Explained* (1991).
39. Gillette, 1973, p. 29.
40. Tarde, 1969, pp. 177-208, and Tarde, 1899.
41. The differences between Tarde's theory of imitation and neo-Darwinist memetics is discussed in Schmid, 103-118. See also Sampson.
42. The ZAP in 'zapping' may be a reference to the underground comix magazine ZAP that was part of the youth counterculture of the late 1960s.
43. Frank Gillette, 1976, p. 219.
44. An excerpt from the tape was published as 'Video Wake for my Father' in Ryan, 1974, pp. 69-90.
45. Ryan, 1993, pp. 53 and 77. See also Ryan, 2011.
46. Ibid., pp. 53-54.
47. The 2001 text 'The Earthscore Notational System', (at www.earthscore.org) is one among many where Ryan credits Waddington as a source of inspiration for his *Earthscore* project.
48. Paul Ryan, Letter to René Thom, 7 August 1974 (Paul Ryan holdings, Smithsonian Archive.) *Cybernetics of the Sacred* includes numerous references to the work of Thom.
49. 'In my work as a video artist, I have repeatedly returned to moving water as the richest single source for developing a vocabulary of 'chreods' in nature … In 1975, I spent a year recording over thirty-five chreods on videotape at the waterfall in High Falls, New York.' (Ryan 1993: 390). The 1988-89 video work *Five Waterfalls* can be seen as a repetition and renewal of this study.
50. http://videofreeamerica.com/site/category/skip-sweeney.

51. In 1978, Paul Ryan was invited by Roy Skodnick, director of the Passaic Valley Video Project, to do work on the Passaic Watershed and its flood problems – the subject of numerous official reports so as to meet flood control needs. The contradictory information provided by these reports (due to scientific disagreement about what constitutes environmental destruction) had consistently halted political action and the production of feasible and publicly acceptable plans. As a response, Ryan produced the concept of a Watershed Watch based on video monitoring: this would produce shared perceptions of water patterns that would in turn form the basis for political consensus and plans of action. The Channel W would enable such shared perception among the 2.4 million inhabitants of the Passaic Watershed area. According to Ryan, 'it would not be designed to compete with other channels but would be shaped for a second, "background" television set that would provide images of the watershed at all hours of the day like a painting on the wall, and to be focused on when watershed issues are hot.' (Ryan 1993: 159-164, 165).
52. The concept of three-way communication was equally important to other *Radical Software* associates such as Juan Downey. The vol. II, no. 5 issue includes his 1972 design for a *3-way comunication* (sic) event using voice transmission laser beams and super-8 movie projections as well as video recording.
53. Warren McCulloch, *Communication: Theory and Research* quoted in Paul Ryan 1974: 49-50. The essay was originally part II of the article 'Cybernetic Guerrilla Warfare' that Ryan published in *Radical Software* vol. 1, no.3, 1971.
54. Avery Johnson, pp. 10-11. Johnson was close to McCulloch through his work at the MIT neurophysiology lab in the 1950s and 60s. (After 1951, McCulloch was associated with the Research Laboratory of Electronics at MIT, doing research on spinal cord physiology). As a graduate student, Johnson contributed research to several papers produced by McCulloch and his team of researchers.
55. 'We laughed our heads off digging each other's tape while the old perceptual imperialist Walter Cronkite explained Earth Day to us'. Ryan, 1971.
56. Ryan, 1993, pp. 59, 319-321.
57. Ryan (1971) was highly aware of these differences: in his view, cybernetic strategy could learn from the guerrilla tactics of relying on the irregular and non-repetitive, but he wanted to provide an alternative to the 'film scenario of the NYC urban guerrilla warfare "Ice": Using machine guns to round up people in an apartment house for a revolutionary teach-in is not what the information environment is about. All power does not proceed from the end of a gun.'
58. Böhme, 1995 and Latour, 2004.
59. Fuller (2005) provides a series of in-depth case studies of such ecologies. On a more general level, Felix Guattari's concept of ecology is key to this mode of thinking
60. Fuller and Goffey.

61. 'Modular Video Matrix,' uncredited. *Radical Software* vol. 2, no. 5, 1973, pp. 18-19.
62. Bateson, quoted in Guattari, p. 131.
63. Ryan, 1971b. In this text, capitalism is essentially contrasted with the ecologies information machines.
64. The distinction between biopower and biopolitics does not just hinge on the distinction between a general harnessing of life powers and a specific conjunction between economy (the government of the family) and politics (the government of the polis). As Lazzarato (2002: 112-25) has pointed out, Foucault's concept of biopolitics indicates an ontological shift that breaks with the concept of political economy and its privileging of the capital/labour relation and that instead concerns itself with the whole range of relations between forces that run through the social body. Hence biopolitics cannot be understood as the capacity to legitimize sovereignty but constantly targets powers that do not properly belong to it, that always come from some outside.

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Chapter Seven

FileLife: *Constant*, Kurenniemi, and the Question of Living Archives

Eivind Røssaak

The archive has increasingly come to be understood as a cultural paradigm, transfiguring notions of collective memory and the complexities of historical and temporal processes.
– Geoff Cox, Michael Murtaugh, and Nicolas Malevé[1]

Archives are never neutral. They are dynamic spaces of knowledge and power, never passive, always active. However, most archives tend to hide their shaping and transforming role. As they enter the digital age, this role is reinforced by machine operations that have their own realm of invisibility. With the implementation of computation and digital files, documents are not only readable but also writable and executable. Archival documents have become new media, and the routines and standards subtending them have become techno-logical. I will explore this problem through a study of the Belgian art and media group *Constant* and its engagement with the file/life of the Finnish artist-engineer and composer Erkki Kurenniemi. *Constant* foregrounds the digital life of an archive by practicing what it calls an 'active archive'. Unlike most online archive initiatives *Constant* places emphasis on the generative and active part of making an archive come alive.[2] They do not primarily make the archival files more easily accessible but carry out an 'active forensics', as it calls it, on the files.[3] Etymologically speaking, 'forensics' comes from the word 'forum' and deals with how to demonstrate an argument before a court by examining its various parts. *Constant* reveals how 'an archive is in a permanent state of mediality, always in temporality, always re-writing itself' by intervening directly in the computational regimes that govern the arrangement and accessibility of the archived files.[4] This implies adapting Foucault's concept of the 'archive' for a new media age. Foucault separates 'archives' (in plural) –as physical places one can visit –from 'the archive' (in singular) as pertaining to general rules regulating the visible and the articulable or what is seeable and sayable. While Foucault never addressed digital archives, his distinction is still useful. Media archaeologists like Wolfgang Ernst have argued that

with the advent of codes and computer algorithms as the new *arché* or command system of knowledge, we have to reload Foucault's archaeology of knowledge for a new age.[5] We need to look into how computation and digital files have intervened in the rules governing knowledge. This is where *Constant*'s practice is instrumental. The group does not simply open up the holdings of an archive (what it says and shows) but tries to engage with the codes and algorithms or the *arché* itself of the archive with what constrains the sayable and visible in a digital age. Furthermore, *Constant* makes accessible this archival infrastructure for its user as a new mode of *sharing* the archive. It focuses on the new dynamics or life of some of the smallest items of prosthetic memory, codes and files, on how they are constructed, transformed, and connect to other files. This is the life of files – or what I call filelife, a phenomenon rendered tangible in Constant's operations. Their approach seems to lay the ground for new ways of conceptualizing social memory, provoking a set of questions that may benefit from insights concerning the life and agency of objects in actor-network theory as well as philosophical and media-theoretical investigations of the concept of life itself.

I will focus on *Constant*'s take on Erkki Kurenniemi, whose work was to a large extent premised on the idea of the extended life of files. More precisely, Kurenniemi set out to create an archive of his own life for a possible artificial life resurrection in the future. While Kurenniemi was oriented toward the question of new life forms based on compiling archival materials in a variety of media forms, *Constant* cares more about the infrastructure of these files – their technical and social profile. To assess what I call the social profile of files, one needs to explore how the files are constructed and shared. Moving from a traditional archival file (*Akten* in German, or acts) to a digital file implies nothing less than a technological revolution relating to many of the issues familiar from the media discourse on the transition from old to new media. But what does this transition imply from the perspective of social memory, which is traditionally formulated around the concept of the relative stability or repeatability of the objects and frameworks that attest to a communal past? The digital file implies a new temporal dynamism in the archive, with constant updates, regenerations, and affordances forging new connections and associations.

I will follow some of the strategies of *Constant* that reveal how this new dynamism expresses itself through a constellation of technical and human agencies, generating what I will call a memory network. Here the network does not simply refer to the digital infrastructure through which files are generated, stored, and transmitted; the *sense* of a network

is indeed implemented in the construction of the single file as well. My approach takes its cue from Bruno Latour's concept of decomposition and his emphasis on 'The … many folds [of a file that] become visible as soon as one moves a bit closer to where agencies are made to express themselves.'[6] One decomposes the file to better assess the network of forces constituting its operations. Such forces or agencies may be seen as key components in a reformulated understanding of social memory. Now, it goes without saying, social memory is always technical in some sense. However, we need to make a distinction between a concept of social memory informed by relatively stable materials (paper-based archives, for instance) and a concept of memory informed by temporalizing technologies (electronic/digital archives) – i.e. technologies that produce time *as* difference (events). To the extent that the latter seems to foreground a concept of social memory based on constant mobilization, it may also make us question representational approaches to the social as such. Following Latour, it would appear that the social is less a special thing or substance than new events of association and connection.

Constant creates a laboratory where these temporalizing technicalities are more precisely delimited and reimagined: the more emphasis it places on the specific features of technical performance, the more it reveals the social dimensions of the technologies in question. In other words, here, social memory must be understood in terms of events of association that include human and non-human capacities alike. I will investigate how such interaction may express itself in the context of an archival practice based on algorithmic operations – i.e. on the techno-mathematical language of commands and machine performance.

The life log

Files and their relation to potential life was a key concern for Erkki Kurenniemi. During the 1960s, he was mostly known in Scandinavia as a maker of experimental films and music and as an inventor of electronic instruments and synthesizers. It was only later that it became widely known that he also obsessively documented his everyday activities: From about 1970 until 2006, when he fell ill, he collected vast amounts of audio-visual-textual material to make what he calls a digital 'backup' of his life 'in the belief that in fifty years at the latest they can be downloaded onto a pocket computer and be reanimated.'[7]

It is difficult to say exactly when Kurenniemi started the archive project. However, there are scattered thoughts on memory and documentation in his notes, cassettes, and diaries going back to the early 1970s, where he refers to a particular memory system. In a cassette recording from 1971 he says:

> I have it in my bag with me. I feel like I'm getting all stuck in my ways, getting all pedantic and reclusive. Hahaha, fantastic, this. Mm, getting more organized by the day. I'm not cleaning or anything, no… It's about systems. Organizing the suitcase, having an assigned place for everything in there. Recorder on the left, a slide rule behind it, a microphone in front and empty, filled-up cigarette cases to be placed on the mantelpiece when I get home. Some A4 material upright on the right side. Lost ones on the bottom, current ones on top, topmost. A book, some tissues, and a box for cards. A case for film, photographic film, that with small modifications turned out to work great as storage for the small cards, about a hundred of them that otherwise fill my pockets. There's a system for the cards, different colours: white for long term memory, yellow for short-, short term memory, blue for projects, red for components and so forth… or something. That last one, at least, isn't quite clear yet.[8]

He kept the memory cards in small filing cabinet-boxes. Some of the memory cards contain mind maps, and a significant one dated 28/7/1972 includes an indexed inventory of the early cassette recordings (see figure 1). They are mostly classified according to time and place. Some of them have more elaborate and idiosyncratic explanations. He seems to have recorded many of his cassettes while driving his car. Some of them have annotations like: 'driving [my car] in the night, [on the road] Viitamaa, Helsinki'. In another, the speed is also indicated: '100km/h'. Some are also more crypto-poetical, 'The dream of Sahara' (*Saharan Uni*).

His life archive project transformed both his way of life *and* a certain notion of life itself on a more general level. His own life became an experimental surface for recording devices. The archive was not something he created during his spare time. Rather, he let a wide variety of recording media–both analogue and, after the mid-1980s, digital (from the diary to the cassette recorder, film, and photography as well as a variety of classification systems) – become an integrated part of his daily life, whether he was alone or among friends. He even felt 'stuck', as he says, in his own recording and classifications apparatus.

Fig. 7.1: Kurenniemi's index cards. Courtesy of Erkki Kurenniemi's Archive, Finnish National Gallery. Photo: Ainur Nasretdin.

Furthermore, his archival project seems to be an experimental aspect of a more general fascination for research into new modes or notions of life and collectivity. Intellectually, he was deeply enthused by science fiction, cybernetics, and the unresolved problems of contemporary mathematics. He lived through a period of revolutions within science and technology, such as the emergence of the computer, artificial intelligence, biotechnology, the human genome project, and the Internet. He was aware of the writings of scholars such as Vannevar Bush, J.C.R. Licklider, Ted Nelson, Alan Key and Ray Kurzweil who developed and questioned the creative and co-evolutionary capacities of computation, memory, and knowledge, and he subscribed to the journal *Systems, Man, and Cybernetics* published by the Institute for Electrical and Electronics Engineers (IEEE). A common denominator for many of these interests is the gradual breaching of the distinctions between life and machines or what has been called the informatization of life principles.[9]

As Eugene Thacker has concluded in an overview of these tendencies, our notions of life underwent important changes during these post-war decades: 'the advances in genetic engineering and artificial life have, in different ways, deconstructed the idea that life is exclusively natural or biological."[10] This tendency in the sciences is crucial for understanding Kurenniemi's idea that an archive of files or information about a life as it is lived can actually also *be* or become a life form. He therefore explored many models for the continuation of life by other means. In his article 'Relative Life', he discusses the possibilities of finding the mathematical formula of life, and he seems inspired by the cybernetic dream, once mentioned by Norbert Wiener, that it would be theoretically possible to send human beings 'over a telegraph line' as information.[11] He was always interested in what he calls research into 'the giant brain or electronic brain.' The first electronic,

general purpose computer, ENIAC, was launched in 1946 as a 'giant brain'. It had a speed of one thousand times that of electro-mechanical machines, and as the speed of such machines would continue to increase exponentially, future computers 'can be programmed with the entirety of our consciousness and emotional substance,' Kurenniemi thought.[12] Furthermore, he argued that life should, for practical and ecological reasons, be continued artificially and computationally rather than genetically. The fusion of life and information runs as a leitmotif throughout his argument and vision: 'all these things [consciousness, character, identity] we used to connect with a biological living entity – and especially the human – are found out to be universal and independent of the underlying material' and 'we can transfer our consciousnesses [sic] and minds and personalities onto computers'.[13] His own life archive seems to be an integrated experiment into this possibility:

> If cryogenics and reanimation can't be attained biologically, there's this other possibility: you store the mind and consciousness as bytes and, even though we don't yet have a quantum computer which could allow the consciousness to continue living, then it at least makes sense to make a backup by registering everything from images and sounds and thoughts and burn them on a CD and rest in the belief that in fifty years at the latest they can be downloaded onto a pocket computer and be reanimated.[14]

Kurenniemi translates the discourses of cybernetics and life sciences into an experimental self-archiving fantasy where the passage from life to information is believed to culminate in a from-information-to-life option. Furthermore, it seems that he saw his own experiment as a preemptive attempt at testing out a situation that all of humanity will have to face in the future. He calls our time the age of 'the Great Transcription'.[15] This refers to the fact that most cultural heritage industries (museums, archives, libraries) are now in the process of digitizing their holdings. In the future, Kurenniemi believes, this heritage will be subject to the same dynamic, futural logic as his own life archive. With the help of super computers, the global cultural heritage will be reanimated through virtual modelling. 'I like to think of the Earth as a museum,' he says.[16] Due to overpopulation and ecological depletion, humanity will need other sites for living. Kurenniemi wants to solve this problem not by seeking refuge on other planets but rather by creating artificial environments in outer space. He pictures each individual's consciousness as computationally compressed into small chips. One golf ball can thus contain ten billion people, he explains. In their spare time, these populations will enjoy virtual models of their past lives on Earth,

or, as he says, 'watch porn'.[17] If you want to be part of this, 'you don't have to wait for the actual Technology [to arrive]'; he encourages you to:

> just store every tram ticket and store receipt, and photograph everything using a digital camera, where [sic] you don't have to pay for development… take a hundred pictures every day, write or dictate all your thoughts on a tape and you'll have at least easily accessible raw material, which can perhaps be used for your consciousness reconstruction later on.[18]

Indeed, in addition to his collections of audio-visual recordings of his own life, he assembled a vast amount of ephemera such as bills, tickets, tax return documents, and various gadgets, games, and computers.

From archival files to computer files

After Kurenniemi fell severly ill in 2005, he gave most of the collected material to the Central Art Archive of Finland's National Gallery of Art in 2006, where it is being catalogued and digitized.[19] In 2012, a smaller portion of this was handed over to the art and media group *Constant*. If Kurenniemi believed in files becoming life, *Constant* uses the same files to investigate the life of files.

Constant (with Nicolas Malevé and Michael Murtaugh as principal investigators) were commissioned by the group KURATOR (led by Joasia Krysa), Kiasma, and Documenta 13 to create a prototype of an online archive of the Kurenniemi files.[20] The material they were given can be considered a sample. It consists of almost all the pictures, some of the cassette diaries, a few home videos and transcripts of the most recent diaries (including the digital files from the Newton MessagePad) from around the mid-1990s and up until 2005 – all totalling one terabyte of information. Kurenniemi's early musical compositions, his experimental films, and his gadgets and ephemera were not included in the samples.

To understand the complexity at play in the Kurenniemi files and in *Constant*'s work on the files, we have to look at what has happened to the file more generally in the twentieth century. The transformation of the file from being the official record of a political and administrative system to becoming itself a governing entity in a computational network is actually a revolution with huge ramifications. Not only does it mobilize the file itself, both conceptually and practically the very notion of an archive and its functions –recordkeeping, storage, cancelling,

manipulation, destruction, distribution, search, and access—undergoes drastic changes.[21]

Files are the stuff that archives deal with. As Cornelia Vismann has shown in her history of the archival 'file', the file has been there ever since the beginning of the modern archive. 'For the administration of the Western world, a life without files, without any recording, a life *off the record*, is simply unthinkable,' Vismann demonstrates. Historically, files were 'the administrative underbelly of the law and its representation', and from there they proceed to become 'trellised, inaccessible chanceries', Vismann writes.[22] Essentially, files and archives were difficult to access. With computers, a significant change occurs in the operationality of files. 'The appearance of files as stylized pictograms or icons on computer screens indicates the end of the epoch of files,' Vismann maintains.[23] This is a bold statement. However, files in a computer are no longer simply files documenting the commands and protocols of a political system but are now themselves carriers of algorithms, the new commands and protocols of a computer system. As Vismann writes, today 'files and their techniques organize the very architecture of digital machines [...] they ensure access to all internal operations by controlling both instructions and data, as well as their addresses.'[24] The files are no longer simply the static record of the actions of an administration but have themselves become an integral component of a world of algorithms and codes that carry out a complex series of operations as well as *suturing* them into visibility and remediating them into pictographs looking like old media (a 'document' on a 'desktop', etc.). The operations that control their visibility are, just like the old files, inaccessible to most users. Their operations work in the hidden abode of computational systems, and their operations are so manifold that most users are happy if they can avoid dealing with them.

The sociality of files

A number of algorithms work in all digital devices. 'In mathematics and computer science, an algorithm is a step-by-step procedure ... used for calculation, data processing, and automated reasoning.'[25] They operate as an interlocutor between machine input and machine output. *Constant* intervenes in this process, and the art and media group's approach combines two methods. The first is a media-archaeological approach in which they bring out some of the hidden operations (algorithms and codes) at play in new media. The second approach underscores the social dimension of files

and computational procedures. They use open source software to interact with the files, *and* they document, step by step, the codes they use. In this way, they both rely on and foreground a dynamic memory network of shared codes.[26] Their focus on the potential for constant sharing and reworking directs our attention to a different concept of social memory when such processes constitute the materiality of both our 'objects' and 'frameworks' of memory.[27] Early on in their 'Kurenniemi online' logbook, *Constant* writes:

> When starting an archive project, one reveals the sociality inherent in the documents. All items in an archive are shared objects. They are produced in a transaction, through collaboration with instruments (pen, paper, camera, recorder, etc), software agents (programs, algorithms) and people.

Constant's focus on sharing and sociality places it beyond a purely media-archaeological approach.[28] The media-archaeological groundwork carried out by Friedrich Kittler and Wolfgang Ernst, among others, has been an important corrective to that strain of media studies that has been too concerned with the content or social context of media and too little concerned with how the logic of media machines structure knowledge. However, *Constant* pushes the questions of media archaeology into a more socio-political terrain by showing how machine logics are constantly renegotiated and interrupted by shifting forms of sociality and modes of sharing. If *Constant* addresses the inner workings of new media, it is only to demonstrate how this internal dynamic co-evolves with a complex series of actions organized externally through processes of sharing. From the hacker's perspective, new media are constructed through models of sharing and enclosure. Alas, it is also a battlefield over control and ownership. *Constant* has made a clear choice to systematically work with processes based on open access and sharing. This approach demonstrates an underlying politics of sharing which implicitly critiques most social media web 2.0 platforms, as they tend to hide and copyright their algorithms.

As Eric von Hippel has shown, the Internet and its culture have become the new ground for collaborative innovation. He calls it 'democratizing innovation', and the development of open source software is a key example of 'user-centered innovation systems' that 'supplant product development carried out by manufacturers'.[29] *Constant* is part of this turn to user-centred innovation based on openness. Codes are developed and shared in teams, and this sharing is expressed as collaborations between human and non-human capacities. Algorithms give instructions as to how a certain feature

is supposed to interact with other types of software and so on. Files *make* new connections and links, they operate precisely by always 'assembling new allies', to paraphrase Latour. The very definition of 'open source code' is that it is meant to be implemented in new media in such a way as to be open for further elaboration and manipulation. It assembles allies (and foes) by default.

The development of free and open source software (FOSS) is a form of collaborative innovation which aligns itself nicely to the way files work. Computer files *work* by collaborating with other files in series. These collaborations involve several layers of transactions on a synchronic and diachronic axis. Diachronically they rely on forms (such as open source software and algorithms) that have been tested and tried out in a series of earlier innovations, collaborations, and practices; synchronically they communicate and collaborate with other programmes and instructions to execute their tasks. *Constant* applies its knowledge of FOSS communities to archives, and thus extends its practices of sharing further than most FOSS communities. It moves from 'sharing in' (sharing in a restricted community of experts) to 'sharing out' (sharing with a larger public) to even 'sharing across' (having the non-experts comment and intervene in their practices).[30] Let us look more precisely into how *Constant* organizes its acts of sharing within an archive context.

Constant is committed to several acts of sharing. It wants to share Kurenniemi's files. Forging accessibility is something most state archives and national libraries in the democratic world do (unlike many private archives), and such archives and libraries (unlike private book repositories like Google Books) are committed to free and open access to their search and metadata standards. However, while libraries, for instance, try to enter the digital age without radically changing their system of metadata standardizations, FOSS communities like *Constant* openly apply their knowledge of how metadata regimes are implemented in digital files and how they co-evolve with other ICT standards relating to formats, files, and protocols. *Constant* wants to share this new infrastructure of archives and files. It does this in a critical way, and the story behind its alternative approach in this particular case is curious.

Due to the often sexually explicit content of some of Kurenniemi's video and image files, much of the material is 'unshareable' because of privacy rights, despite Kurenniemi's own desire to share. These restrictions forced *Constant* to invent new ways of presenting the material. Even if some of the images are unsharable *as* images, that is, on the level of 'cultural material' (the visible layer of data), they are still 'sharable' as 'techno-mathematical

material' (the data underneath the visible layer). The files are opened up to affordances the law could not imagine. Indeed, Constant's algorithmic approach allows them to share what would otherwise be unsharable due to legal restrictions. The legal restrictions release a playful retake on the archive. *Constant* addresses the files so as to activate dormant affordances, enabling it to assemble new connections and allies through interactivity and sharing. The source codes organizing the group's archive are not only free and open, sharable in themselves, but make objects 'not for distribution' sharable. *Constant*'s 'active archive' is an experiment in sharing. In *Constant*'s view, the entire Kurenniemi archive body is a source code to be shared.

> In this essay, we take the archive-body to be an exemplar of an active archive, not as fixed materials or a mere collection of objects but something more like source code that is modifiable and shareable.[31]

Constant's 'active archive' is an experiment in sharing following the hackers' ethics. Its online archive does not share files in the way most online archives do ('click to open'); it wants to share the digital infrastructure of the archive itself. It operates in between an experimental archive and a git hub (an archive for shareable software).

Navigation through *Constant*'s archive is difficult. It does not have one single interface but several entries and few overviews and is more like a hypertext with a plethora of samples, links, and extended blog commentaries resembling a lab log or a research paper in progress. The layout brings out associations with an anti-immersive, Brechtian web editor promoting *Verfremdung* and reflection rather than classification, overview, and easy access. It resists the merchandization of a collection. *Constant* addresses the potential construction of an online archive rather than the finished product, and finally, its commitment to the politics of sharing turns archiving into an ethical issue way beyond the Kurenniemi holdings. Nevertheless, it is all done in the spirit of Kurenniemi who was himself committed to the hacker ethos of the 1970s.

Essentially, *Constant* opens up a single file in its multiplicity. It activates the file's data, codes, histories, fixed and potential connections, as well as its possible transformations. This involves at least three different *forms* of sharing:

> 1) Sharing the files. This is done by opening up the other side of the file to access the data governing its affordances and metadata; this enables

Constant to legally share information about a file that would otherwise be legally unsharable.
2) Sharing the knowledge of sharing. This is *Constant*'s most elaborated mode of sharing and involves several operations: it uses free and open source software (FOSS) to access and read the files—it refers to it as 'seeing through the lens of algorithms' and it manipulates FOSS for its own purposes and shares its code amendments with the user in an online logbook, so that he or she can activate them elsewhere.
3) Sharing the knowledge of its users. This is done in some of *Constant*'s samples by inviting the user to interact with the files by tagging them on the fly.

Furthermore, these processes of sharing add new data to the archive and become part of it. The archive, here, is an evolving and dynamic entity without closure. Below, we will examine how these modes of sharing are specific to a digital age and how they challenge our longstanding understanding of social memory as related to the way things are shared in a society.

Seeing with algorithms

Constant's most extended investigation into how to share archival files is explored in its take on Kurenniemi's picture files. Numerous ways of reorganizing the material according to its internal data structure are tested. In the probe called 'Sample Data', it extracts the technical metadata (not the picture itself) of 17,000 picture files. This goes way beyond what archives usually consider valuable metadata and it demonstrates how the hidden multiplicity of a file is activated. It opens up the nested other side of the picture file which contains various technical data such as the date and time, focus length, colour information, camera type, etc. Furthermore, *Constant* uses open source sorting algorithms for face detection, contour detection, colour measurement, and metadata extraction. This gives a multi-faceted commentary to the image files displayed in its online archive on a two-row grid.[32] Unlike most digital archives, it upsets the WYSIWYG (what-you-see-is-what-you-get) logic of the computer interface. Instead of *suturing* the viewer into the somnambulist normalcy of a graphic user interface, where you click and see a picture, *Constant* creates what Alexander Galloway has called an 'infuriation event'.[33] When you click, you are suddenly taken into a new space of multiplicity. The user can spend hours clicking her way through the samples.

In a commentary called 'montage', *Constant* explains how it reads files algorithmically, for instance when using easily available Python-based software. The files are rearticulated through a series of simple commands, available on its website log. By executing the codes < #!/usr/bin/env python> and <#-*- coding:utf-8 -*->, *Constant* is able to present all the images from Kurenniemi's trip to Venice as a running script overlaid by clusters of images.[34] In another more detailed and extensive probe entitled 'Thumbnails by time', *Constant* again uses the folder Kurenniemi has entitled 'Kuvia' (Finnish for 'image') containing 17,000 images. This is referred to as a 'test folder'. The 'Kuvia' folder is used for a variety of algorithmic approaches like sorting algorithms and different scripts. The script is based on 'the pyexiv2 library'.[35] This is an open source code library for the manipulation of EXIF, IPTC, and XMP image metadata. The python module allows 'your python scripts to read and write metadata (EXIF, IPTC, XMP, thumbnails) embedded in image files (JPEG, TIFF, etc)'.[36] This algorithm sorts the images both as a text (spreadsheet) and as thumbnail data (see figure 2). *Constant* first use 'a script' (erkki_walk.py) to create a spreadsheet, and then another script (erkki_draw.py) that 'reads the spreadsheet and draws a new single image (10,000 x 1,000 pixels) where the thumbnails are each drawn individually with horizontal position related to their timestamp of creation, and vertical position random' (see figure 2).[37] We do not see a *single* picture from the Kurenniemi folder as readable by the human eye but instead as an image of the content of the (almost) entire folder, i.e. thousands of images as read and organized by computer vision according to time and colour indicators.

This latter visualization model may resemble a typical way of visualizing big data research within digital humanities and cultural analytics. David Berry has identified three distinct phases of digital humanities, which involve: starting out as 'humanities computing' dominated by linguistics (phase one), whereupon emerge the big data projects of various digital humanities labs (phase two) which often aim to create new semantic or relational links within and between huge corpus of cultural texts, followed by a critical phase (often involving media archaeology) where computation and the software tools themselves are being questioned (phase three). *Constant* may be said to belong to this latter phase where software studies and critical code studies are involved.[38] However, as we have underscored earlier, with its keen commitment to a politics of sharing, *Constant* also bypasses many of the well-known phases of digital humanities.

Algorithms are far better at addressing big data than the human brain and, significantly, they make it possible for us to enter and understand various aspects of files, folders, and formats and share it with users. 'When

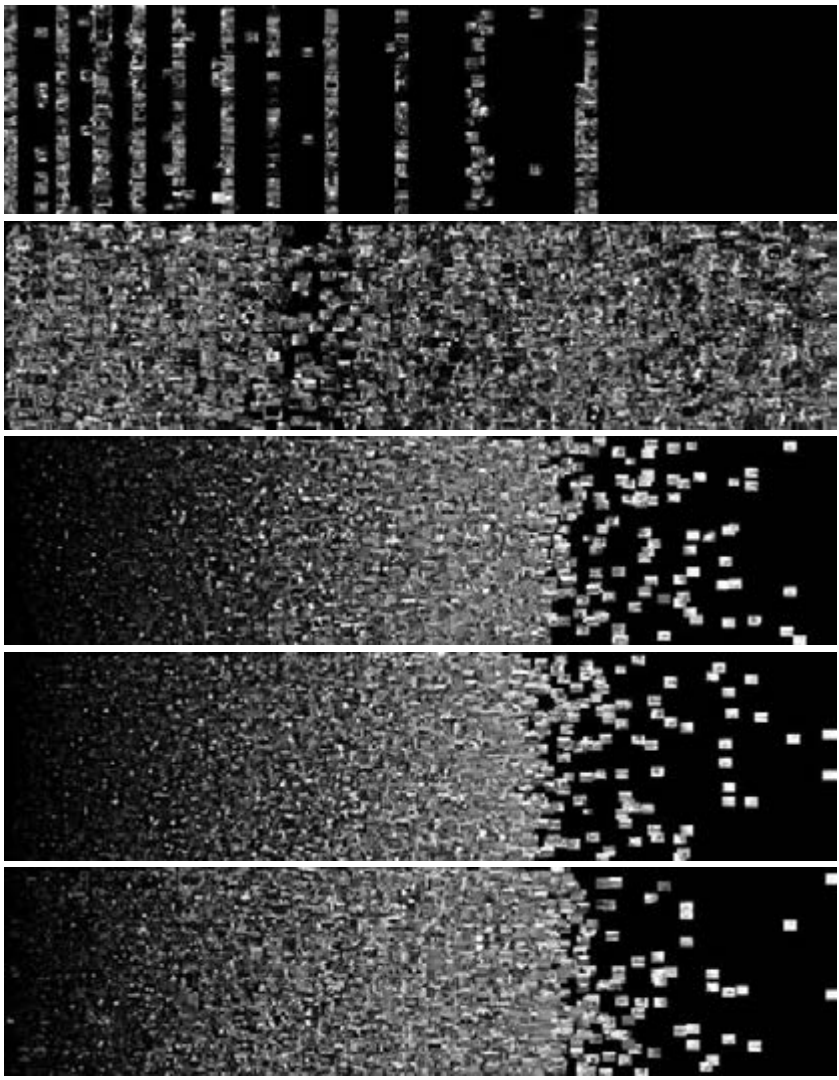

Fig. 7.2: A set of photos from Erkki Kurenniemi's Archive ordered in five different ways by Constant. Horizontal placement relates respectively to timestamp of creation, time of day, red, green, and blue values.

we delegate our vision to a series of algorithms and programs, we begin to realize the complexity of the connections that bind the format together, the device and the use,' *Constant* writes.[39] The complexity referred to are all the algorithms, protocols and code libraries that build up a digital device to make its operational flow continuous from capture (input) to processing and, finally, to screen image (output). Furthermore, to make files shareable

and interoperable between platforms, tech firms have agreed upon a vast number of technological standards in more or less willing cooperation with international standard-setting bodies such as ISO (the International Organization for Standardization). Sorting algorithms like the 'pyexiv2 library' rely on these standards. However, they may work fine for a while (on a synchronic level), but as soon as new developments change the standard, they are no longer interoperable, and that is why digital formats communicate so badly across time (on a diachronic level). Incidentally, this is also why the sorting algorithms *Constant* uses only work on certain portions of the files; Kurenniemi used any industrial standard available at the time of recording, not worrying about their interoperability but hoping that a future super computer would be able to process it all.[40]

Significantly, *Constant* foregrounds the way in which a digital device leaves its material and archival imprint on a recorded file. These imprints say much about the human-machine assemblages which in this case is a series consisting of the user, the camera, the file, and its repository. Algorithms work in the interstices along this series to transform and profile the data. *Constant* uses a specific digital image, 'DSC02048.JPG', as its example. According to the file's metadata the picture is shot on a digital Sony camera by Kurenniemi on the 6th of November 2004 at 21:56:37. Again, we are not shown the picture 'itself'. *Constant* uses open source algorithms to address the data and format standards of the picture file, focussing in particular on the Design rule for Camera File system (DCF). This is a key industrial standard system for the indexing and sharing of files. It works as a complete archival registry unto itself inside the digital device. It generates data about the who, where, and when of every image and decides who is its ally and who is its foe. It serves as an archival protocol for digital images and guarantees their interoperability across media. In other words, it regulates the image's possible connections and associations. Its specifications define the file system for the digital camera. DCF replaces the paper card index classification system that Kurenniemi used back in the 1970s. While Kurenniemi's analogue system could potentially work across media, the DCF directory structure conforms to only a limited number of file extensions, such as the JPEG (Joint Photographic Experts Group).[41]

In a funny comment, *Constant* mentions the fact that some of the axioms governing the algorithms of the JPEG lossy compression formats are not wholly justifiable: 'The Joint Photographic Experts Group thinks that the eye is less sensitive to fine color details than to fine brightness details.'[42] We all know that regardless of what JPEG 'thinks', we can all see the difference if we increase the size of the image. We can say that the JPEG method of lossy compression

actually represents lousy archival work on the level of preservation but is nevertheless useful when it comes to distribution, as smaller files are easier to dispatch. By entering into a 'negotiation' with these methods (DCF and JPEG), *Constant* shows how an ecology of formats, standards, and algorithms works underneath the visual image, revealing archival agencies other than the ones operating in an analogue archival registry like Kurenniemi's. Their approach also allows for other cartographies and more automatic implementations of the consolidated knowledge hidden in the hundreds of algorithms at play in the filing assemblage (user, camera, file, repository).

Another set of algorithms is implemented in the RGB (red, green, blue) colour protocol, which decides the colour spectrum of the image. It is based on the Young-Helmholtz trichromatic colour vision theory, developed in the early to mid-nineteenth century, and on James Clerk Maxwell's colour triangle elaborations (circa 1860).[43] The algorithms constituting the RGB model are a condensed and very efficient version of centuries of colour theory. The high speed of execution enabled by the digital components makes the model work at paces faster than human recognition. *Constant* uses a sorting algorithm that can read the RGB notations and sort the pictures accordingly. By only reading the numeric colour separation equations of the image, *Constant* can say quite a lot about the picture file – without showing the 'picture'.

While a traditional analogue archive would sort the visible image, *Constant* sorts the picture by accessing the archival procedures within the digital file itself. If each of these methods (DCF, JPEG, and RGB), with their hordes of algorithms, could be called robotic archivists, we could say that *Constant* reveals how each digital file is constructed by a network of archivists, and that the way the files are programmed actually implements and consolidates a long knowledge tradition going back to Helmholtz and ancient archival methods originating in Babylonia. The files absorb this tradition and turn it into the subaltern workforce of digital media.[44]

The third way *Constant* activates sharing is by engaging the user as an active participant in the tagging and commenting upon the file or running script in question. This is most often done in connection with a live streaming rendition of the audiovisual files such as videos and tape recordings. In the Dataradio project, *Constant* creates a new kind of folksonomy (collaborative tagging or social indexing) by using the open protocol Internet Relay Chat (IRC) as an annotation tool. Users can tag and share on the fly a 'live stream' of a selection of Kurenniemi's audio-diaries by writing down comments and associations as they listen to the recording. Each tag becomes part of a larger indexing system and creates a minor crowd-sourced evolving filing cabinet.[45] A similar operation is carried out in connection with a 'video

stream' of his diary films. This experiment is called 'Blind Annotation'.[46] The viewer tags image sequences as the video is played. By pressing the replay button, the film is replayed, showing only the tagged passages. The viewer's interactivity, under heavy constraints, creates a new cut of the film.

These experiments address and problematize the differences between human processing (perception and experience) and algorithmic processing. What comes in, what comes out? How do human and machinic processing work together? How do these collaborations transform the object? Or, as in the latter case, how does it transform the human into something else, while at the same time questioning the transformation? What is semantically significant? As the user in the Blind Annotation probe has to tag the file on the fly, the user's brain is called upon as a reflex mechanism rather than as a contemplative reader of, say, a book. The hasty tagging may be said to mimic the super-fast operations of algorithms. A human script runs alongside a machinic script. The human user becomes a robot-like archivist or a digital workforce tagging and reassembling files according to more or less subconscious impulses. The title of the project seems to cover this becoming-machine of the user quite well: 'Blind Annotation'. While *Constant*'s probes with pictures show how sorting algorithms work as pseudo-human archivists, Dataradio and Blind Annotation show how a human user can become a pseudo-sorting algorithm. From a semantic perspective, however, the output is of a different kind. Hence, the active archive opens up an interactive space as a precarious zone where the human user slides toward becoming machinic and the machine towards becoming human. Implicitly, this reflects upon the various human-machine assemblages instantiated in file processing.

It also bears resemblance to the way in which Kurenniemi defined his obsession with archiving as both a biological *and* machinic drive. He called himself a 'self-flagellation machine'. The personal drive to make an archive and new media's drive towards archiving produce a series of new individuations. *Constant* shows how these drives not only operate between an archivist and his tools but operate across time and space as relation-making practices through a politics of sharing.

Sharing and social memory

What happens to social memory in a time of altered connections between humans and technologies? Today, memory needs to be rethought in relation to a more general politics of life. The proliferation of discourses that view

technologically mediated life as a self-constituting entity are understood by many critics as a key symptom of a new form of biopower.[47] If the new emphasis on life issues is at times taken to indicate the return of 'real bodies' and 'real materiality' – a new metaphysics of presence – it is more precise to say that the new biopower is premised on revised conceptions of the body as well as of materiality. There is, for instance, a tendency to see an extension of life principles and biological functions in the realm of digital technologies. Eugene Thacker writes, 'the major problem concerning life has to do not with its definition … but with the very *plasticity* of life, [as] a shape-shifting quality.'[48]

Such renegotiation of the question of life is a key feature of computing history. In its early stages, computer scientists suggested that intelligence (in Turing's version) and memory (in von Neumann's version) were not exclusive to humans and could be reconstructed in a computer. Now, Thacker explains:

> The very concept of life itself begins to dissolve and dissipate, while still remaining in use and in circulation. What if life is not assumed to reach its pinnacle in human life? What if life is only incidentally, and not fundamentally, an anthropocentric phenomenon? And what if life actually has very little to do with the presumed self-evident nature of the living?[49]

Such insights are fueled by phenomena such as biocomputing and the development of biosynaptic computer chips and are becoming part of standard medicine. Thacker uses the term biomedia to discuss the 'technical recontextualization of biological components and processes.' The body is reconceptualized as 'compiled' through modes of information processing, modeling, data extraction, and *in silico* simulation.[50] Kurenniemi prefigures such 'compilations'.

Both Kurenniemi and *Constant* imply that life can express itself through a series of materialities and media. Indeed, there are many possible ontologies of life today, and they also recall Thacker's notion of a 'superlative life' which exists at different stages in history going back to certain ancient vitalist positions where life is seen as 'that which flows or pours forth.'[51] Here, life is 'distributive, pervasive, and outflowing.' Life is 'at once everywhere and nowhere, a pure excess and generosity, and yet in itself not any one, single, individual instance of life.'[52] Aspects of this notion reappear in biomedia practices that resituate life in relation to media. Here, life relies no longer on the 'wet lab' but the 'dry lab'; biology is done '*in silico*'. Life expands into

media technologies and their specific features and affordances: 'If the encoding process carried patterns of relationships across material substrates, then the recoding process will extend the functionality of those encoded or translated data in ways that are specific to the medium.'[53] This implies that 'the generosity of life is itself irreducible and unlimited, though the particular manifestations of life may in and of themselves be constrained.'[54]

Kurenniemi's work may be a symptom of the general questioning of 'life' identified by Thacker, but it is important to distinguish between Kurenniemi's ideas and other visions of technologically aided afterlife. On the one hand there are ideas about biological afterlife secured through various forms of cryonics; on the other hand we have ideas about afterlife secured through information technologies and artificial intelligence. Kurenniemi clearly belongs to the latter strain, as seen in his technical conception of the material body: 'Man is a machine. A machine produced by evolution. I find it impossible to think that for mere nostalgic reasons, such a slime-based system would be preserved,' he says in an interview.[55] Yet the specificity of his project resides less in such a vision of body/machines than in his emphasis on life as memory – seeing the personal archive as a point of departure for the potentially continued life of an autonomous entity. Essentially, he believed in future computers' ability to turn the remains of a personal archive into some kind of consciousness. He seems less interested in the emerging field of bioinformatics where both the biological (genes) and the computational (codes) are conceived of as informational structures.

In the latter part of his active life, Kurenniemi increasingly took interest in an ecological perspective in which flesh-based life on earth is viewed as detrimental to the environment. He believed that artificial forms of consciousness could be stacked in small balls and sent to outer space: cultural heritage would be salvaged in the sense that these balls of consciousness could enjoy the Earth's past as some kind of digital entertainment in outer space. He also discusses the politics of cloning and how certain democratic freedoms can be sustained in a posthuman artificial world of clones and extraterrestrials.[56] In this respect he was several decades ahead of many of his compatriots who have only recently started working on what they call the constitutional rights of extraterrestrials.[57]

Constant's online version of Kurenniemi's life is severed from any direct association with the extraterrestrial aspect of his afterlife. They do not talk about consciousness or artificial intelligence. Their horizon of operationality belongs to the Internet culture. Unlike *Constant*, Kurenniemi was prevented from experiencing the way in which digital networks have turned life into a series of interconnected events. In the transition from

early computing to Internet culture, 'life' is extended in a variety of ways and associated with the ongoing researches in biocomputing. While Turing and von Neumann were interested in computational explanations of human-centred attributes such as intelligence, learning, or memory, biocomputing focuses on molecular processes. At this level, 'life' is both non-human and intelligent. Life is both an automatic process and an intelligent process in the way it relies on heritage, memory, and interaction with its environment. It is informational and networked. Modern biology represents, in other words, a shift in the human-computer relation from an emphasis on mind (and cognition) to an emphasis on 'life' as articulated in complex networks. Thus in the 'PC era', computing is seen as nonconscious and distributed, and as a parallel to *life* rather than to mind, cognition, and intelligence.[58] *Constant* foregrounds this trajectory by capitalizing on the inherent life of files, their dynamic sociality. In *Constant*'s work, Kurenniemi's life becomes extended as a networked entity. He is shared, distributed, and transformed by a network of users and producers. This development is allied to the social turn within computation, and it also comes with a catch. As Jose van Dijck writes, making the web social actually means making 'sociality technical' – a development that some would see as another instance of the instrumentalization of social relations.[59] *Constant* is aware of this and endeavours to project an alternative to a homogenizing sociality by instantiating Kurenniemi's 'life' through a hacker ethos based on the use of open source code. How does this transform the concept of social memory?

Archives and collections have always been part of cultural memory, but as archives become digital, they become more dynamic and potentially more like *social* memory. No longer relatively stable storage systems, archives increasingly figure as dynamic living systems, constantly transformed and updated, constantly the object of mergers with new informational clusters and programs. The work of *Constant* is focused on bringing out the living or social dynamic in the technological infrastructure of digital archives. The group's microscopic work on the life of files in a world of shared data show how the presence of a file, the file in question, does not simply testify to a unique singularity but to a multiplicity of past, present and future actions. The file is, so to speak, the 'undead of information', an 'enduring ephemerality'.[60] It is always the result of undead layers of *actions at a distance*.

After Gabriel Tarde, we can investigate how social memory works in a deeper, more pre-cognitive way. Memory is whatever creates some form of association or connectivity. Such associations are not found 'in' society but constitute the social link as such and may be mapped by tracing

movements of imitation and invention.[61] The impact of the newspaper in the nineteenth century made Tarde speak of imitation as a form of 'action at a distance' – a perspective that has become even more relevant with the introduction of electronic media technologies.[62] Influence 'at a distance' works in, through, and around our connected lives, our *file lives*. *Constant* shows how such dynamics of imitation and invention are capacitated and exploited through digital technologies, generating new connections along the complex pathways of 'living' files. The politics of sharing advocated by *Constant* shows not only how Kurenniemi's files always already existed in connected, disassembled, and reassembled cartographies of socio-technical memory arrangements but also that such arrangements are always battlefields. Algorithms and codes are not neutral tools that neatly implement whatever is given to them – they constitute a transformative field of constant renegotiations and reconnections.

Constant's politics of sharing, analyzed in this chapter, shows that what differentiates one memory assemblage from another is to a large extent a question concerning different ways of assembling the sociality of files. The art and media group's three modes of sharing – sharing the file, sharing the knowledge of sharing, and sharing the knowledge of the users – is an approach to memory that underscores the active involvement in the new technological infrastructure of memory events. The new technologies do not represent a dead repository or a neutral tool for memory, they are rather a living system where memory itself becomes a mode of action. As we have seen, software is not simply mathematics but a consolidation of long traditions of knowledge, memory, habits, and techniques of ordering and remembering. As they are implemented in shareware (FOSS), memory becomes action. *Constant* foregrounds the *eventness* of memory by entering the operations going on both inside and outside the files. These are operations that make the files speak and remember, work, connect, and transform themselves. *Constant* does not see the archival document or file as a single static entity, an image or a text to be preserved and classified in a static dead repository according to its unique singularity; it activates the file in its living multiplicity and brings out its networked condition through events of associations and connections where a single file no longer simply represents an image but a series of complex arrangements and operations (DCFs, JPEGs, RGBs, and a series of FOSS), each with their own controversies that can be readdressed directly by well-targeted algorithmic operations.

Kurenniemi wanted his life archive experiment to become a template for mankind. He did not know how it would be remembered or continued, but he devoted much of his intellectual life to projecting the ways and

means of doing it. Interestingly, several of the Kurenniemi videos used in Mika Taanila's documentary film show Kurenniemi talking about his life archive at parties and among friends. He opened up his archive and shared his ideas whenever he had the chance – and recorded his sharing. In this way, Kurenniemi's archive was social, improvisational, and reflexive from the start. The files contain a self-reflexivity that projects a series of possible future trajectories. *Constant* does not monumentalize Kurenniemi into an object to be commemorated but opens up the files to a multiplicity that demonstrates their dynamic sociality as well as their ability to produce future memories.

Notes

1. Cox, Malevé, and Murtaugh, p. 125.
2. This is how *Constant* presents itself on its own website: 'Constant is a non-profit association, an interdisciplinary arts-lab based and active in Brussels since 1997. Constant works in-between media and art and is interested in the culture and ethics of the World Wide Web. The artistic practice of Constant is inspired by the way that technological infrastructures, data-exchange and software determine our daily life. Free software, copyright alternatives and (cyber)feminism are important threads running through the activities of Constant. Constant organizes workshops, print-parties, walks and 'Verbindingen/Jonctions' meetings on a regular basis for a public that's into experiments, discussions and all kinds of exchanges.' See Constant (n.d.a).
3. Cox, Malevé, and Murtaugh, pp. 133f.
4. Ibid.
5. On this notion of *arché,* see Ernst, 2013, pp. 57, 101, and 124.
6. Latour, p. 112.
7. Kurenniemi quoted in Taanila, 2015, p. 298.
8. Kurenniemi, 1971.
9. Kurenniemi's most extended published study on these visions ends by concluding thus: 'The material world, the planet and its biosphere, the human body, all the material things, will be conserved in the planet-size museum, but our true descendants will be algorithms and data structures encoded by immaterial bit strings, roaming free of their slimy origins. It will be great fun. Pity I won't see it' (Kurenniemi, 2015b, p. 168).
10. Thacker, 2010, p. ix.
11. See Kurenniemi, 2015, and Wiener, p. 36.
12. All Kurenniemi quotes in this section are from Taanila, 2015, here pp. 293 and 298.
13. Ibid., p. 299.

14. Ibid., pp. 298.
15. Ibid., p. 299. See also the development of this idea in Kurenniemi, 2015b, p. 159.
16. Ibid., p. 302
17. Ibid., p. 303.
18. Ibid., p. 300.
19. According to Kiasma curator Perttu Rastas (2014), the Kurenniemi archive currently contains (all figures are approximations): 5,000 pages of 'autobiographical' notes (his diary notes are contained in about 20 handwritten books and a few hundred pages on a computer and a few hundred pages written on a Newton MessagePad from 1994), 5,000 pages of science drafts (some of them in his diaries), 20,000 pieces of ephemera (tickets, shopping lists, tax return documents, etc.), 17 metres of boxes in archive shelves containing letters, webpages (printouts), and journals, 100,000 pictures, 500 hours of video/film, 100 hours of cassette recordings, 14 experimental films (all made in the 1960s), 10 self-made electronic instruments (synthesizers) and 'computers', five LPs (mostly electronic and syntheziser-based experimental music originally on tape reels), an unknown number of gadgets, games, and recorded discs, three cameras (one 16 mm camera from the 1960s and two video cameras) and seven old computers (Apple II, the original Macintosh 1984, some other Macs, two Newtons, and a lot of computer junk). The collection is as yet unavailable for the general public except for the snippet views presented at venues like Documenta 13, Kunsthal Aarhus, and at Kiasma in Helsinki. For even if Kurenniemi himself wanted his entire archive to be made public, this has been prevented due to legal concerns, such as protection of the privacy of various people documented in his archive. Hence *Constant*'s preliminary archival probes are one of the few publicly available portals to his life archive. Two larger scholarly anthologies deal with his work: Mellais (2013) and Parikka and Krysa (2015). Kurenniemi's music recordings are only partially in circulation. Excerpts of some of his films and science and synthesizer presentations are available on YouTube, and a feature film by Mika Taanila (2002) portraits Kurenniemi's life and includes several excerpts from his films.
20. Constant (n.d.b). As there is not one single entry to their archive, a good place to start is Constant (n.d.c) and (n.d.d).
21. This topic is covered more generally in Røssaak, 2010.
22. Vismann, p. xiii-xiv.
23. Ibid., p. xiv.
24. Ibid., p. 164.
25. Wikipedia, n.d.a.
26. There is indeed an affinity between the politics of open source code and the early hacker ethos of the 1970s with its keen awareness of a new politics of memory. One of the early hardware hacker communities in San Francisco was called the Community Memory project. They took 'the Hacker Ethic

to the streets,' as Steven Levy has put it. They set out to establish a decentralized network for sharing computer hardware in communities outside bureaucracies and manufacturers. See Levy, p. 157.

27. On 'frameworks of memory', see Halbwachs.
28. In connection with Constant's work on the "archive" of the artist Guttorm Guttormsgaard, Wolfgang Ernst calls Constant's approach "experimental media archivology". If media archaeology is also an aesthetic practice, Constant's "probes" are veritable examples (see Ernst, 2015, p. 10). My approach seeks to analyze Constant's work as also more than media archaeology; their call for open source software and what I call a 'politics of sharing' transcends most media archaeological approaches.
29. Hippel, p. 124.
30. Andrea Hemetsberger discusses different practices of sharing within FOSS communities. See Hemetsberger, 2012, p. 117-130.
31. Cox, Malevé, and Murtaugh, p. 127.
32. See the probe at Constant (n.d.e) and its commentary Constant (n.d.f).
33. An 'infuriation event' is Alexander Galloway's way of characterizing a key feature of digital media's dynamic structure. See Galloway, p. 171.
34. See Constant (n.d.g).
35. Constant (n.d.h).
36. See the Pyexiv2 library (n.d). Constant (n.d.i) explains their use of 'the pyexiv2 library'. There is a rotten link in its explanation, which most likely would refer to where it is downloadable. I found this (Pyexiv2 library (n.d)) site when it was googled. Here 'the pyexiv2 library' is downloadable and explained. 'Python' is an object-oriented programming language. It is called a 'powerful programming language… for scripting and rapid application development in many areas on most platforms.' See Python (n.d).
37. Constant (n.d.h).
38. See Berry, 2011. Michael Murtaugh, a member of Constant, has himself contributed to some of the key works of software studies. Significantly, he glossed the term 'interaction', highlighting among other things the 1960s idea of 'giving (untrained) groups and users 'live' contact with the machine'. See Murtaugh, p. 143.
39. Constant (n.d.j).
40. This is a great challenge for any archive working with digital material. Several international archival initiatives for standardizing routines for working with old formats are currently being developed for libraries and archives globally. See IFLA among others.
41. JPEG (seen most often with the .jpg or .jpeg filename extension) is a commonly used method of lossy compression for digital images, particularly for those images produced by digital photography. The degree of compression can be adjusted, allowing a selectable tradeoff between storage size and image quality. JPEG typically achieves 10:1 compression with little perceptible loss in image quality. (Wikipedia, n.d.b)

42. Constant (n.d.k).
43. 'The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue.' (Wikipedia, n.d.c.)
44. This analysis can also be extended to include the fact that manufactured software also involves a subaltern workforce in a more concrete way to the extent that software sold in the West is usually produced in China or the South by low paid, often female workers. See Scholz , Fuchs, as well as Huws.
45. The documentation of some of these experiments is available online. The Dataradio is here but currently not working or is incomplete, see Constant (n.d.l). Here is a sample of the annotations: Constant (n.d.m).
46. Constant (n.d.n).
47. See Braidotti (2010), Clough and Willse (2011), Thacker (2004 and 2010), as well as Rose (2006).
48. Thacker, 2010, p. 4.
49. Ibid., p. x.
50. Thacker, 2003, pp. 11 and 15.
51. Thacker, 2010, pp. 49-50.
52. Ibid., p. 27.
53. Ibid., p. 66.
54. Ibid., p. 27.
55. Taanila, 2015, p. 298.
56. See Kurenniemi (2001) and Taanila.
57. See for example this research initiative at The British Interplanetary Society, 2013.
58. The argument follows Eugene Thacker who demonstrates how the 'PC era' or what I call 'Internet culture' is allied more to biocomputing and computing's relation to notions of 'life' and less to Turing and von Neumann's notions of computation as 'intelligence' or 'mind'. See Thacker, 2004, pp. 106-107.
59. Dijck, p. 12.
60. These are Wendy Chun's terms for understanding the life of information in a networked society. See Chun.
61. Tarde, p. 48.
62. The term 'action at a distance' is taken from Newton's law of gravitation; see Tarde, pp. 26, 61-64. Both Lazzarato and Latour have underscored the fact that Tarde's theories have become even more relevant now after the rise of the Internet, big data brokers, and statistical computing.

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Images

Chapter Eight

Mapping the World: *Les Archives de la Planète* and the Mobilization of Memory

Trond Lundemo

They Had to See Paris. And in order to see it, a traditional family from rural Oklahoma who had struck it rich in oil, depicted in a little-known 1929 comedy by Frank Borzage, decides to go there. But why did they have to see Paris instead of New York, London, Berlin, or Tokyo? Because they had already seen it. They had seen photographs in newspapers and films and read descriptions of the City of Light. The image of Paris was the most propagated in the world, and the logic of tourism takes them to the place they already know from visual media. They had to see Paris because they had a memory of the city, even if they had never been there. Even as they decide to cut their visit down to a couple of days, feeling homesick after having covered the sights reproduced in the media, their choice of destination indicates how images of places format memory. The main production value of Borzage's film is a series of views of Paris, which serve to perpetuate the image propagation that makes the rural family want go there in the first place. The simple denomination of Paris in the film's title releases swarms of images and expectations and demonstrates the close relation between memory, images, and topographical location. For this reason, memory always *takes place*, as images are spatial and topographic. I will probe this topographical layout of memories as sociotechnical networks of images by looking at a well-known (psycho-)geographical location, Paris, and the visual construction of its mnemotechnical properties.[1]

As examples of such networked memory topographies, I will focus on the media configurations and mapping techniques of two rather unique productions, separated by almost a hundred years. The first is Albert Kahn's *Les Archives de la Planète*, a collection of photographic images forming an inventory of 'the surface of the globe'. Financed and supervised by the French banker Albert Kahn between 1908 and 1931, it prominently features the city of Paris at different moments during the production of the collection. The second example, also configured as an inventory, is the web installation *Paris ville invisible* created by Bruno Latour and Emilie Hermant in 2004 which portrays the infrastructural composition of networks upholding the City of Light. The 'invisible' aspects of the city are accessible only to a

few, notably the technocrats and maintenance personnel in city planning offices who follow its operations on surveillance monitors, but even so, they subtend the visible aspects of Paris. The difference between the media employed in the two mapping projects – analogue film and photography in *Les Archives de la Planète* and digital interactive installation in *Paris ville invisible* – allow us to approach not just the changing technologies of geographical mapping during the past century but also the different conceptions of memory that underpin these changes. Both cases form heterogeneous media networks in their own right but also display interesting connecting points between image technologies and visual media in a larger context. I will analyze these configurations of images with regard to the specific processes of individuation that they facilitate and discuss them in the light of Gilbert Simondon's theories of imagination and individuation as well as Gabriel Tarde's concept of the 'public' as an eminently modern social formation. For in Tarde's work, the public is notably defined in terms of its capacity to affect and to be affected 'at a distance' – that is, across spatial and temporal boundaries – a capacity afforded by forces of image propagation that may be understood as networks of memory.

Memory as image propagation

Before we move to a discussion of the two media networks mentioned above, the role of the image in relation to memory and the topographical dimensions of this relation call for some elucidation. An image, in this broad sense, is never one but a composite structure, a cluster, governed by interconnectabilities and montages. Images are pre-individual and autonomous beings forming networks of memory through association and propagation. In Gilbert Simondon's view, memory is a form of imagination because it consists of forces and energies and forms processes rather than fixed representations of time and place. Memory is not the 'storehouse of the past', to be retrieved or not by the individual, as described in Freud's theory of the unconscious, but a dynamic process that produces consciousness and subjectivity. Memory is a medium where images act upon each other, agglomerate and multiply, and modulate the present as well as the past for the purpose of future action. Simondon takes as his point of departure the mental image as a relatively independent agglomeration in the human being, but it soon becomes clear that the image transgresses any boundaries between subject and object, interior and exterior, concrete and abstract. He outlines the role of 'object-images', 'aesthetical, prosthetical, technical' in

the process of image formation and propagation and how they play a crucial role in forming collective life and memory.[2] As Simondon notes, imagination (and by extension memory) is a pre-individual vehicle of ontogenetic processes where mental and material images are formed. The life of images starts with spontaneous growth into a framework of motoric tendencies; develops into perceptual patterns that structure experience and serve an organism's adaptation to the world; and finally forms a system of relations, evocations, and mutations that creates analogical and reflexive models of the world.[3] These models are symbols, according to Simondon, in the sense that they are integrated with objects in the world. The universe of symbols is capable of integrating new complete images through synergic compatibility and can open itself up to invention. By incorporating the past, the image makes the past accessible for projection into the future. In the process of multiplying and propagating, images can transform and reinvent themselves and change the ways in which the objective, the subjective, and the social are configured.[4] Images are in this sense eminently political.

Imagination can be turned towards future (anticipation), present (perception), and past (recollection). It should be noted that not only the last dimension of images are concerned with memory, because memory entails also perception and dispositions and agencies for the future.[5] Significantly, Simondon's concept of imagination, and by extension our understanding of memory, is not centred on individual creativity, inventiveness, or ability to retrieve moments and events of the past. Imagination is a process of image propagation – hence its name – in which images act like micro-organisms that invade the mind and body of the thinking and remembering subject at certain times and leave him/her on others. Images, material or mental, can be viral, as we have learned from YouTube and other online video servers, and act like parasites in memory. They are genetic processes that present themselves according to their own proper forces and can act autonomously, with an agency of their own.[6] There is an emergent potentiality to images that allow them to modify and re-arrange themselves as well as the larger arrangement of images we live by.

If images are the matter of memory, it explains how recollections are always in modulation and change. The question of memory is where Simondon meets Bergson, who equally understood matter/memory as streams of images: such images are at the core of memory's regulation of the relation between present, past, and future.[7] For both philosophers, memory and imagination are non-psychological concepts that pass beyond the interiority of the subject; in contrast, image streams, as continuously evolving asubjective perceptions, constitute processes of individuation and socialization.[8]

However, such modes of memory and processes of individuation are subject to alterations and transformations due to changes in image technologies. Simondon is not directly concerned with historical changes within these networks of images in his thesis on imagination, but he is certainly aware of them when he calls for the 'philosophical, psychological and social task of saving phenomena, by analysing the image that they emit, and reinstall them in the becoming and in invention'.[9] Taking the cue from Simondon, I will analyze the mnemotechnical image networks emanating from the two geographical mappings of Paris, with particular attention to the way in which differences in mnemotechnical modes inform the individuation of these projects.

The life of images takes place in sociotechnical networks that change over time and according to context, opening up to analysis specific modes of propagation and mutation in distinct but interconnected visual technologies. The technological image networks of film and photography, which constitutes its own micro-network in the *Les Archives de la Planète*, form one such historical memory layer, while digital photography and hyperlinked text materials in *Paris ville invisible* represents another. As will become clear, however, these networks never operate in isolation but interact with and transform each other. The life of images, and hence of memory, is always intermedial as well as intermediary, connecting technical objects, bodies, and minds with subjects and collectives and the world.[10]

When the image acquires self-motion with the advent of cinema, the connectibilities of images are reconfigured. In an epistemological sense, the montage between images takes on new exigencies and affordances by submitting the spectator to a specifically designed time flow and hence also a specific network of memory and individuation. The emergence of time-based analogue media technologies at the end of the nineteenth century redistributes the connectibilities of the media networks, underscoring the asubjective role of memory and perception. With the distributed networks of the Internet and the feedback loops and recursive programming of computing, memory and individuation is modulated according to a different temporalizing dynamic. Memory is, then, in motion, because the media are changing. Moreover, this change in media does not only entail a shift from 'old media' to new, as in the often proclaimed development from the analogue to the digital, from film to computer, from TV to Youtube or Netflix. The very concept of media is in motion. Computer media not only store and transmit information but actually process it – a procedure that is closer to action-oriented memory than passive storage of data. If the mode of connectivity between images is changing, so are the *specific* processes

of memory and individuation that they afford. But this also means that the concept of 'the public' cannot be taken for granted and neither can related concepts such as 'the audience', 'the mass', and 'the crowd'. In their place we have to identify other and more distinct collective individuations based on the agencies at work in each case.

These concepts are not historical and social stable categories but depict processes of becoming that always proceed through networks of images, media, and people. In Simondon's theory of individuation, collective and psychological individuation consists of forces that expand on and refer back to biological as well as technical individuation by posing problems that cannot be finally resolved and consequently lead to interminable processes of formation. These problems depend on an incongruity between perception and action, between consciousness and body, and lead to a succession of individuations going from metastability to metastability.[11] These processes form the 'transindividual', or what we often call a personality, for a limited period of time. Collective and psychological individuation always proceeds in the relation between a body and the world, a subject and other subjects, and hence on the circuits of the propagation of images that make up imagination and memory. Psychological and collective individuation depend on each other, 'they permit the definition of a category of the transindividual that tends to account for the systematic unity of interior (psychological) and external (collective) individuation'.[12] This unity of the system of individuation proceeds through links between the body and its environment, mental images and object images, making the individual a 'transindividual' in becoming, going from metastability to metastability. The psychological individual as well as the collective are not stable or isolated entities but formed in the process of affecting and being affected by each other.[13] The historical shifts in connectivities between images strongly define these processes of collective individuation.

If Paris is the locus for our discussion of shifting modes of collective individuation, it is because media and memory always entertain complex relationships with places and their history. As Cicero already observed, *ars memoriae* are about assigning what should be remembered to a place and about performing a spatialization of the past. Classical mnemotechnics, as described by Frances Yates in *The Art of Memory*, deploy the 'method of loci', memory palaces, a way of recalling information drawing on visualization and spatialization.[14] Moving images have continued to reshape this topography of memory. The City of Light, eminently visual and visible in the history of painting, photography, and film as well as in literary description, is a privileged place for the formation and propagation of images. It is the

capital not only of a nation or a culture but also of a period of pervasive technological change worldwide. As the 'capital of the nineteenth century' (to use Walter Benjamin's words), Paris is a luminous point of entry for addressing shifting processes of image propagation and individuation.

Les Archives de la Planète

It is not only the case that images install memory through representations of places; different modalities of memory are also produced by different kinds of locations and locational techniques or cartographic procedures. A case in point is the collection of films, colour photographs, and stereoscopes that make up Albert Kahn's *Les Archives de la Planète*, formed between 1908 and 1931 in France – a part of the world-mapping ventures of the early twentieth century. *Les Archives de la Planète* was initiated in late 1908 when Albert Kahn made a trip around the world. While visiting the United States, Japan, and China, he had his chauffeur take photographs and films from the trip. After this trip, Kahn decided to create a photographic and cinematographic archive of the planet and appointed Jean Brunhes, a pioneering cultural geographer, as its director. Between 1912 and 1931, Kahn financed cameramen travelling to more than 50 countries around the world to make this inventory. When the collecting processes were brought to an abrupt end in 1932 due to Albert Kahn's bankruptcy in the wake of the stock market crash, it comprised 72,000 autochromes (a new colour photography process on glass plates invented by Louis Lumière in 1907), 183,000 metres of film (over 100 hours of projection), and 4,000 stereographs. There are also some 4,000 black-and-white photographs, but their role in the archive appears to be secondary in comparison to the other technologies used. A small part of the film footage was acquired from newsreel companies and was not shot by the Kahn cameramen. The archive was kept intact after Kahn's bankruptcy and even survived the occupation of France, which commenced shortly after Kahn's death in 1940. Almost all of the film material is stored as unedited shots, and only small parts of the material were spliced together for use in Jean Brunhes' courses at Collège de France or the occasional screening for invited guests at Albert Kahn's mansion. The collection was never exploited commercially, and the material largely remained locked up in the vaults of the archive.

The collection is embedded in the globalizing and colonizing technologies of modernity, aiming to construct an image of the world in its spatial as well as in its historical dimensions. Albert Kahn described the project

as an '*inventory* of the surface of the globe inhabited and developed by man as it presents itself at the start of the 20th Century in order to *fix once and for all* the practices, the aspects and the modes of human activity, whose fatal disappearance is only a question of *time*'.[15] This description reveals the topographical dimensions of the project as well as its temporal ones. The mapping of the world takes place at a moment of change, for use in an unknown future when these modes of human existence have disappeared. The visual media employed in this charting of the surface of the globe immobilize and 'fix once and for all' a moment in time. The photographic terminology employed by Kahn announces what André Bazin later will describe as the 'Ontology of the Photographic Image'– a fundamental and eternal human need for the preservation of the past in order to defy death.[16] Moreover, the stylistic prescriptions identified by Bazin for this ontology – long takes, staging in depth, deep focus – are intimately linked with the topographic properties of photography and cinema. What is to be 'fixed once and for all' for Kahn or 'embalmed in time' for Bazin is, essentially, a geographical location.[17]

In most mapping projects, local detail is multiplied until it makes up a coherent world map. In a geographical world atlas, the map of the globe is broken down into separate sections of continental, national, regional, and municipal scope.[18] Brought together, the different parts of the atlas are supposed to form a coherent and comprehensive map of the world. This interconnection between the local and the global, the social and the national does not only apply to the spatial dimensions of Kahn's project. Kahn's collection is also a historical map. Certain places and regions are included in the 'archive' at different times and given intervals, producing a historical cartography, a network of world-encompassing techniques of control that inscribed the local in a larger global system and the single event in world history. In such an approach, cinema unifies the eagle's perspective with that of the fly.[19]

If *Les Archives de la Planète* is a geographical and historical mapping project, it is only by stretching the sense of the term that it can be called cartographic. There are, of course, a plethora of cartographic techniques in different cultures throughout history, but the collection makes no use of cartographic maps of the kind that was shaping geographical representation and imagination at the time it was produced. No maps in the ordinary sense of the word form a coordinating interface for the collection, nor are maps inserted in the films or photographs as means of orientation or links between places. The presence of cartographic maps was a convention in fiction and documentary films at the time, deployed in order to situate

the individual shots within spatial coordinates and to create a continuous world of the film. In this sense, cartography is often allied with the unifying embedment of the shot in classical editing.[20] In the relative absence of editing of the film shots or sequential ordering of the autochromes, the singular images in Kahn's collection present us with a fragmentary world, isolated islands of spaces as places and time as events. If there is a cartographic principle to the organization of the shots and autochromes, it is closer to the loose juxtapositions of places and times known from ancient Japanese and other oriental maps, where fragments of space are separated by amorphous clouds, lakes, and streams (a mode of cartography that Albert Kahn would have known well through his fascination with Japanese culture). A compelling image of this dissociative organizational principle can perhaps be found in its adjoining gardens in Bolougne-Billancourt in Paris, whose forking paths lead abruptly from the Japanese to the English garden and further into the French garden, the blue forest, and the 'prairie'. This garden is an integral part of Kahn's geographical mapping project, in the sense that it forms a heterotopic collection of places on the site of the archive, but like the films and autochromes, it disregards any latitudinal-longitudinal coordinates in its layout.

There is also a temporal dimension to this mapping, as some locations, especially in Paris, are filmed or photographed by Kahn's cameramen on repeated occasions. This is partly motivated by an awareness of historical change, sometimes actualized and sometimes anticipated. In the area around the Arc de Triomphe, there are films shot before the First World War to document contemporary life, traffic, and fashion. During the war, the location was intensely photographed and filmed, along with the rest of Paris, in the fear that the approaching German forces may ruin the city. The streets were populated with a majority of women, as many men were drafted and killed in the war. The celebrations at the end of the war mark a new layer of the historical sedimentation of the place, followed by the baby boom a couple of years later. Towards the end of the 1920s, changes in fashion and a dominance of automobiles shape the urban landscape. These updates of the visual identity of a place at irregular intervals, functioning as superimpositions of images of the same place at different times, emphasize how *Les Archives de la Planète*'s geographical mapping of the world is inseparable from a historical and temporal mapping.

There are a few rare shots in the archive that highlight this temporal superimposition of the same place at different times in a physical image. A film of 50 seconds called *Superimposition Test* (*Essai de surimpression*) (AI20405), from November 1920, presents clouds passing over shots of the

Arc de Triomphe and the Panthéon. Camille Sauvageot, the cameraman employed by the project who most often conducted technical experiments, also shot superimposed films at different speeds. In *Place de la Concorde* (AI120347) from October 1923, only twelve seconds long, he superimposed night scenes of lights and cars in fast motion with shots from the same camera positions during daytime in normal speed. This layering of the temporality of 'normal' perception with the technological time of cinema, which he dubbed 'the master of time and scales', is repeated in two 1926 films of similar length: *Avénue de l'Opéra le soir* (AI137517) and *L'arc de Triomphe* (AI120266). Sauvageot also directed a series of colour films in 1929, but these experiments are exceptions in the collection. Still, they provide a visual metaphor for the multi-layered temporality informing the project.

As it happens, the concept of temporal superimposition also informed *Les Archives de la Planète* as a whole. The project was to a large extent made for a context that remained unknown at the time of its creation. It was rarely shown or exploited, had no fixed future use in view, and was created as a kind of time capsule, addressing a spectator or user in an unknown future when the world inscribed in the films and photographs had disappeared. The films and the photographs were, in other words, not intended for a contemporary public but for a time when the relation between the individual and the crowd or the mass might be a very different one due to a transformation of the modes of life inscribed in the collection. While photography and cinema have been powerful tools for formatting social memory in general, and in the twentieth century in particular, these images sought no immediate impact on human memory but rather constituted a 'living memory' for the future. Of course, any archive and collection has a future use as its motivation, but most often they consist of documents that are already embedded in a social context and that attest to particularly significant moments in the past. Since Kahn's collection deployed cinema and photography to chart a vast and fragmentary world of life forms, it invests the archive with a wholly new temporality. This archive is made for a future world, for future collectivities.

This locational projection into the future is what makes *Les Archives de la Planète* an aberrant 'archive'. The organization of the collection, with its lack of editing between film shots or a fixed order between autochromes and moving images, removes it from the cartographic logic that informed the colonial and globalizing projects of its time. Instead of creating physical connections between images, places, and dates, there are only virtual connections to be actualized or not at some future moment. The project simply eludes the representational ambitions of most other mapping projects at the

time and proceeds according to a disjunctive logic. While archives are usually defined by rules of selection that determine what to include and what to discard, as well as universal principles of indexing and ordering, *Les Archives de la Planète* is a cartographic project in the unusual sense evoked by Gilles Deleuze in order to describe the work of Michel Foucault. Kahn's collection is diagrammatic, in the sense that it forms 'a spatio-temporal multiplicity' that is 'co-extensive with the social field' and that superimposes 'history with becoming'.[21] Of course, Kahn's collection does not map the diagrams of power through an exposition of the visible and the sayable, as Foucault does in his archaeologies and genealogies. However, the dissociative logic in the connections between shots and autochromes as well as its projection into an unknown future elude the representational primacy in other archives and mapping projects. If we recall the processes of individuation and memory that Simondon identified in the image and apply them to Kahn's collection, we might read Deleuze's diagnosis of Foucault's cartography as a description of Kahn's mapping project:

> ...every diagram is intersocial and in becoming. It never functions to represent a pre-existing world, it produces a new type of reality, a new model of truth. [...] It makes history by undoing previous realities and significations, constituting points of emergence or creativity, unattended conjunctions, improbable continuities. It doubles history with a becoming.[22]

The forces and energies unleashed by the propagation and transmutation of locational images compose circuits of memory that go beyond the historical or the predetermined notion of place. Such a cartography contrasts with French historian Pierre Nora's famous concept of *lieux de mémoire* – the extensive externalization of memory in static representations of places, dates, and events that characterized a modern obsession with memory and the problems of remembering. The concept identifies a shift in history and historiography in a French social context as late as the 1930s.[23] With the end of rural communities and the advent of mass media, a 'real' memory invested in life – what Nora called *milieux de mémoire* – gives way to a memory shaped through monuments, archives, institutions, and dates. In the place of a memory embedded in the gestures and spaces of a community, the *lieux de mémoire* are erected because spontaneous memory is lost and 'we must deliberately create archives, maintain anniversaries, organize celebrations, pronounce eulogies and notarize bills because such activities no longer come naturally'.[24] They are 'the rituals of a society without ritual'.[25]

Hence, a memory that is immediate, natural, real, and part of life is contrasted with a memory-history that is constructed, artificial, and external. Many of the distinctions between true memory and externalized memory echo those of Plato: where Plato's media critique focused on writing, Nora identifies 'the trace, the immediacy of the recording, the visibility of the image' as the problem. 'What began as writing ends as high fidelity and tape recording', Nora claims, without noting the line of descent from Plato's argument.[26] The key role played by cinema in this process becomes clear in Nora's choice of metaphor: 'Indeed, we have seen the tremendous dilation of our very mode of historical perception, which, with the help of media, has substituted for a memory entwined in the intimacy of a collective heritage the ephemeral film of current events.'[27] This dilation of perception is exactly the propagation of images constituting memory and imagination itself.

There has never been a true and real memory separated from media nor a 'life' independent of tools, technologies, and spatial constructions, and this is why memory itself has a history. In Nora's account, however, it appears eternal and stable up until a very recent date. Not only is this account premised on a distinction between human internal memory and technological, external memory; it also produces an image of the social as a distinct entity, criss-crossed by channels of communication, rather than as emergent agglomerations of forces, where technologies function as living memory networks.

In their organization, the images in *Les Archives de la Planète* are intimately connected to places and the time of their recording, but this by no means implies that these images-places, still or moving, are fixed in time and space. Since images are always acting on each other, propagating, modulating, and undoing themselves, their connecting points and constellations are always changing. An image of an event is never fixed but in constant motion because other images are always affecting it. The constant accumulation of images in the collection each time assigns a new place to the single shot and autochrome and relocates it in new circuits of propagation. One example could be the many films of socialist and communist meetings and manifestations. The socialist meeting in support of Russia captures the crowds outside the Wagram theatre in Paris in November 1920 (AI138016), and it may or may not be seen in conjunction with the film of the delegates in the Third International Congress in Tours a month later (AI107253). A conventional documentary on social and political movements would edit these shots together with the footage from the Manifestation of the Communist Party on the occasion of the death of Lenin in Saint-Denis, Paris, in February of 1924 (AI138063). In this collection, however, no one has

made these montages, and there is no way of determining how they would relate to each other. Any other juxtaposition is equally possible, making the montage a virtual aspect of the images, to be realized or not in some future. The individual films and photographs in Kahn's collection may lend themselves to representations of individual persons and specific crowds at given times and places, as has been done in various recent documentaries – for instance in THE BBC TV production *Edwardians in Colour: The Wonderful World of Albert Kahn* (2007). However, as an aggretate of potential connections and disjunctions, Kahn's images are instead a resource for the type of virtual associations that constitute memory in processes of collective individuation.

Judiciary and administrative archives store documents that have a legal and bureaucratic political function. As Cornelia Vismann has shown, it is only after their use has changed and they no longer exert the same political power that they become documents for historiography.[28] Historians then make use of the documents to reconstruct the ways in which they were once active and exerted power. Both while in use and as historical source materials, archival documents form precedence for future decisions or offer a means of scrutinizing authority. In contrast, *Les Archives de la Planète* is devoid of any such history of usage. It deploys the visual media of its time to make an inventory of the world but does not collect documents that have been in use. For this reason, the techniques of inventory invest the collection with a memory that is more cartographic, or better, diagrammatic, than institutional or individual. They aim at an inscription of forms of social life but are never themselves part of the social context they seek to document. It is a collection without a social history, very much in contrast to the way almost all other film and photography archives or collections are a monument to an epoch, a nation, or a social movement.

If images are endowed with a particular capacity for propagation and association, the associational or social forces of the Kahn archive are also infinitely delayed. There is an intentional anachronism in the images from the outset, since the images are mobilized only at the moment when they diverge from the social life they purportedly represent. The deferred propagation of memory is perhaps best exemplified in the various shots of Paris mentioned above, where the Kahn cameramen visit the same places again and again at different times to inscribe a changing social world. Paris is comprehensively mapped before the First World War, and the life of the city is again recorded through the cameras when the post-war fervour is taking place and on other potentially life-changing occasions. Rather than seeing this lack of an 'original' social context as an obstacle to analysis, it presents

an opportunity to reconsider the mediating functions of images and to chart the mobilization of memory in the deferred time between shooting and showing, collecting and exhibiting. The images did not contribute to the social memory of their time, as they were seldom shown or projected. The collection was indexed according to the nations, regions, and cities where it was shot, and it adheres to the topological principles of historiography. However, it would only become active as a network of memory once the social modes of life inscribed in the collection had disappeared. It is premised on an insurmountable leap into the future, a mode of action at a (temporal) distance. In this sense, the collection not only has change or difference built into it, it even contributes to the very disappearance of social life forms by which it is motivated. The new media of film and photography are powerful forces in the globalization observed by Kahn and contribute strongly to the changes in local cultures that this process sets about. The life of images always creates feedback loops in relation to the world they are sensed to document, but in *Les Archives de la Planète,* where the temporal dissociation between the 'inventory' and the world is the impulse for the collection itself, these recursions create superimposed temporalities. The media are themselves propelling the end of what they document by inscribing a place and time that will only emerge as such once it has disappeared, once the map no longer fits any terrain.

Les Archives de la Planète is invested with a latency where the connections between images remain virtual. This suspension of the propagation of images is an important aspect of Simondon's concept of collective individuation. Psychological and collective individuation is caused by problems that biological individuation cannot resolve: an incongruity between perception and action such as the relation to the environment and other individuals or the consciousness of death. Collective individuation intervenes as a deferral or slowing down of the processes of vital individuation where these problems emerge. Simondon describes these processes as a bending back to pre-individual and individual individuations – a kind of regression that creates types of collectives based on the transindividual realm that includes the environment as well as other individuals.[29] The networks of images involved in these processes operate according to intervals and suspensions, as Bergson also identified in the streams of images and matter. These disjunctions form a becoming that is 'co-extensive with the social field' (to quote Deleuze's description of Foucault's diagram) rather than a stable and resolved representation of the world.[30]

The Kahn archive, then, provokes juxtapositions between its images and the geographical sites as they look today, and this was part of Kahn's

intention. However, he probably did not foresee that the material recorded with the new media of his time – autochromes and films – would become accessible in another medium only. Since most of the shots in the archive only exist in one screening print due to their lack of exhibition, and since the autochromes could only be reproduced through re-photographing, the material has been almost entirely inaccessible until today. The archival imperative of digitization has made the documents accessible only as a world in bits. The *FAKIR* database, available on the premises of the Albert Kahn Museum, and its small web version *Mappemonde*, still wanders between the local and the global, the small event and the historical panorama, the individual and the nation.[31] Indexed according to continents and nations –as most film histories are –on a world map interface, the shots and photographs seem to contribute to the traditional cartographies of world geography and history. The digitized images of *Les Archives de la Planète*, which in their fleeting analogue constellations eluded representations of crowds, places, and events as fixed entities, are in a very literal sense reterritorialized. Their interconnections depend on relays between places and historical periods, such as the pre-war years, the battles of First World War, the post-war years, etc. The interface of the *FAKIR* and the *Mappemonde* databases reproduces the traditional coherent and totalizing representational strategies of the atlas and cartographic mapping. In an age of increasingly privatized and individualized reception and representation, however, as epitomized by television, the personal computer, and the Internet, the 'inventory' made by and for Kahn's archive resurfaces in a different format within another mode of life. The media technical affordances emerging from these new connective modes of networks inevitably also inform the way they operate. Alongside the traditional representations of place in the database interface, there is a simultaneous deterritorialization of the relations they impose. These current processes of memory and collective individuation in digital networks are the topic of the web installation *Paris ville invisible*.

Mapping the invisible city

When the social theorist Bruno Latour returned to the photographic inscription of Paris almost a century later, the city had become mute and invisible. Bruno Latour and Emilie Hermant's 1998 book *Paris ville invisible*, with text by the former and photographs by the latter, was made into a web database in 2004 which demonstrates and analyzes this shift in the image of the

crowd and of the city. The reason why Paris is invisible is that every aspect forming the logic of urban networks takes place 'under the surface of the world', in city planning offices and bureaucratic institutions. The once so luminous city, with its monuments and institutions, eludes representation through fixed inventories of places and crowds. *Paris ville invisible* already announces its representational limitations in its title. This is not because the web installation is overwhelming or beyond the grasp of the subject. The pictures and the text can actually be entirely covered in a few hours. The title of the book and web installation is instead designed to address the concept of visibility rather than to be taken literally. Why would Latour and Hermant make a 'photographic inquiry' if Paris had really become invisible? The invisibility only concerns one layer of visuality, and the project aims to make another visibility stand out.

The City of Light has not given way to the 'City of Bits', as argued by William Mitchell in his book from 1995, as the streets and monuments of Paris still co-exist with the urban roles of computer surveillance and infrastructural operational images.[32] Latour and Hermant aim to make another level of the visual composition of the city apparent, one that is normally hidden to the inhabitants and visitors of the city and that is only visible to a few. This is why they call their web installation an 'oligopticon', and the project is in this sense intensely concerned with visuality and visibility: to make visible the images one doesn't normally see and to investigate how these images subtend the intensely propagated images of the city informing the memory of Paris. *Paris ville invisible* is an archaeology of a globalizing image that depends on other images and especially on the networks they create. The tourist attractions and monuments propagated all over the world, the images that make people want to 'see Paris', are only the surface layer of a connective network of images and media subtending them. The continuities between the city and its representation in film and photography – a de facto monumentalization of the city in cinema theatres and museum galleries – change once the city's images are navigational means in a virtual as well as an actual urban space. Places of transit, designed to be anonymous and non-specific as well as emptied of memory, form key parts of the 'invisible' Paris in Latour and Hermant's oligopticon. Their project is to analyze these subtending images with an emphasis on their social or connective dimensions.

Adapted to the digital techniques of the web installation, these alternative views of the city are exempt from 'social life' as ordinarily understood. The streets are empty. The life of the city is now found in the offices for infrastructure and city planning and their operational images

for controlling traffic and surveillance of the city. Operational images tracking traffic and automated work processes, rarely seen and perhaps only *read* by an individual salaried worker, make up the visual panorama of the web installation. *Paris ville invisible* focuses on the new role of images as control tools for the waterworks, sewerage, train services, and public safety –images that propagate a very different form of memory than the cartographic representation of the city. These images do not display the sites and monuments of the arguably most remembered city of the world but instead become functional through intermittent yet continuous updating: they are mapping a Paris in motion.

The control rooms for traffic and public safety surveillance are populated by screens that change at regular intervals, where human or automated reading devices are programmed to react to certain changes in the images. These networked images constitute processes of memory thanks to the way in which they are interconnected, updated, and read by stored algorithms that respond to emerging data. Such memory networks thus depend on computing operations whose microtemporalities are beyond the grasp of the human sensorium: even more so since a change in the composition of the image or in the constellations between the different constituents of the network produce recursive effects in the image networks. These image networks operate through feedback loops and transmutations: operational images never stand alone. They only function through interoperability, and their links and connections instigate a form of memory that is continuously updated with a view to future action.

In Latour and Hermant's description, the city has changed from 'the City of Light' into an opaque city, but this does not mean that it cannot be traced through digital means. However, their database project provides little reflection on the way in which the media used for the web installation also form part of this reconfigured visibility. In reality, the physical properties of the digital camera for the inscription of (the city of) light constitute a radical change in social techniques. The images and texts of the web database cannot implement the continuous updates and recursions of the image networks they depict, and consequently they resort to a different temporality. The website is constructed so as to create connections between the iconic views of Paris and the networks of images that subtend them, but they cannot implement the updating and feedback that make the interconnections operable. The images are the same as when the installation was put online in 2004, and the itinerary through the designed pathways remain stable. The movement of the single images is restricted to navigation within a frozen panorama where the user may pan across the

landscape: there is no movement in the image itself. By clicking on the text at the bottom of the image, the whole of the text is superimposed over the image, and the still images lend themselves to a variability of movement at the user's impulse of navigation. The interconnections between the images and the texts may change according to the navigation of the human agent, but the pre-established order between images and texts remains fixed. This can be understood as an unavoidable concession to the online installation format, where the processual dynamics of the operational images are irretrievable. The archival logic of the web installation had to sacrifice such dynamics, but it may still pinpoint important changes in the collective modalities of these image networks. The introduction to the piece reads:

> Paris, the City of Light, so open to the gaze of artists and tourists, so often photographed, the subject of so many glossy books, that we tend to forget the problems of thousands of engineers, technicians, civil servants, inhabitants and shopkeepers in making it visible. The aim of this sociological opera is to wander through the city, in texts and images, exploring some of the reasons why it cannot be captured at a glance.[33]

According to Latour, Paris has probably never been visible at a glance, as it has always relied on the networks and actors forming the city. The opening image of the web installation's indicated pathway is a shot from the top of the Samaritaine department store which can be panned 360° by moving the cursor to the left or right edges of the image. The adjoining text reads:

> 'You can find anything at the Samaritaine' is this department store's slogan.
> Yes, anything and even a panoramic view of the all of Paris. All of Paris? Not quite. On the top floor of the main building a bluish ceramic panorama allows one, as they say, 'to capture the city at a glance'. On a huge circular, slightly tilted table, engraved arrows point to Parisian landmarks drawn in perspective. Soon the attentive visitor is surprised: 'But where's the Pompidou Centre?' 'Where are the tree-covered hills that should be in the north-east?' 'What's that skyscraper that's not on the map?' The ceramic panorama, put there in the 1930s by the Cognac-Jays, the founders of the department store, no longer corresponds to the stone and flesh landscape spread out before us. The legend no longer matches the pictures. Virtual Paris was detached from real Paris long ago. It's time we updated our panoramas.[34]

The revelatory panorama of Paris that opens and ends *Paris ville invisible* fails to make a representational inventory of the city: 'it no longer holds any attraction, and gives no information'. Since Latour and Hermant produced their web installation, the Samaritaine has closed, and the blue ceramic panorama is no longer accessible, if it is even there. So perhaps it is also time to update the web oligopticon. The key point of *Paris ville invisible*, however, is that the temporal logic of the panorama itself has changed. It is no longer a question of just replacing the panorama of Paris with a new one and including the Centre Pompidou and other changes in the surface cityscape. In the final 'station' of the indicated pathway of the installation, it returns to the panorama presentation:

> The term Virtual Paris doesn't refer to the downloading from the Web, the complete disembodiment, ultimate modernization or final connection that is the stuff of hackers' dreams; on the contrary, it means a return to incarnation, to virtualities. Yes, the power is invisible, but like the virtual, like the plasma, like the perpetual transformations of the Pont-Neuf. […] We suddenly notice that if we spoke of Paris, the Invisible City, it was, essentially not simply to combine social theory with a photographic inquiry, but to give back, in a little beauty, some of the lavish splendour that the City of Light has in store. Paris scan, Paris can.[35]

This new beauty of Paris resides in its capacity for new incarnations rather than representations. Latour's Paris is a network of social and technological mediators, couplings, and relays. The operational images surveying traffic and sewer systems, shopkeepers, and mailmen are parts of the same network as the photographic images in the web installation and the inhabitants and the visitors that navigate the city through paper maps, signs, Google maps, GPS, or Google earth searches. *Paris ville invisible* charts the city as a memory that is being reconfigured at the bureaucratic and technological levels every day.

Incidentally, *Paris ville invisible* was itself invisible for a period: the URL of the web database, <http://www.bruno-latour.fr/virtual/index.html>, had expired in the fall of 2011 and only returned a 'page not found' message.[36] Web retrieval is always unreliable, and any page can disappear at any moment, and it was perhaps in anticipation of expired links that Latour published the web project as a text-only PDF book, with the caution that: 'This text is not understandable without the pictures. It is provided simply to help those who have difficulty tracing the complete legends on the web.'[37] The sudden invisibility of the web installation demonstrates the ambiguous

visibility upholding these networks addressed in Hermant and Latour's title. They subtend the 'official' and stable representations of the city and yet operate beyond the thresholds of perception, thus instigating different forms of collective individuation. The infrastructural networks integrate technological and human forms of memorizing by operating in terms of the connective forces of memory itself. The individuating capacities of images are thus folded back onto the representations of Paris, now investing them with a virtual dimension. *Les Archives de la Planète*, through its deliberate time lag between shooting and projecting and the disjunctive logic between shots and autochromes, also operates according to a diagrammatic mode of mapping, where the connections constitute points of emergence and invention. 'It doubles history with a becoming' that is 'co-extensive with the social field'. The futural logic of Kahn's cartographic project is now realized at the level of media infrastructure.

Collective individuation and the public

In *Les Archives de la Planète*, the media of autochromes and film contrast and complement each other in order to make an inventory of the social modes of life at the time of shooting for a time to come. Like a time capsule, the surface of Paris at a given time was to be compared and contrasted with Parisian life in an unknown future. However, this visual information is unleashed at a time when archival image technologies operate according to a different processual logic. Today, the images of the collection are only accessible in digitized formats and through digital interfaces. Kahn and Latour's respective cartographies thus reveal two different yet intersecting approaches to the life of images. Kahn's mapping of Paris, or any other city in his collection, is oriented towards a future when the map no longer matches the terrain. Where Latour evokes a Paris of the past, as represented for instance by the panorama on the top of the Samaritaine, it is only to fold the city's infrastructural connections and relays back onto its representations, inscribing these representations within a processual and connective dynamics.

Both mapping projects form temporalizing image networks, but they produce different types of collective individuations. The temporal deferral in *Les Archives de la Planète* seems to entail the type of individuation that, according to Simondon, takes place when the individual is confronted with a world in which perception and action becomes incongruous, i.e. a 'problem' in Simondon's terminology of individuation. The experienced lack of continuity

between the historical world and its anticipated, undefined present can only be resolved with recourse to the environment and other individuals. Since imagination and memory are key elements in all processes of individuation, the suspension of image propagation invests such processes with a diagrammatic becoming that is co-extensive with the world itself. Along similar lines, *Paris ville invisible* depicts memory as a virtual power of incarnation in which temporal images network themselves. The connections and recursions between images are determined by processes beyond human perception and action, but they still constitute collective individuations. The problems Simondon sees as characteristic of this mode of individuation always refer back to biological and technical individuation as a kind of regression to pre-individual individuation.[38] These different individuations are distinguished by degrees rather than processual forms: also technical individuation encounters incongruities with the environment that produce concretizations of technical objects.[39] As a principle, individuation must consequently be understood in terms of processes of deferral and quantum leaps, metastabilities and recursions, and not in terms of specifically human or machinic substances.

These processes of individuation, actualized by Kahn's and Latour/Hermant's image networks, consequently demand that we understand the concepts of the audience, the mass, the crowd, and the public in new ways. The instances of metastability we often refer to as the person, individual, and collective are not pre-existing or subjected to these processes. They are isolated fields to be described and analyzed, since they only exist within these very individuating processes. Such insights confront us with a very different social ontology than the one underpinning, for instance, the Frankfurt School. If we understand individuation as processes of memory operated through the propagation of images, we also have to think about the media networks historically, as different network forms produce different modulations of memory and images. Collective memory was always in motion since it is formed through ontogenetic processes where images propagate and transmute like micro-organisms, but the velocities and technologies of connectivity have undergone radical changes. These shifting velocities and connecting points between images – material and mental, past and present – have reconfigured and transformed the very idea of what is communal and social.

For Simondon, collective individuation is a function of the affectivity between living organisms, objects, and technologies.[40] Such affectivity is the matter of images –'material' as well as 'mental'– and the way in which they propagate, act on, and transmute each other. Collective individuation is in this sense a continuous process of affecting and being affected according to the connectivity between elements in image networks. This capacity for affecting

and being affected also informs Gabriel Tarde's concept of 'a public' formed by a dynamics of imitation and invention. In a move that prehends certain aspects of Simondon's concept of individuation, Tarde finds invention at the intersection of (or disjunction between) two imitative trends. In contrast to the concepts of crowds or the mass (*la foule*), Tarde's concept of the public depicts the capacity to affect and be affected over a distance but congregated in time.[41] This theory of the public is developed in the years between 1893 and 1901, with reference to the impact of newspapers and more generally the development of the printing press, the railway, and the telegraph.[42] Yet these are also the early years of cinema. With its many different forms of distribution and exhibition throughout history, individual and collective, from 'peep show' to projection, cinema is instrumental in forming the 'public' as a temporal social formation.

Les Archives de la Planète implements collective individuations in similarly temporal terms – through a suspension of memory and the introduction of a latency in the propagation of its images rather than fixed spatial representations of places and crowds. By inscribing history within a logic of becoming and by giving the document an explicitly multitemporal mode of existence, *Les Archives de la Planète* forms an idiosyncratic archive of its time. It is perhaps a paradox that when this archive is just re-emerging in a medium able to support dynamic processes of connectivity (the digital databases *FAKIR* and *Mappemonde*), Kahn's project is reterritorialized and stabilized as representations of places and events of the past. The current version of his cartography forms a coherent historical and geographical atlas; the disjunctions between the shots have been edited into self-sustained narratives and the differences between the media of the archive have been smoothed out. Instead, it is an entirely different database memory of Paris that points us in the direction of what might perhaps be a more appropriate interface for the Kahn archive. *Paris ville invisible* produces connections between images that themselves have the status of infrastructural memory networks, defined by the time-critical feedback processes of collective individuation.

Notes

1. I call Paris a psycho-geographical location to emphasize how it also has a place in memory and consciousness. The term calls forth associations to the *dérive* of the situationist movement and their psychogeographical maps (and Guy Debord's 1955 psychogeographical map of Paris in particular), but I will not pursue a further elaboration of the situationist theory of specta-

cle, the city, maps, and memory here, as it would lead to a clouding of the theories of place and memory I am focusing on in this context.

2. Simondon, 2014, p. 16.
3. Ibid., pp. 18-23. For a discussion of the ontogenetic role of images in Simondon's philosophy, see Väliaho, pp. 91-93.
4. Simondon, 2014, p. 13.
5. Ibid., pp. 15-21.
6. Ibid., p. 7.
7. Which is, of course, not to say that their philosophies of the image are identical: Simondon doesn't conceptualize a 'plaque sensible' or a centre of indetermination halting and making cuts in the streams of images, and he notes how Bergsonian intuition only partly accounts for the processes involved in the genetic cycles of imagination leading to invention (ibid.: 23).
8. The whole of Bergson's *Matière et Mémoire* [1896] treats this problem; see pp. 11-17 for an introduction to the thesis.
9. Simondon, 2014, p. 14.
10. When Simondon persistently refers to images as 'intermediary', he uses the term differently from Bruno Latour's distinction between 'intermediaries' and 'mediators'. An intermediary is for Latour 'what transports meaning or force without transformation: defining its inputs is enough to define its outputs', while with mediators, 'their input is never a good predictor of their output; their specificity has to be taken into account every time' (Latour 2005: 37). Simondon is also concerned with the agency of elements within networks, but he understands the intermediary role of images, material and mental, as transmutations, propagations, and deferrals where the output is never decided by the input – in other words, along similar lines as Latour understands mediators. This is clear from his first paragraph in *Imagination et invention* (*1965-1966*), where he claims that images 'present themselves according to their own forces, inhabiting consciousness like an intruder who comes to disturb the order in a house where he has not been invited' (ibid.: 7).
11. Simondon, 2005, p. 29. Simondon's concept of individuation is explained and discussed in Chateau, pp. 45-64.
12. Simondon, 2005, p. 29.
13. Chateau, p. 59.
14. Yates, pp. 27-30.
15. Albert Kahn quoted in Amad, p. 144 (my italics).
16. Bazin, pp. 9-17.
17. Tom Conley points out this 'cartographic' property of Bazin's aesthetics in Conley, pp. 6-8.
18. Teresa Castro employs the atlas metaphor to describe Kahn's endeavour in '*Les Archives de la Planète*: A Cinematographic Atlas'.
19. Siegfried Kracauer sees the interdependence of these two perspectives as the ideal for modern historiography and illustrates the method with

cinema's constant shifts between the establishing shot and the close-up. See *History: The Last Things Before The Last*.

20. Of course, there are many exceptions to this general assessment, as analyzed by Tom Conley in his mapping of cartographic cinema.
21. Deleuze, pp. 42-43. Tom Conley also draws on Deleuze's discussion for his discussion of maps in films (pp. 10-14).
22. Ibid., p. 43.
23. Nora, p. 11.
24. Ibid., p. 12.
25. Ibid., p. 12.
26. Ibid., p. 13.
27. Ibid., pp. 7-8.
28. Vismann.
29. Simondon, 2005, pp. 152-153. See also Chateau, pp. 57-58.
30. Deleuze, p. 42.
31. http://albert-kahn.hauts-de-seine.net/archives-de-la-planete/mappe-monde.
32. Mitchell.
33. Latour and Hermant, 1998, p. 1.
34. Ibid., p. 2.
35. Ibid., p. 103.
36. It was back online by the spring of 2013, accessed 8 April 2015.
37. Ibid., p. 1.
38. Chateau, pp. 57-58.
39. For a discussion of the interdependencies between different forms of individuation in Simondon, see De Boever et al., pp. 36-45.
40. Simondon, 2005, p. 165.
41. Tarde.
42. 'Ainsi s'est formée, par un faisceau de trois inventions mutuellement auxiliaires, imprimerie, chemin de fer, télégraphe, la formidable puissance de la presse, ce prodigieux téléphone qui a si démesurément grossi l'ancien auditoire des tribuns et des prédicateurs.' (ibid.: 12).

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Chapter Nine

Stills from a Film That Was Never Made: Cinema, Gesture, Memory

Pasi Väliaho

Among their myriad of powers, images may become propellants of memory - dynamic, even explosive materials that force the bullets of remembrance and imagination into motion, conscious or unconscious.[1] One particular photograph so triggered the flights of my thought as I encountered it, quite accidentally, whilst browsing through the Yad Vashem photo archive online.[2] The photograph affected me strongly and has obsessed me since, causing a sort of historical reverie – or nightmare – that I will unravel in what follows. Perhaps the photograph acquired in my eyes the status of what the art historian Aby Warburg called an 'emotive formula' (*Pathosformel*): a temporal and psychic force that with particular affective and corporeal intensity compels the recognition of something that has been buried in oblivion, the return of the repressed.[3]

The photograph spoke to me in at least two ways. On the one hand, I was made to wonder how the past leaves us memories we find difficult to categorize, memories that stir our imaginations of history and obliges us to acknowledge something (in our past as well as present) we normally don't want to acknowledge. On the other, I was led to ask how we become the protagonists of our lives and the histories we belong to; how we become the beings we perceive we are. These questions emanated from the photograph that I felt was seeking to burst the stillness of its frame and that materialized a particular 'memory in motion': the gestures of the characters in the picture were already anticipating their next position, and the photograph itself was to become meaningful only when viewed in relation to the images that (one might imagine) preceded and followed it.

Thus the problem also became one of motion and stasis, of images that move, either in imagination or animated by a machine. There is an enigmatic but compelling statement Giorgio Agamben has put forward that every image can be considered a still 'of a lost film' wherein it regains its 'true meaning'.[4] Every image, on this account, is 'mobile' in the sense that it 'virtually anticipates its future developments and remembers its former gestures'.[5] This is true for the images that live within us, in our dreams, memories, imaginations, and desires; they are never at rest. I started to speculate that perhaps the position of cinema has at some point become so powerful that

also these inner images – including those evoked by our encounters with pictures – have started to follow the cinematic medium's formulaic patterns. The paths and forks of my historical reverie followed this direction: I started to look for the 'lost film' the photograph was part of and simultaneously to question cinema's role in telling us who we have been and who we could be, indeed, cinema's power to mould our actions and make history. What became evident was that cinematic images should not only be considered recordings and revelations of the past but also as memories of the future: as forces that tell us what is or was (if taking a retrospective look) to come.

Two moments

A man and a woman, both dressed and groomed for celebration: an exchange of looks. The man is wearing a Nazi uniform, the woman a black evening dress. The pine trees in the background and the branch positioned on the dining table betray, one can assume, that it is Christmas. A moment of intimacy: we can detect something about the relation between the man

Fig. 9.1: Westerbork, Holland, Camp Commandant Gemmeker and his secretary on Christmas Eve 1943. Photograph by Rudolph Breslauer. Courtesy of Yad Vashem Photo Archive (album no. FA29/153).

Fig. 9.2: Westerbork, Holland, Camp Commandant Gemmeker with his secretary and an SD officer on Christmas Eve 1943. Photograph by Rudolph Breslauer. Courtesy of Yad Vashem Photo Archive (album no. FA29/152).

and the woman that was not perhaps meant to be so obviously apparent. The way their arms almost touch one another suggests amorous tension and desire, the cigarette that burns in the man's hand defying the moment's finitude, hailing its fleeting eternity. The man's gaze is seductive but tender at the same time. How did the woman respond to it? That we cannot directly witness, although she's definitely smiling.

The photograph was taken at the Westerbork 'transit camp' (*Durchgangslager*) in the occupied Netherlands on Christmas Eve in 1943. The man who casts the seductive look is the camp commander SS Obersturmführer (Lieutenant) Albert Gemmeker, the woman his secretary Elisabeth Hassel. The photograph was taken by one of the Jewish inmates, Rudolph Breslauer, who was a professional photographer before he was taken into captivity. Gemmeker gave Breslauer permission to document daily life at the camp with his Leica camera. A range of different kinds of photographic material taken by Breslauer still survives: of manual (and forced) labour in the camp; of Hannukkah celebrations; of the empty bunks in the barracks; of young women dancing; of selected inmates boarding the train that transported them to the east; and of the Christmas Eve celebration in 1943 that was organized in the SS mess hall.[6]

Fig. 9.3: Frame enlargements: Elisabeth Hassel and Albert Gemmeker.

But to go back to my question: how did Frau Hassel respond to camp commander Gemmeker's gaze? With a similarly affectionate and seductive look, as we can witness in a photograph that must have been shot only a few seconds before or after the one I started with (fig. 2). Crucially, the exchange of looks was captured as if in a cinematic shot-countershot (fig. 3). The work of editing that combines these two moments into a continuum, however, has in this case not been relegated to an apparatus but is the duty of the observer's imagination. Here, images come together and get juxtaposed and blended with one another through a spontaneous mental power of montage that composes the textures of memory and perceptions of the past.

What is striking in the way these two photographs communicate the past is that they seem to tell a story that is quite different from the ones we ordinarily associate with the Holocaust: no visible signs of suffering, death, and horror. Neither piles of corpses nor of clothes they left behind, no starving and naked bodies, no chimneys or railway tracks. The fates of those who were transported to the death camps in the east (including Breslauer and his family, all of whom were killed, except for his daughter, in Auschwitz in 1944) rather colour the pictures like an afterthought. The imagery we are familiar with today, made especially after the liberation of the camps, looms only perhaps as a series of ghostly apparitions that our contemporary gaze returns to these photographs. These are, nonetheless, mere retrospective superimpositions. The victims of the persecution are significantly absent from the documentation of the Christmas Eve, the reality of the genocide perhaps being, from the viewpoint of the perpetrators, a matter of duty and of the everyday one wants to forget momentarily during an evening of celebration. The photographs seem to want to betray, even cancel the world they come from, emanating from a psychic space

where one can act out one's dreams and desires, no matter how absurd and horrific the circumstances.

The two moments captured on photosensitive emulsion speak of a world that seems as oneiric and detached from (historical) reality as a Hollywood script. The man and the woman were, indeed, lovers, but Frau Hassel was married to another man (Gemmeker's adjutant, we are told). A powerful drama thus plays out through Breslauer's photography worthy of mainstream cinematic clichés. Here, crucially, when perceived in a cinematic continuum – a continuum that defies the image's evidentiary function and instead 'burns imagination to heat up reality'[7] – photographic images reveal an essential aspect of their own making. They can even testify to, if not bring forth, a realm of possibility, of forgetfulness and fantasy, which is carved out of the present moment's facticity. We learn from psychoanalytic theory that the temporality of the psyche's reservoir of images, desires, and meanings, which translate into reality as our actions, is different from the linear sequence of events we often call history. Defying the consciousness of time's course (and, by consequence, of death), these phantasmatic productions are forces that can make time stop and disjoint the individual from her/his habitual dwellings.[8]

The amorous looks, the cigarettes: each belong to a dream space carved within a general nightmare. But where did they learn these poses? Where do these gestures come from?

Cinematic doubles

'So perhaps we could try to get married once again?' a man asks a woman. Paul Wendlandt, a lieutenant in the Luftwaffe, has been wounded in action, and his lover Hanna Holberg, a famous singer of Danish origin, has


Figs. 9.4 & 9.5: Frame captures from *The Great Love* (*Die Grosse Liebe*, 1942).

Figs. 9.6 & 9.7: Frame captures from *The Great Love* (*Die Grosse Liebe*, 1942).

come to see him. The couple was to have married three weeks prior to this day, but Paul got suddenly called to the Eastern front where his plane was subsequently shot down. Now this brave man is back on German soil healing his wounds in a hospital in the mountains. The lovers' amorous encounter is captured in a series of shot-countershots (figs. 4 and 5) that results in a kiss (fig. 6), which is interrupted by a fleet of bombers crossing the sky. Paul and Hanna follow the spectacle in awe before Hanna responds to the marriage proposal with a nod and a smile, and they both gaze anticipatively but confidently at the sky (fig. 7).

This is how Rolf Hansen's *The Great Love* (*Die Grosse Liebe*) ends. The film premiered in 1942 and soon became one of the most successful UFA films of the Third Reich. It starred Zarah Leander as Hanna and Viktor Staal as Paul. Staal and Leander (who was also a hugely popular singer) were Nazi Germany's key cinematic icons, at the forefront of the popular dramas that filled the German *Volk*'s imaginary. In *The Great Love*, they are lovers whose marriage attempts are constantly put off by the uncertain conditions of the war and would perhaps be completely thwarted were it not for Hanna's devoutness and forbearance.

But why I am looking at this final scene of *The Great Love* in conjunction with the photographs of the Christmas Eve celebration at Westerbork? Of course, we don't know whether Gemmeker and Hassel ever saw *The Great Love* (was there even a movie theatre in the town of Westerbork?). However, the resemblance between the couples comes across as striking: stars and starlets groomed in the UFA studio in Berlin appearing in Nazi Germany's scrapbook of ideal social types on one side, and on the other, petty functionaries of the most powerful machinery of death in history, located in a remote camp in the occupied Netherlands. The former are clearly not murderers, whereas the latter couldn't have been completely

Fig. 9.8: Frame enlargements: Elisabeth Hassel and Zarah Leander.

blind about the deathly roles they played. Yet these individuals seem to be cast in the same mould: tall blond men in uniform, brunette women whose haircuts and picked eyebrows are almost identical. One cannot fail to see how much their postures are alike (fig. 8). Hassel and Leander's eyes bear the same spark of affection (even if the former's is a bit more mischievous, lacking perhaps the token of devotion we can read in the latter's). And it is almost as though Gemmeker was about to ask his secretary on that Christmas Eve in Westerbork in 1943: 'Will you marry me?'

Leander and Staal are clearly acting out a script, but could it be that Gemmeker and Hassel are, too? Is that how history works and how we become protagonists of the films that we call our lives – through a mimicry of gestures that mark at once our freedom (potentiality) as well as our submission to destiny (necessity)?[9]

Gestures on screen

In the 1960s, anthropologist André Leroi-Gourhan put forward a powerful thesis about the prominence of gestures, alongside speech, as primary expressions of the mind - collective and individual, conscious and unconscious. Leroi-Gourhan saw how any culture is based on a certain repertoire of gestures that gets repeated and conditioned between individuals. Gestures, he argued, are organized into 'operational sequences' that are 'borrowed from a collective tradition that one generation passes down to the next.'[10] These sequences establish a form of collective bodily memory

that guarantees gestures their social function as well as meaning. From the carpenter's skilled hand movements utilizing a saw to the bodily expressions of courtship – from the use of tools to aesthetics – the organization of the body's movements into culturally coded manners is a matter of learning to cope with the material environment as well as becoming a member of society.

Even if gestures have played this social and mnemic role throughout millennia, one might argue that it was not before the introduction of modern moving image media that their dynamic became a matter of systematic recording, dissemination, and standardization as well as of new mutations and differentiations across the planet. Art historian Erwin Panofsky observed already in the 1930s how 'it is the movies that mold, more than any other single force, the opinions, the taste, the language, the dress, the behaviour, and even the physical appearance of a public comprising more than 60 per cent of the population of the earth.'[11] It is not certain where Panofsky got that figure (60 per cent) but the crux of his argument is clear: moving images operate as external forces or attributes that we assimilate into our habitus and that begin to take charge of our collective gestural programmes.

Cinema's intimate relation with the habits of moving and gesticulating was likewise observed by Marcel Mauss. Suffice it to recall the often-quoted passage from his 1935 essay 'Techniques of the Body', in which Mauss recounts an uncanny observation he made whilst lying ill in a hospital bed in New York:

> I wondered where I had seen girls walking the way my nurses walked. I had the time to think about it. At last I realized that it was in movies. Returning to France, I noticed how common this gait was, especially in Paris; the girls were French and they too were walking in this way. In fact, American walking fashions had begun to arrive over here, thanks to the movies. This was an idea I could generalize.[12]

And Mauss goes on to think about how societies are built on 'prestigious imitations' whereby the 'individual borrows the series of movements of which he is composed from the action executed in front of him, or with him, by others'.[13] Social life is a question of the embodiment of shared patterns of movement, of common styles of acting and doing. Through this imitative behaviour, society in a sense 'writes' a person into its textures; gestures function as the *graphein* (marks) that form the basic elements of this writing.

Also worth considering is the fact that Mauss seems to make no difference between the gestures people learn from others in so-called real

life and those they absorb from the movies. The silver screen is in a sense transparent in Mauss' account. The movie theatre appears above all as a global educational institute organized around circa 90-minute lessons in bodily pedagogy, which people leave moving their hips, legs, bums, arms, shoulders, and heads differently than before but in a curiously uniform fashion. We can perhaps, following Leroi-Gourhan's vocabulary, speak of particular cinematic operational sequences that become inscribed into the codes of bodily comportment, even into people's definition of themselves and their location of themselves in the world.

On a personal note, one that lends itself to such a conceptualization, I remember how at primary school (at the age of seven or eight) we used to spend the breaks between lessons playing in the snowdrift on the schoolyard and mimicking the characters from the *Star Wars* film series. One child was moving, gesticulating, and speaking like R2-D2, another fencing like Luke Skywalker, and so forth. Who was playing what character depended on the roles that each person had within the group's hierarchy. What is important here, however, is that I don't think many of us had actually seen any of the films (there was no movie theatre in my small town, and VCRs were still scarce), so most of my classmates must have come to know the characters only from secondhand accounts. But it is precisely through this type of contagious mimicry, if you will, that the ethereal play of light and shadow on the (cinema or televisual) screen acquired material reality, or more generally speaking, images became cultural and cognitive forces.

Do images thus operate as contagious elements that move with/in our bodies as much as on the screen?[14] When talking about gestures as forms of imitation (and, by implication, about the power of cinematic images), Mauss did not mention the French criminologist Gabriel Tarde's seminal work on the topic. This is curious, because Tarde was the first to position imitation as the basis of the formation of societies. 'All resemblances of social origin in society,' Tarde argued, 'are the direct or indirect fruit of the various forms of imitation, custom-imitation or fashion-imitation, sympathy-imitation or obedience-imitation, precept-imitation or education-imitation; naïve imitation, deliberate imitation, etc.'[15] Tarde's point was that a society's makeup could be explained by these spirals of mimicry within which shared beliefs and desires become transmitted from one individual to another and translated into modes of doing and thinking. Tarde argued that these beliefs and desires, anchored in a collective memory of images and gestures, are passed from one person to another through suggestion. Imitation is based on an individual's fundamental openness to others, on the porousness of our composition as ready to absorb, beyond conscious control, energy and

influences from the environment. This porousness is what Tarde's references to the hypnotic state and the notion of suggestibility crystallize: the impossibility to distinguish between imagination and reality as well as between images coming from the outside and the mind's internal productions.[16] In this sense, social life is composed of a dream-like imagery, one that everybody acts out in concert with others: 'The social like the hypnotic state is only a form of dream, a dream of command and a dream of action. Both the somnambulist and the social man are possessed by the illusion that their ideas, all of which have been suggested to them, are spontaneous.'[17]

Social life is imitation, and imitation is 'somnambulism', Tarde summarized.[18] Indeed, for me and my classmates playing *Star Wars* in the snowdrift, this held true: the gestures of popular film had been assimilated into our everyday reality, into the frames of our perception and comportment, and perhaps even into our desires. Importantly, this imitative behaviour doesn't concern children only but, in Tarde's terms, the 'social man' in general. From this angle, then, we can draw similarities between Zarah Leander in *The Great Love* and Frau Hassel at the Christmas Eve party in Westerbork, for instance, and so recognize resemblances that are perhaps 'uncanny' in the sense of something that is familiar and incongruous or repressed at the same time: the repetition of a film-like scene at the Westerbork concentration camp in people's gestures and postures, and the return of the appearances of these functionaries of death in film stars' and starlets' personas.[19] In this perhaps abrupt montage, we begin to see cinema as an industry of imitation and of a collective 'gestural memory', the images of which quickly spread contagiously from one somnambulist to another, inside as well as outside the movie theatre.

Cinema's historical significance – its place and meaning in defining the contours of our bodies and the world we locate ourselves in – lies in the fact that movies effectively erase the difference between the image and imagination, the reality external to our bodies and what emanates from the inside. As Marc Augé puts it, 'the miracle of cinema is that I don't imagine this image, I see it.'[20] But film theory reminds us as well that the presence of bodies on the silver screen is by no means unambiguous. We cannot touch these bodies (even if they can touch us); an attempt to do so only ends up breaking a spell that we very much try to avoid breaking. The absent or the dead ones keep repeating their lines but don't respond if they are spoken to. Akira Mizuta Lippit summarizes the paradox: 'The body is there as an animated photograph, carrying with it all of the phantasms of photographic reality, but the body, that same body doubled, is profoundly and irreducibly absent.'[21] This absent body becomes doubled – and moved,

made present – by the body of the cinematic apparatus: camera movements (pans, tilts, tracks, etc.) and editing. 'To understand movement in cinema, and gesture in particular, one must recognize the activity of two bodies or sources of movement in cinema,' Lippit points out.[22] The moving camera puts the frame (the spectator's viewpoint) into motion, whereas editing dictates the rhythm of shots and ensures (or alternatively breaks) continuity in space and time.

These two aesthetic operations of camerawork and editing in the final analysis compose bodies on screen: they give bodies their rhythm (style) and unity, that is to say, their phantasmatic presence. This means that the programming of the collective memory of gestures – of what Leroi-Gourhan called operational sequences – in the movies is largely a question of the cinematic apparatus' movements (as mechanical as subtle). Hanna and Paul's love affair finds its reality only as a result of the cut that joins their bodies and their gazes in the shot-countershot. Likewise, Gemmeker and Hassel's scenario becomes conceivable only by means of an (imaginary) montage that sutures the two bodies into a circuit of desire. Any gesture is thus a blend of flesh and bone and screen phantasms. Hence, perhaps, the power that cinematic spectacles have in shaping the contours and frames of our bodies: they amalgamate gestures into a screen fantasy, which for us somnambulists becomes collective reality.

A fantasy of consecration

My argument so far has placed cinema's social as well as historical function (only partly, needless to say) in the medium's capacity to capture our gestures and inscribe itself in the collective memory of movements that we execute mostly out of our awareness – a memory that is made of phantasies (screen presences) as much as so-called real events. But there is an important aspect to cinematic images as 'self-spreading contagions' (to use Tarde's words) that remains to be addressed.[23] Namely, following Tarde's thought, imitation – the ways in which we repeat the gestures of film stars and starlets like puppets of the cinematic apparatus – only explains half of the picture. The other half contains the moment of 'invention' (very generally understood) that inheres in imitative behaviour at least potentially, the germ of differentiation that every act of repetition bears within itself. 'Socially, everything is either invention or imitation,' Tarde wrote.[24] However, in contrast to what the 'either-or' disjunction used by Tarde might suggest, invention and imitation are not mutually exclusive. Imitation

(which, as noted, consists of the repetition of shared beliefs and desires) can involve 'interference' within and between repetitions – interference that in a 'fruitful' case may not simply reiterate the same but create something new, that is to say, make a difference.[25] Invention happens when two (or more) old beliefs, for instance, become so combined that they change in shape, or when the encounter of two desires leads to the transformation of one or both.

What does this imply with respect to conceptualizing the contagious mimicry of cinematic images? Simply that our imitations of cinema's phantasmatic bodies are *in potentia* moments of invention; that our encounters with images can yield transformation – of our perceptions, our desires, even ourselves. This also means that cinema's relation to collective memory (of gestures, in particular) should not only be considered in terms of storage, reiteration, and recollection; importantly, it also involves the anticipation and performance of the future. The potential transformation of our desires and beliefs means the reshaping of what we expect is to come and how we seek to fashion it.

This 'inventive' function of the movies might further explain the position of the likes of Zarah Leander in Nazi Germany's makeup (just as it might explain the power of moving images in any modern society of spectacle – totalitarian or 'democratic'). Let me pause for a moment on this particular starlet's glossy image. Originally a Swedish singer and actress, Leander was perhaps the most famous film actress of the National Socialist period, competing with Hollywood stars like Greta Garbo and Marlene Dietrich. Her position as the iconic female of the Third Reich was nonetheless not uniform, at least in ideological terms. We are told that Leander was never in Adolf Hitler's favour and that Joseph Goebbels didn't like her either. When her salary was cut due to the war effort eating the UFA's budget and her villa in Grünewald ruined in an air raid by the allies, she secretly moved back to Sweden in 1943.[26] After her departure, an article that appeared in the newsletter *Politischer Dienst* for SS and police officers condemned her persona: 'She dealt in a whole new form of eroticism: a cunning mixture of transparent prudery and trivialized lasciviousness. She divulged to the masses how a "great" woman conquers the hearts of men."[27] The Nazi idol of German womanhood – a loving, dedicated, and self-sacrificing wife and mother – became denigrated into a greedy vamp incapable of real feelings: 'If she ever loved, truly and self-sacrificingly, is impossible to say. It seems that for this imported Swede – cool, calculating and cunning as she was – love has never been more than a game, which she played on screen, playing with the confused emotions of an insufficiently educated public."[28]

The description in *Politischer Dienst* crystallized Leander's star image, which wasn't without contradictions. From one film to another, Leander meandered between 'maternal warmth and vampish sadism'.[29] But isn't this precisely why she was populating the screens of the Third Reich? Going back to Hassel, our more or less fictional Leander fan who might or might not have read the condemning piece in *Politischer Dienst*, we can detect a blend of both piety and eroticism in her eyes, which resembles Leander's gestures that combined 'maternal warmth', even 'self-sacrifice', with vampishness (fig. 8). A star image (a screen fantasy) arguably became an object of (more or less) unconscious mimicry, suggesting how the collective body's imitative comportments and individuals' ways of refashioning themselves dealt with conflicting erotic drives.

Critics point out that Nazi cinema was generally focused on 'the rousing, diversion, and re-containment of desires and impulses', that is to say, both the invention and standardization of a certain model of being and doing.[30] One might argue that *The Great Love*'s display of gestures held sway precisely in this purpose. Let me cut to a scene in *The Great Love* where Hanna and Paul meet for the first time. An allied air raid interrupts Hanna and Paul's evening and they go to Hanna's apartment to leave Paul's dog behind before taking shelter in the basement. Just as they are ready to leave, Hanna opens the window onto a blackened Berlin. 'Gosh – beautiful, isn't it?' Paul remarks. Hanna replies: 'Hmm… like in fairy tales.' 'No, much more beautiful – like reality,' Paul corrects. 'Yes. And that's why we now must go quickly to the cellar, because in reality there are shell splinters and bombs,' Hanna urges. But Paul interrupts her: 'And yet, the reality is beautiful, even if there are dangers. Perhaps even *because* there are dangers.'

The last sentence is underscored by Paul's suggestive look into Hanna's eyes (figs. 9 and 10), which is followed by a quick cut to Hanna, whose facial expression is worried whilst at the same time seeming to flirt with the possibility of an erotic encounter as well as with the imminence of death. This shot-countershot is a brief but significant moment in the film, at odds with its overall narrative. For a split second, the couple is toying with the danger that comes from the skies, embracing the possibility of their elimination and its 'beauty'. For a brief moment, one could argue, the world becomes the stage for something much more sinister than a fairy tale of the German nation's triumph: the nearness and indeed intimacy of death as a sexual fantasy.

If the characters were allowed to smoke in Nazi films, this could be the moment that Hanna and Paul light their cigarettes. This is also the moment at which Hanna and Paul's love affair gets further intertwined with Elisabeth

Figs. 9.9 & 9.10: Frame captures from *The Great Love* (*Die Grosse Liebe*, 1942).

and Albert's at Westerbork. The latter's romance is a perverse twist (by no means unheard of, one might assume) on a classic drama, staged in a landscape of horror. If death haunts this love affair and the two photographs that have turned this story into a cinematic scene, it does so precisely by couching itself with sexual attraction and desire. The cigarettes in Gemmeker and Hassel's hands epitomize a compulsion towards life's eventual annihilation in combination with the seductive looks: a dramatic moment within which the sex drive blends with its apparent opposite, the death wish.

Early in his career, Sigmund Freud noticed how gestures work as 'symptoms' or 'derivatives' of the psyche's underlying forces.[31] These forces can be memories of a traumatic nature but also, just as importantly, phantasies that are the building blocks of psychic life and need not have a reference point in the so-called real world, past or present.[32] What phantasies are derived from the above gestures of holding a cigarette, ambiguous looks, slightly fatal facial expressions, etc.? My aim here is not to go into the intricacies of psychoanalytic theory. Let me simply note that these bodily positions and the scenarios they support express a dark and perverse desire of the abolition of life – a desire that in this case manifests itself in a 'state of exception', which the extralegal conditions of the concentration camp in Westerbork particularly crystallize but which we can also feel to be present in wartime Berlin where life's ordinary course becomes regularly suspended by the nearness (and 'beauty') of death.

Thus, the deathly eroticism of gestures in both scenes acquires a political dimension that relates to their particularly 'exceptional' circumstances. Giorgio Agamben has analyzed how modern societies are predicated on a generalized logic of exception that constitutes the political body with its inclusions and exclusions and ultimately allows the eradication of those who cannot be incorporated into the political system.[33] What the state of exception permits is the separation of those considered worthy of political existence

from those who are deemed unworthy of living and can hence be killed with impunity. In Nazi Germany, the state of exception in this sense acquired a particular role in differentiating and separating the German *Volk*, which symbolized life in its vitality, from the Jews, Romani people, homosexuals, and so on, who represented life unworthy of being lived. The death machine of the camps was the extreme expression of this process, where those excluded from the political body were subjected to systematic elimination.

However, this attempt at the reinvention and 'purification' of the German *Volk* had detrimental consequences for the body of the nation itself. As Agamben notes, the process of exclusion that the state of exception makes possible is by definition 'inclusive', suggesting that what becomes excluded from political life appears simultaneously as its intimate interior: the life that is considered unworthy of living enters the core of the political body itself.[34] That is to say, when relegating its others to the forces of death, the German *Volk* also included within itself the germ of its own destruction. Death returned as the 'repressed' (to paraphrase Freud) of the Nazi politics of life. The Nazi political body consecrated *itself* to death.[35]

Perhaps the gestures dealt with above express – or, using Freud's term, derive precisely from – this consecration through which the Nazi political body sought to transform itself. What shapes and, if you will, haunts these gestures is a fantasy of self-annihilation turned into eroticism. Death is the repressed of these scenarios of love, but it is simultaneously life's annihilation of itself that consecrates these gestures. In retrospective, I realize it might have been this thought that flashed involuntarily in the back of my mind when I saw Gemmeker and Hassel gazing at one another in a suggestive manner: that one's own destruction is the collective desire that animates these looks. It is what programmed the Nazi political body's operational sequences, which were rendered in *The Great Love* as a screen fantasy and performed at Westerbork as a real-world scenario. And by extension, to be extreme, it is what appears to programme our gestures of love at large – however tender and beautiful – if we consider the normal from the viewpoint of the abnormal (following Agamben) and take the Nazi political body as paradigmatic of the political space of the West generally.[36]

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I will end here. We all know what happened subsequently when the gestures performed by Gemmeker, Staal, Hassel, and Leander became history, when their freedom became destiny. But let me conclude by pointing out that, if moviegoers are somnambulists, as suggested above, they dream a particular

kind of dream. This is a dream where the projections of light and shadow on the silver screen merge with the psyche's internal productions and where the postures and behaviours of starlets and stars are assimilated into an individual's bodily repertoire – and where thus a 'programming' of our phantasies and gestures, and potentially a process of transformation of ourselves, takes place. In this way, cinema inscribes itself into the collective psyche as well as its mnemic textures.

What is crucial to take into account here is that dreaming, as François Roustang reminds us, is a particular kind of power – a power to configure what the world could become. It is thus not focused on memory in the sense of recollection of the past; instead, it makes a memory of the future. Or, as Roustang puts it, the power of dreaming 'is not in history, but it is the motor of history as the capacity to invent. It is a reservoir of possibilities, which is why it is a power.'[37] The same could perhaps be said about the collective dreaming that happens in the movies. Film-induced somnambulism doesn't come across merely as mechanical repetition but also as a process of becoming. The programming of the bodily memory of gestures and the phantasies these gestures express is a question of the reinvention of ourselves as well as the world around us. Going to the cinema means the (re)discovery of who we could be. We remember ourselves in a different light at the movies.

Cinematic images, when viewed again after their original moment of making, do not come across as simple historical records of what was but is no more. The deictic function of 'that has been' – which we can in certain cases assign to photographic images – as well as the capacity to reveal the reality of the past are missing from cinematic ones.[38] That is because cinematic images, when viewed through the lens of history, are images of what will have been. They speak of memories that were to be made: the reality of the future that the gestures animated on the silver screen were to accomplish. The submissive but simultaneously slightly vampish manner in which Zarah Leander moves her head as she removes her hat and looks into Paul's eyes was a gesture of consecration by which the German *Volk* performed its fate (fig. 11). This might be a crude overstatement, but I cannot help thinking about how this fate – and the dark fantasy of life's annihilation that animates Hanna and Paul's love affair – was similarly played out (with the very same gestures and expressions) by Hassel and Gemmeker at Westerbork, in the way they invented themselves as protagonists of their lives.

Thus, our understanding of the past should encompass these moments where the 'what was to come' was already played out as a screen fantasy. So cinematic images have the power to animate our bodies so that they become historical forces. As Vilém Flusser asserted, cinema 'makes history'.[39] And

Fig. 9.11: Frame capture from *The Great Love* (*Die Grosse Liebe*, 1942).

so our thinking about memory (whether personal or collective, conscious or unconscious) should take into account these memories of the future – these stills from films that were never made.

Notes

1. This essay should be read as a companion to my 'video essay' entitled 'Stills from a Film that Was Never Made', published in *Photomediations Machine* (2014): http://photomediationsmachine.net/2014/06/30/stills-from-a-film-that-was-never-made/
2. See http://www.yadvashem.org/yv/en/resources/index.asp
3. On the emotive formula, see Didi-Huberman, p. 16.
4. Agamben, 2000, pp. 55-56.
5. Agamben, 2008, p. 61.
6. In 1944, Gemmeker commissioned Breslauer to make a documentary film about the camp, to be sent to Berlin as evidence of how orderly his approach to camp discipline and transportation was. This footage is the subject of Harun Farocki's film *Respite* (2007), which has heavily influenced this essay.

7. Jean-Luc Godard, *Histoire(s) du cinéma, 1A: Toutes les histoires* (1988).
8. Green, pp. 167-74.
9. On the gesture in this sense, see Agamben, 'Notes on Gesture', 53.
10. Leroi-Gourhan, p. 253. Leroi-Gourhan, however, emphasizes the 'strongly marked local and individual character' of operational sequences.
11. Panofsky, p. 94.
12. Mauss, pp. 457-458.
13. Ibid., p. 459.
14. For a concept of the image that involves our bodies and minds in addition to technology, see Belting.
15. Tarde, p. 14.
16. On the hypnotic state in this sense, see e.g. Roustang, pp. 76-79.
17. Tarde, p. 77.
18. Ibid., p. 87.
19. On the uncanny in this sense, see Freud, p. 241.
20. Augé, p. 41.
21. Lippit, p. 116.
22. Ibid., p. 117.
23. Tarde, p. 17.
24. Ibid., p. 3.
25. Ibid., p. 382.
26. Ascheid, p. 162.
27. *Beiblatt zum 'Politischen Dienst' für SS und Polizei,* Reichsführer SS, SS Hauptamt, 1943, quoted in Ascheid, pp. 162-163.
28. Ibid.
29. Rentschler, p. 138. Antje Ascheid expands on this: '[Leander's] film characters continuously oscillated between the impulse to pursue their own erotic desires and exhibitionist drives – which were enacted in a radical privileging of the romance-intensive lifestyle of a revue performer – and the ennoblement of self-restraint and sacrifice, which the very intensity of those earlier feelings of passion, either for a child or a lover, might motivate.' Ascheid, p. 170.
30. Ascheid, p. 199.
31. Freud and Breuer, p. 95.
32. On the notion of fantasy in the psychoanalytic sense, see Laplanche and Pontalis, pp. 314-318.
33. Agamben, 1998, pp. 171-174.
34. Ibid., pp. 8-9.
35. Ibid., p. 180.
36. See ibid., pp. 187-188.
37. Roustang, p. 26.
38. See Barthes, p. 79.
39. Flusser, p. 124.

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Chapter Ten

The Archival Promise of the Biometric Passport

Liv Hausken

Throughout its history, the international passport has been an archival practice. As Mark Salter underscores in *Rights of Passage: The Passport in International Relations* (2003), the passport as well as other ID documents have always been a feature of the activity of matching a person to a number through which the particulars of that person can be traced in other records.[1] As Craig Robertson explains, regarding the USA: 'In the 1920s the increased administrative reach of the federal government produced a documentary regime of verification in which documents begat documents to produce official identities verified through the archival memory of the state.'[2] Admittedly, this confidence in the archive contrasts with earlier practices. Even in countries where one had both international passports and checks at the national borders, passport inspectors did not always believe that it was necessary to check the passport and did not always have confidence in this document.[3] Robertson illustrates the latter case with an example from the US borders before the First World War. At that time, immigrants were not required to carry identification documents, even if the federal government had taken control of the administration of the US borders in the late 1870s. Until the outbreak of the First World War, such documents were not thought to provide an accurate determination of an individual's identity. Robertson refers to the documents issued to Chinese immigrants who were exempt from the Chinese Exclusion Act, which the immigration officials apparently ignored. The officials trusted their own ability to verify on the basis of physical appearance the identity of Chinese as merchants and students rather than the distant authority of Chinese government officials and U.S. diplomatic agents distilled in what they considered a questionable document.[4] According to Robertson,

> It was only during and after the World War I that an increased official perception of the value of identification documents led to sufficient enforcement of documentary evidence in the issuance of passports and visas for the U.S. officials then to trust them to provide a useful form of individual verification at the border – that is, to perform the specific role of allowing 'the state' to remember people who crossed the border at official points of entry.[5]

The foundation of the League of Nations and the organization of the first Conference on Passports in Paris in 1920 confirm that this history of the US passport is part of a general shift in the direction of more committed international agreements and regulations of human mobility. This entails objectifying the passport as an archival practice.

Passport guidelines and a general booklet design emerged from the 1920 Paris conference. As the booklet design was developed and implemented during the 1920s and 30s, one may in some sense also consider the passport booklet itself a small archive. It is not just a travel document like the safe conduct pass of earlier centuries, which was a letter including the name of the traveller and the purpose of his mission asking that the bearer not be hindered in his journey.[6] Nor is it just a standardized travel document issued by the state and part of a network of archives certifying that the document of the passport is identical to other documents.[7] The booklet is also a place for the storage of documents and records, a means and method of inscribing, storing, and transmitting information.[8] In addition to the information on the cover page and the identity page that is entered when the passport is issued, there are passport pages reserved for visas coming from different embassies or consulates. These pages also include stamps from passport control officers of both the holder's home country and countries visited, revealing the history of entering and exiting those countries. In some countries, there are also pages for amendments where the issuing country may place travel restrictions, modify conditions for travel abroad, or change the period of validity. The passport not only allows the state to remember people who crossed the border at official points of entry, as Robertson reminds us; the passport booklet is also an archive producing and recording events for the traveller.

Today's passport booklet is in many ways still a small archive. Yet, since more and more regions of the world are opting for passport-free border crossings, one may experience travelling through many countries without having one's passport marked with the stamps or visas. This means that the externalized memory of traveling is now full of holes and missing tracks. What is more, in the contemporary ePassport, the inscriptions of data on a microchip are also subject to archival restrictions. Such registration can only be done at the time of the issuing of the passport. To prevent the data on the chip from being overwritten, a public key infrastructure (PKI) scheme has been implemented to assure the reader of the chip that the original data of the authorized issuer have not been altered in any way.[9] As Wolfgang Ernst points out, 'It is worth remembering that the archive as the condition for our knowledge of history becomes dependent on the media

of its transmission."[10] If we consider the electronic microchip as a medium, it is a medium that enables read-only access. In a certain sense, we may therefore say that the booklet as such (including the chip) is less an archive today than it used to be in its pre-electronic era. However, as an electronic document, today's passport is inscribed in larger and far more complex and mutable archival networks.

This text will investigate the biometric passport as an archival practice. Drawing on conceptions of the archive as an epistemological project (Foucault 1991, 2010), as technology and medial logic (Ernst 2013), as well as a practice (de Certeau 1984), I will show how the introduction of the biometric passport has transformed the passport not only as a tool and technique for regulating mobility but also as a techno-political model of the world. My argument is informed by recent studies of the history of paperwork technologies, like Cornelia Vismann's work on the law and its mutual relationship with the technology of files and Lisa Gitelman's investigation of the document as object of inquiry and epistemic practice.[11] Previous studies of the history of passports and other ID documents have, of course, also been very helpful. Most of these historical accounts focus primarily on the development of the modern state and often end their stories around 1920, which is exactly when the international community recognized the passport as a record for the regulation of identity and mobility.[12] Very little is written about more recent passport history, Mark B. Salter being a notable exception.[13] Even less has been published about the current biometric passport and its technology and materiality, which is the topic of this chapter. By comparing a variety of pre-electronic passports, I will investigate transformations in the archival conditions of today's biometric passport in order to show the way in which it produces a specific conception of individual identity as well as a special condition of social vulnerability. But first, a brief outline of what a biometric passport actually is.

What is a biometric passport?

In 2005 the International Civil Aviation Organization (ICAO) approved a new standard for international passports, now commonly known as biometric passports or ePassports. A biometric passport is a machine-readable passport (MRP) containing biometric information on a contactless integrated circuit chip.[14] The United Nations agency ICAO presents their specifications for machine-readable passports in a document called Doc 9303 Part 1. In its sixth edition in 2006, this document is divided into two

volumes, the first dealing with passports with machine-readable data stored in optical character recognition format (MRPs), the other volume giving specifications for electronically enabled passports with biometric identification capability (ePassports).[15]

The machine-readable passport was launched in 1980 and its specifications published as the first edition of Doc 9303, titled *A Passport with Machine Readable Capability*.[16] The sixth edition of Doc 9303, Part 1, is the first that also indicates regulations of biometric information to be stored on an electronic chip. The machine-readable data refers to two strings of alphanumeric characters printed at the bottom of the identity page. It is formatted in such a way as to be readable by machines worldwide. It is considered a different representation of the data found in the visual inspection zone (VIZ) of the identity page, as it provides verification of the information in the VIZ –data not specifically intended to be read by a machine but by human beings.[17] The two strings of machine-readable data, however, do not duplicate the information offered by the photograph also present on the identity page of the passport. The photographic information was singular and displayed in one format only until the introduction of the biometric passport.

The chip contains all the data from the MRP identity page, a biometric measure of the passport holder, and a security object to protect the data with Public Key Infrastructure (PKI) cryptographic technology and which conforms to the specifications of Doc 9303.[18] The ICAO recommends facial recognition as the primary biometric, mandatory for global interoperability in passport inspection systems, while the finger and iris are recommended as secondary biometrics to be used at the discretion of the passport-issuing state.[19] The biometric measure of the passport holder is, in other words, a measure of the face and sometimes also contains fingerprints or iris scans. The biometric capture of the face is an integral part of passport photography, which explains why one can no longer use one's own photographs when applying for a new passport. The specifications require that biometric data be stored in the form of high-resolution images on a high-capacity contactless integrated circuit (IC), the IC also being encoded with a duplicate of the MRZ data.[20] Since the data in the machine-readable zone (MRZ) already duplicates the information in the visual inspection zone, the biometric passport provides yet another place and format for the registration of information; notably the microchip.

The machine-readable passport represents a shift from human to machine in the verification of the traveler's identity. The biometric passport presents the chip as its primary source of information. The passport inspectors do

not even have to open the booklet to verify its identity. The microchip is coupled to an aerial (antenna), which allows data to be communicated between the chip and an encoding/reading device without the need for a direct electrical connection.[21]

Why biometrics?

What is the reasoning behind the introduction of biometric passports? According to the ICAO's Doc 9303, the biometric passport is a crucial measure for allowing authorities to connect identification papers to the physical singularities of actual human bodies:

> 11.1. It has long been recognized that names and honour are not sufficient to guarantee that the holder of an identity document (MRP) assigned to that person by the issuing State is guaranteed to be the person purporting at a receiving State to be the same person to whom the document was issued.
>
> 11.2 The only method of relating the person irrevocably to his travel document is to have a physiological characteristic of that person associated with the travel document in a tamper-proof manner. This physiological characteristic is a biometric.[22]

Between these two paragraphs, we find the history of the international passport as we know it. The first paragraph is an understatement, since the guaranteed identity between person and document has been internationally recognized as a challenge for more than hundred years. The latter, however, appears as a deliberate misrepresentation, presenting the latest solution to the challenge identified in paragraph 11.1 as if it was simply not the last in the line of attempts at solutions but the first and only. Biometrics is here considered a 'physiological characteristic' relating the person 'irrevocably' to his travel document; the 'only method' of doing this is to have a physiological characteristic of that person associated with the travel document in 'a tamper-proof manner'. The entire paragraph comes across as peculiarly insistent, almost like an incantation. After a century of effort to produce the foolproof passport, one is now determined to finally make it.

In 1920, the League of Nations organized the *Paris Conference on Passports & Customs Formalities and Through Tickets*. The League of Nations was a predecessor of the United Nations,[23] an intergovernmental organization

founded the very same year as a result of the Paris Peace Conference that ended the First World War. The Passport Conference of 1920 was the first League Council Session, and it was at this conference that, for the first time, a set of standards for all passports issued by members of the League was agreed upon.

For many years there had been great variations both in terms of the physiological characteristics to be included in the passport and whether or not the passport should also contain a photograph of its holder. In 1914, the US Secretary of State introduced the requirement that all new passports issued should include a photographic portrait.[24] The British passport required a physiological description of the passport holder in 1915.[25] Although there have been a wide variety of requirements and practices also after 1920, it is from this point onward that we can speak of a transnational history of the international passport. In many ways, this history revolves around the question of how one can relate 'the person irrevocably to his travel document'.

Biometrics essentially refers to metrics related to human characteristics and traits, as seen, for instance, in fetal biometry, where antenatal ultrasound measurements are used to assess the growth and well-being of a foetus. Yet, the concept tends to be used more specifically to refer to technologies that measure and analyze human body characteristics for identification purposes (authentication, verification).[26] Within this operating range, some consider biometrics an appropriate term for 'automated biometrics' only, which is often dated back to the 1960s and related to the computer-assisted registration, storage, and distribution of biometric data.[27]

The physiological information of the passport holder in the 1920s is a biometric as well in the sense that it measures human body characteristics for identification purposes (authentication, verification). This is in keeping with the definition of biometrics in Doc 9303, although the term is not used in this general meaning in this document. In a list of definitions and terms, biometrics is explained as a 'measurable, physical characteristic or personal behavioural trait used to recognize the identity, or verify the claimed identity, of an enrollee'.[28] With this definition in mind, one could say that biometrics has been part of the international passport for about one hundred years.

In his entertaining and idiosyncratic book *The Passport. The history of man's most travelled document* (2003), Martin Lloyd refers to a variety of different practices of relating physiological characteristics of a person to his travel document, one of them being the passport of the Kingdom of Belgium,

which in 1920 required a list detailing hair, eyebrows, eyes, forehead, nose, mouth, chin, face, beard, and height – in addition to a photograph.[29] Many of us remember our passports from earlier decades or that of our parents or grandparents. The Swedish filmmaker Ingmar Bergman opens the short film *Karins Ansikte* (Karin's Face, 1986) with an image of the photograph in his mother's last passport before letting the camera slowly slide down the passport identity page and showing the data that the Swedish authorities at that time (1964) deemed relevant in order to identify Karin Bergman as a person with permission to leave and enter the country: profession (in her case, her marital status), date of birth, place of birth, residence, height (without shoes), colour of hair, colour of eyes. Compared with the biometrics Lloyd refers to in the Belgium passport of 1920, the amount of information is markedly limited. Compared with a more contemporary Belgium passport, we see the same tendency; Jean Chevremont's Belgian passport from 1968 lists profession, place and date of birth, face (shape), eyes (colour), height, and 'special peculiarities' in addition to name, nationality, signature, and a photograph of the passport holder.[30] The biometric passport that the ICAO launched in 2006 further reduces the amount of information. At this point, the only mandatory biometrics is the face.

To be more precise, the face is the only mandatory biometric requirement described *as just this* in Doc 9303. It states quite explicitly that 'Doc 9303 considers only three types of biometric identification systems': facial recognition (which is mandatory), fingerprint recognition, and iris recognition (the latter two are optional).[31] These are the biometrics to be stored on the microchip. However, if we apply the more general definition of biometrics from Doc 9303, there is more biometric information in today's passport than the biometric measures stored on the chip. More importantly, with the biometric passport, biometrics has been given a new status and also some radically new archival premises.

From eye-readable to machine-readable biometric inscriptions

If we first compare the current requirements for mandatory categories on the identity page of the machine-readable passport (MRP) with those of the pre-electronic passports, three or four additional biometric features are significant: date of birth, sex, signature, and, in a sense, also photographic portrait. These are all mandatory for MRPs as well as for ePassports, and they are in line with the abovementioned generic definition of biometrics in Doc 9303.

Date of birth is usually not considered biometric information. Hower, as an indicator of age, it provides some information about the individual even though it is not distinct enough to enable differentiation between two individuals. The same goes for biological sex. Just like date of birth, the sex of the holder may be considered permanent. Doc 9303 provides three categories for the sex of passport holders, 'F for female, M for male, or X for unspecified'.[32] These may, as all categorizations, be discussed and criticized.[33] The point here is to show that biological sex, just like date of birth, satisfies one of the two fundamental premises about biometrically relevant body traits: relative permanence. However, as biometric traits, both date of birth and biological sex suffer from a lack of discriminative power. It is therefore sometimes referred to as 'soft biometrics'.[34]

The signature is the third additional biometric feature that is mandatory on MRPs.[35] Like date of birth and sex, it should be displayed on the data page. For ePassports also, it must be stored on the chip. The signature has been considered a behavioural (rather than physical) biometric modality,[36] and signature verification is still regarded as a poorly developed biometric modality. It is nevertheless considered vital in international passports because of its long pedigree, its considerable legal recognition, and its continued usage in document authentication and autorization related to, for instance, checks and credit card receipts.[37] Comparative approaches to the international requirements specified in Doc 9303 may thus include date of birth, sex, and signature. A possible fourth candidate is the displayed photograph. Different countries or states may also supplement identification features to be displayed on the passport's data page. The Swedish passport, for example, also contains information about the passport holder's height.[38]

If we compare the visible (eye-readable) information about physiological characteristics in contemporary Belgian or Swedish passports with the list of data in Karin Bergman's 1964 passport, we see a significant reduction in biometric information. At first glance, it may seem that all the physical features that a fraudster might easily change and that today's law-abiding citizens are in fact changing on a regular basis –such as hair colour (and to some extent also eye colour, thanks to coloured contact lenses) –have been removed from the list. Only physical traits that cannot easily be altered remain, such as age, gender, and (for the Swedish passport) height.

Yet, as mentioned above, these features are all typical examples of soft biometrics –physical, behavioural, or adhered human characteristics that have been derived from the way in which human beings normally recognize their peers.[39] The substantial reduction in biometric information on the

passport identity page is, then, also a reduction of the types of information that *people* rely on in order to identify other human beings.

Instead, biometric information has been displaced to the chip, to be verified by machines. Certainly, and somewhat surprisingly perhaps, the choice fell on computerized face perception, which is proving to be an incredibly difficult technology to engineer.[40] This stands in sharp contrast to the human ability for face perception, often described as the most developed visual perception skill in humans.[41] Despite this difficulty, the ICAO chose to concentrate on only one body part (the face) and one primary method (facial recognition technology, or FRT), with the option of including two additional features (fingerprint and iris scan).[42] Comparing biometrics in pre-electronic and electronic passports, we now see fewer biometric inscriptions on the human-readable identity page. The current passport is primarily aimed at just one area, which is investigated more thoroughly through digital technologies.

Body, network, state

In addition to the changes in biometric information described above, a comparison between the pre-electronic passport and the current biometric passport (as specified in Doc 9303) shows three major changes.

First, compared with Karin Bergman's 1964 passport, the current ID page in international passports indicates a striking reduction of the *social* dimension of individual identity: profession, social status, children, and residence are no longer mandatory information.[43] There is, in other words, a substantial decrease in *all* the types of information that people rely on in order to recognize and identify other human beings, both biometric and social information.

Second, the list of inscriptions on the ID page inscribes the passport as well as its holder into a network of registries. This applies not just to the passport number (passport registry) and the personal number (national registry) but also to the date and place of birth. *Place of birth* is often used in legal documents, together with one's full name and date of birth, to uniquely identify a person.[44] Place of birth then indicates entries in databases like church records and population registries and refers to individual identifiers like 'personal number', 'social security number', 'Unique Population Registry Code', or else 'Personal ID Code Number'. *The date of birth* – an indicator of age that may be considered biometric information – equally refers to a number of public registries, databases, and archives. As stated

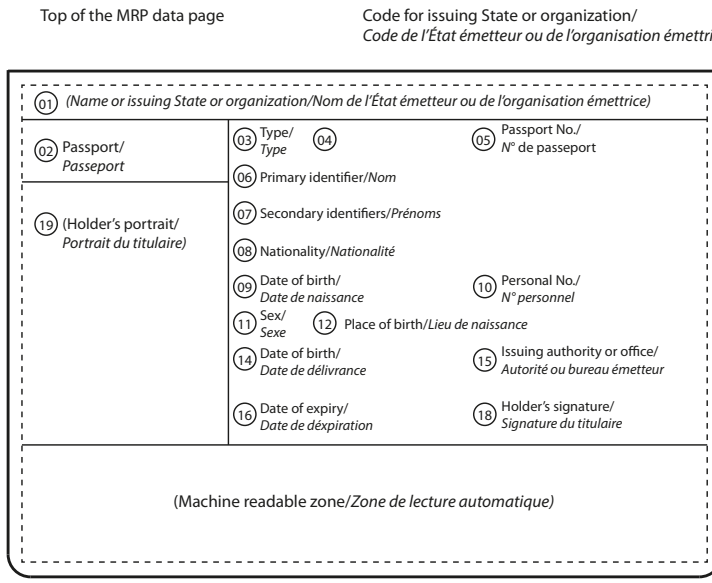

Fig. 10.1: On the ID page, both the types of information and location of data elements are strictly regulated.

by Doc 9303, the holder's date of birth shall be specified 'as recorded by the issuing State or organization'.[45] So even as date of birth may be a physical biometric and place of birth could be said to have a social dimension, both connect first and foremost the holder of the passport, as well as the passport document itself, to public bureaucracy and to the state to which the document belongs.[46]

Third, this emphasis on the state or nation is repeatedly stressed on the passport identity page: the issuing state and the nationality of the holder are stressed twice, both in full (e.g. SVENSK SWEDISH) and by a three-letter code (e.g. SWE for Sweden). In countries where the place of birth automatically determines the nationality of the baby, the holder's place of birth also indicates the nationality (or citizenship) of that person or his or her parents (such as NEW YORK, USA, which would also indicate US citizenship).[47] In these cases, there are three entries explicitly stating nationality only in the visual inspection zone (VIZ) of the identity page. In cases where the issuing state is the same as the nationality of the holder, the nation is almost more pronounced than the person.

The political dimension of this emphasis is particularly evident in cases where national affiliation is disputable or unclear. This is strikingly obfuscated in Doc 9303. A well-hidden example may be found in a footnote to

the list of three-letter codes for nationalities specified in the first volume of Doc 9303. Remarkably, this is the only footnote to the list. It refers to the dispute between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland 'concerning sovereignty over Falkland Islands (Malvinas)', as it says. The code that has been provided with this footnote is FLK.[48] It may, in other words, seem as if Doc 9303 has taken sides with Great Britain in this dispute, as the British name 'Falkland Islands' is chosen over the Spanish 'Islas Malvinas'. More important in this context, the example shows how strongly the contemporary passport nationalizes its subject. This nationalization of individual identity is also clearly demonstrated in cases where people are without nationality (e.g. stateless persons, refugees), as this must be marked in the passport as XXA, XXB, XXC, or XXX, codes that define people according to the requirement of nationality. Both these examples underscore the significant connection of *nationality* to machine-readable passports as well as the *political* dimensions of such nationalization.

To sum up, the biometric passport specifies a person's identity in terms of a name and signature, gender and age, a biometric measurement of the face, as well as a body of data connecting individual identity to societal regulations of work, taxation, government benefits, health care, and other governmental functions. This information is given maximum-security protection in accordance with current ideologies, systems, and technologies of document security. In the current passport regime, individual identity is thus defined as: (1) machine-readable body measurements and (2) a set of personal data recorded in governmental and other public archives that are (3) mediated by a document owned and managed by the state.

The archival practices of enrolment and inspection

As we have seen, few –if any –human observations of physical (or social for that matter) traits are inscribed in the ePassport. Admittedly, some countries do note both physical details (such as height and eye colour) and place of residence in a local or national passport registry. For the passport booklet, however, the passport issuer will verify the identification papers of the applicant against available records and databases before capturing one or several biometric samples from the applicant by use of a high-resolution image capture technology for facial image enrolment (mandatory globally) as well fingerprints or iris scans in countries where this is required.

Sometimes biometrics is also used in the identification process in order to improve the quality of the background checking that is part of the passport application process.[49] Identification is then understood as performing 'a *one-to-many* search between proffered biometric data and a collection of templates representing all of the subjects who are enrolled in the system.'[50] This assumes, of course, that one has biometric records such as a passport registry or a police record that can be searched in order to find a biometric template of the enrollee.[51] Doc 9303 defines 'biometric template' as 'a machine-encoded representation of the trait created by a computer software algorithm' which 'enables comparisons (matches) to be performed to score the degree of confidence with which separately recorded traits identify (or do not identify) the same person.'[52] Such a template is, as they also say in Doc 9303, of relatively small data size.[53] This is due to the amount of information being sharply reduced compared with the high-resolution image as captured during enrolment. It is, therefore, a highly simplified representation created by a computer software algorithm.

Biometric templates are used for matching the high-resolution image on the microchip against archives during enrolment (as mentioned above) as well as in passport inspections. The templates and their readers are not internationally standardized.[54] Each manufacturer of a biometric system uses a unique template format, and templates are not interchangeable between systems.[55] According to Doc 9303:

> Facial recognition vendors all use proprietary algorithms to generate their biometric templates. These algorithms are kept secret by the vendors as their intellectual property and cannot be reverse-engineered to create a recognizable facial image. Therefore facial recognition templates are not interoperable between vendors – the only way to achieve interoperability with facial images is for the 'original' captured photograph to be passed to the receiving State. The receiving State then uses its own vendor algorithm (which may or may not be the same vendor/version as the issuing State used) to compare a facial image captured in real time of the MRP holder with the facial image read from the data storage technology in their MRP.[56]

Doc 9303 does not specify a globally interoperable machine-assisted verification method. However, it warns against relying on a single feature to verify authenticity because this increases the risk that the method will be compromised.[57] Overall, we can still say that the high-resolution image of the face is stored on the chip to be used as input in facial recognition

systems.[58] The verification system uses a camera to capture a facial image of the traveller in real time and uses an algorithm to compare this image with the one stored on the chip. Mark Salter (2003) underscores the fact that '[…] the modern passport does not guarantee the 'security' or even the 'identity' of the bearer'. He also claims, somewhat inaccurately, that 'the passport certifies only that the document of the passport is identical to other documents.'[59] When looking into the verification process from an archival perspective, we can see that the information inscribed in the pre-electronic passport implies a human verification not only of documents but also of people's appearance. The same applies to the electronic passport, except that now a machine checks the papers *as well as* the traveler's appearance. But Salter is right that the passport cannot prove the identity of the traveller. This also holds true for the biometric passport, no matter how hard the ICAO insists that the 'only method of relating the person irrevocably to his travel document is to have a physiological characteristic of that person associated with the travel document in a tamper-proof manner.' As Julian Ashbourn and others have underscored, we should never consider a biometric as positive proof of identity.

> In the early days of automated identity verification, a common claim was that a biometric check proves that you are who you say you are. Of course, this is simply not the case; a biometric check proves no such thing. […] All we are doing is comparing two sets of data and, according to predefined criteria, reaching a conclusion as to whether they are alike enough to be considered a match.[60]

So, when a traveller enters or exits a state or for any other reason has his/her biometric passports checked, the information on the chip is not just compared with the image of the traveller captured on the spot (often referred to as a 'one-to-one match').[61] The information on the chip and the newly obtained image data can also be compared against a small number of biometric reference templates on file (locally or accessed from elsewhere), for instance when matching against a 'watch list' of persons who warrant detailed identity investigation or are known criminals, terrorists, etc.[62] This is the archival practice of passport verification.

The archival promise

The background for developing electronic passports with biometric capability is the perception of increased security threats in our globalized society.

The first volume of Doc 9303 asserts that: 'The growth in international crime and illegal immigration has led to increasing concerns over the security of travel documents and calls for recommendations on what may be done to help improve their resistance to attack or misuse.'[63] Research gives no indication that crime is on the rise, yet we witness (as Doc 9303 also states) a more 'security-conscious world'. As a result, 'the need for machine-assisted global interoperability has become pressing' and has 'necessitated the standardization of one primary biometric identification method and of one method of data storage.' The ICAO has therefore developed recommendations 'specifically in response to the needs of passport issuing and immigration authorities to ensure accurate identification of a passport applicant or holder while minimizing facilitation problems for the traveller.'[64] The primary purpose of using chip technology in the passport has been to augment the security of authentication of the passport documents as well as their legitimate holders.[65]

Another reason for developing electronic passports is the desire for efficiency, faced with a global population increasingly 'on the move' across borders. Doc 9303 tells the story of how the ICAO started this work in 1968 with the development of the first machine-readable travel documents. A panel was charged with developing recommendations for a standardized passport book or card that would be machine-readable 'in the interest of accelerating the clearance of passengers through passport controls.'[66] In 1998, the next chapter of this story began –the work 'to establish the most effective biometric identification system and associated means of data storage' for use in passports and other machine-readable travel document (MRTD) applications, 'particularly in relation to document issuance and immigration considerations.'[67] 'Throughput' they call it (e.g. 'travellers per minute'), whether it refers to 'the biometric system or the border-crossing system as a whole.'[68]

This call for security and efficiency in the identification and verification of individual identity overlaps in striking ways with historical attempts at registering and storing biometric information about repeat offenders in late nineteenth-century police archives. Allan Sekula is often credited for having brought forth the Paris police official Alphonse Bertillon in this regard. In his influential essay 'The Body and the Archive' (1986), Bertillon is described as the inventor of:

> the first effective modern system of criminal identification. His was a bipartite system, positioning a 'microscopic' individual record within a 'macroscopic' aggregate. First, he combined photographic portraiture,

> anthropometric description, and highly standardized and abbreviated written notes on a single fiche, or card. Second, he organized these cards within a comprehensive, statistically based filing system.[69]

Anthropometric description refers to a measurement of the human body (from the Greek words *anthropos*, meaning 'man', and *metron*, meaning 'measure') transformed into a verbal text. This text was pared down 'to a denotative shorthand, which was then linked to a numerical series'.[70] According to Sekula, this was 'not merely a self-contained archival project. We can understand another, more global, imperative,' Sekula states, 'if we remember that one problem for the late-nineteenth-century police was the telegraphic transmission of information regarding suspects.'[71] Bertillon's response to the problem was to make all the data telegraphable. The ambition was, as we can see, global –both in its technical design and with regard to current communication technologies.

Sekula is mostly interested in the photographic archive. He is concerned with the way in which the archive, as he argues, became the dominant institutional basis for photographic meaning somewhere roughly between 1880 and 1910.[72] However, for photography, the 'archival promise was frustrated by the messy contingency of the photograph as well as the sheer quantity of images'.[73] As Sekula sees it, the solution to this was 'to invent a machine, or rather a clerical apparatus, a filing system, which allows the operator/researcher/editor to retrieve the individual instance from the huge quantity of images contained within the archive.'[74] This is what Bertillon did and with success. 'Thus Bertillon arrested the criminal body, determined its identity as a body that had already been defined as criminal, by means that subordinated the image – which remained necessary but insufficient – to verbal text and numerical series.'[75] Herein lies the archival promise of the late nineteenth-century police archive: it allowed the operator to retrieve the individual instance from the huge quantity of instances contained within the archive and the exchange of information between police departments and between states.

The Bertillon system should not only be precise but also efficient. Bertillon wanted 'to accelerate the work of processing criminals and to employ effectively the labours of unskilled clerks'. Sekula positions Bertillon as a 'prophet of rationalization' akin to Frederick Taylor, 'his American contemporary, [...] the inventor of scientific management, the first system of modern factory discipline.'[76] In his discussion of the history of the US passport at the beginning of the twentieth century, Craig Robertson refers to Sekula's perception of Bertillon's project as the invention of a system

'for regulating and accelerating the flow of texts, profoundly linked to the logic of Taylorism.'[77] Robertson argues that the passport developed into an archival technology that 'classifies and orders evidence in the service of the production of truth to be used to explain who "we" are and where "we" come from'. And it does this, Robertson states, 'in the *anticipation of a future need to know*. The archival pact with the future is established through the "rationalization" which Sekula foregrounds to articulate archival practices.'[78]

The parallels between the late nineteenth-century police archives and current biometric passports are striking both in terms of ambition and mindset, even if the techniques vary and the archival conditions are radically different. One of the most conspicuous keywords in Doc 9303 is the notion of 'global interoperability'. It shows up already in the foreword to volume one and is introduced with reference to the previous edition of Doc 9303 (from 2003): 'global interoperability' is understood as 'the capability of inspection systems (either manual or automated) in different States throughout the world to exchange data, to process data received from systems in other States, and to utilize that data in inspection operations in their respective States.'[79] Yet 'global interoperability' is not only understood descriptively but also normatively: it is 'a major objective of the standardized specifications for placement of both eye readable and machine readable data in all MRTDs'. With reference to 'the security-conscious world of today', it is further stressed that 'the need for machine-assisted global interoperability has become pressing' and that this has 'necessitated the standardization of one primary biometric identification method and of one method of data storage'.[80] I will maintain the importance of scrutinizing these standardizations of archival entries and functionalities of the biometric passport to understand how this practice shapes identities and societies.

The ICAO's standardized specifications of eye-readable and machine-readable data in MRPs apply not only to the placement of data but also to the question of which information to convey and in what form it should be conveyed. Earlier in this article we saw how the information on the identity page of the ePassport has been significantly reduced. The issuing state is to some extent free to select certain traits (such as Sweden, where information about the passport holder's height is included), but the choices are limited. Doc 9303 also strictly regulates the location of the various types of information on the identity page, but in addition to these factors, another form of cultural homogenization is also operative. *Cultural homogenization* may notably be seen as one of the main characteristics of globalization and refers to the reduction in cultural diversity as the result of processes by

which local cultures are transformed or absorbed by a dominant culture. Homogenization of the international passport has been an ambition since the first convention on passports in Paris 1920, if not earlier. In addition to the general booklet design and other passport guidelines (including requirements for physiological descriptions and photographic portrait), the League of Nations decided that all passports were to be written in at least two languages, one of which was French, the diplomatic language of that era.

Today, all passports contain information in at least two languages, of which one is either English, French, or Spanish (an extension of what is considered to be internationally accessible languages, from one to three). Meanwhile, Doc 9303 specifies a strict regulation of acceptable letters, particularly in the machine-readable zone (MRZ) but also in the visual inspection zone (VIZ) of the identity page. National characters may be used in the VIZ, but if they are not Latin-based, then a transliteration into Latin characters must be provided.[81] Dates should be entered in accordance with the Gregorian calendar,[82] and numbers must be presented as 'Arabic numerals' (i.e. Indo-Arabic or Hindu-Arabic numerals).[83] States that use numbers other than 'Arabic numerals' to represent numerical data in the VIZ shall provide a translation into Arabic numerals.[84] If national characters are accepted in the visual inspection zone (VIZ) of the identity page, they shall not appear in the machine-readable zone (MRZ). The same applies to diacritical marks or accents, apostrophes, etc., which are not allowed in the MRZ.[85] The explanation is simple and technical: national characters and diacritical marks generally appear only in the computer-processing systems of the states in which they apply and are not available globally.

The desire to develop such a globalization of letters, calendars, and numbers is not surprising and also perhaps necessary for better international communication between societies. However, I will argue that it is vital to notice *who* is creating the world in their image, that is, which local standards act as templates to create global standards: Latin letters, the Gregorian calendar, and what is often called Arabic numerals. These standardized specifications for both eye-readable and machine-readable data in the MRP are part of a practice that produce not just the document but also *the specific human identity* the passport provides evidence for.

The second major security and efficiency measure in Doc 9303 involves *technical standardizations* of the MRP as such as well as the development of a standardized biometric identification method and a method of data storage. The two strings of alphanumeric characters at the bottom of the

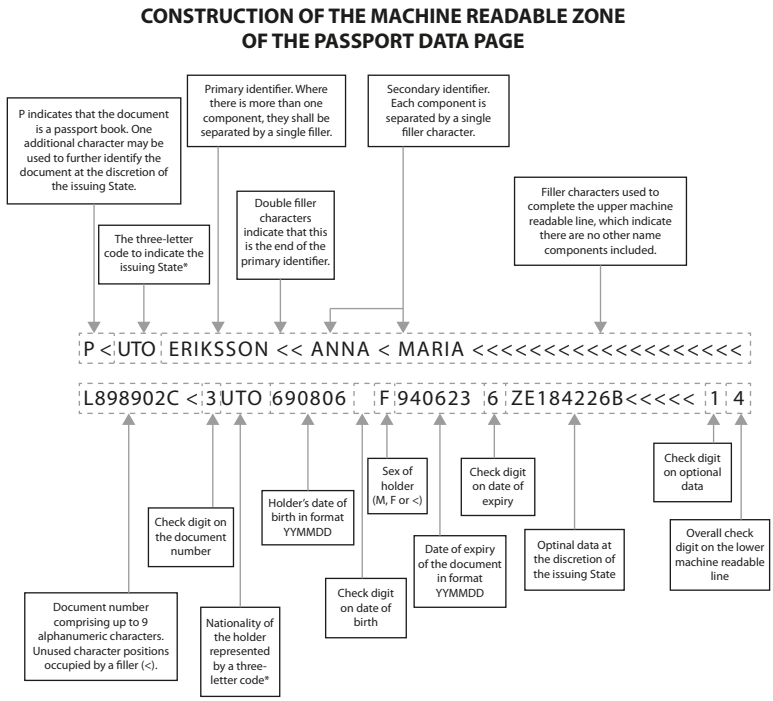

Fig. 10.2: In consideration of national privacy laws, the data in the machine-readable zone (MRZ) must be visually readable as well as machine readable.

identity page (referred to above as the machine-readable zone, or MRZ) enables border controllers and other law enforcement agents to process passports more quickly without having to input the information manually into a computer. In other words, MRPs incorporate an MRZ to facilitate the inspection of travel documents. In addition to increasing efficiency at passport checkpoints, the MRZ provides verification of the information in the VIZ and may be used to provide search characters for a database inquiry. In addition, it may be used to capture data for registration of arrival and departure or simply to point to an existing record in a database.[86] These are the archival promises of the MRZ.

According to the ICAO, the primary purpose of using chip technology is to have the ability to capture biometrics in the travel document.[87] Further, the key application of the biometrics solution is to relate an MRP holder to the MRP he or she is carrying.[88]

> Each time a traveller (i.e. MRP holder) enters or exits a State, his identity can be verified against the image created at the time his travel document was issued. This will ensure that the holder of a document is the legitimate person to whom it was issued and will enhance the effectiveness of any advance passenger information (API) system.[89]

Such verification can be done without touching the passport booklet, since the aerial connecton allows data to be communicated between the microchip and an encoding/reading device at a distance of ten centimetres.[90] Hence, the biometric passport presents the chip as its primary source of information. The chip also functions as a backup of all the vital information otherwise available in the booklet (except visas and stamps). The standardization of one primary biometric identification method (facial recognition technology) and one method of data storage (the chip and the security object) are presented as more than promising for the fulfilment of the desire for greater safety and efficiency in the regulation of travelling. These are the archival promises of the microchip.

The contemporary biometric passport is developed in the name of security and efficiency, its biometrics presented as something brand new, unrelated to the international history of the passport and its changing attempts to connect the traveller irrevocably to his travel document. Yet, to see its parallels to the nineteenth-century police archive, we must first note some significant differences. First, Alphonse Bertillon's police archive was a system designed to register and detect *criminals* (more specifically, recidivists or repeat offenders). The biometric passport, on the other hand, is a system put in place to register *all* travelers and to protect society from criminals. Both are, therefore, systems for the protection of society against criminals, but the first is aimed at the criminals and registers these, while the other detects (in principle) all people to protect them from any potential criminal among them. The second difference is connected to the first and concerns scale. As the director of the Identification Bureau of the Paris Prefecture of Police, Bertillon's archival practice was large and ambitious. It could be used internationally and was also exported and used in other countries, particularly the US. However, the archive was soon outdone by other methods (particularly fingerprinting) and never enjoyed enduring global distribution. In contrast, the ICAO is an international organization, a United Nations specialized agency with nearly 70 years of experience in addition to the 26 years of The League of Nations. It collaborates with 191 member states and global aviation organizations to develop an international

Standards and Recommended Practices (SARPs) that are used as a reference by states when developing national civil aviation regulations, including the current biometric passport.[91] In Doc 9303, global interoperability is one of the ICAO's major keywords.

However, the large-scale collection and archiving of data of entire populations also changes the archive. As underscored by Jonathan Finn in *Capturing the Criminal Image. From Mug Shot to Surveillance Society* (2009), 'Once brought into the archive, all bodies can be identified and re-identified according to changing needs of those in control of the data and the specific parameters for searching and using the archive.'[92] And with digitally networked, large-scale archives, they will. This is not just a technical condition for the large-scale archive but also its political terms. One clear example is seen in the recurring phenomenon of 'function creep' or 'scope creep'. Scope creep is, simply put, when a service conceived for one purpose is pressed into service for another purpose. According to Julian Ashbourn in *Guide to Biometrics for Large-Sale Systems* (2011), this is among the most prevalent and destabilizing effects within large-scale systems, particularly in the public sector.[93] The source of scope creep is often political, Ashbourn states: one government agency wishes to access data held by another.[94]

Scope creep is not a new phenomenon. A very widespread case is the quite blurry histories of the development of identification numbers. Many countries issued identification numbers for a singular purpose, but over time, they became *de facto* national identification numbers. The most well-known and obvious example is probably the Social Security number system developed in the United States in order to disburse Social Security benefits. Due to scope creep, however, these numbers are used for other purposes to the point where it has become more or less mandatory for one to have a Social Security number if one wants to open a bank account, obtain a credit card, or drive a car. Yet, if the phenomenon is not new, it is reasonable to assume that digital information technologies and networked databases make scope creep easier to resort to and also more tempting politically. This is, however, in conflict with privacy principle number one, the purpose for collection: information is collected for a lawful purpose connected with a function or activity of an agency, and the collection of the information is necessary for that purpose. Scope creep threatens to undermine this basic principle in democratic societies. It also seems to compromise the operational integrity of the archive.[95]

By way of concluding, I will give an example of how scope creep can make visible the political radicality of the biometric passport and its archival promise in a way that demonstrates the parallels rather than the differences

between the nineteenth-century police archive and the biometric passport. The example also sheds light on the inscription of the passport in the history of the effort to combat crime as part of an emergent global archive of pre-criminals.

On 21 June 2013, the Norwegian Passport Act (1997) was adjusted on an important point: the § 8, which concerns the Passport Registry. The general rule was, and still is, that only the passport authorities –Kripos (the national unit for combating organized and other serious crime) and the Norwegian border authorities –should have access to the passport registry unless otherwise provided for by law or by regulation pursuant to law.[96] On 21 June 2013, a list was added (section 8a) specifying the kind of cases where the police could access and repurpose information from the passport registry. 'We will make the passport registry an effective tool in combating crime,' stated then Minister of Justice and Public Security Grete Faremo during a press conference.[97]

This is a classic example of scope creep. The source is political; one government agency wants to access data held by another. There are reportedly several types of cases that form the basis for this bill, including grooming and child abuse. But the main background was the official report from 'the 22/7 commission' (2012) following the terror attacks in Norway in 2011.[98] This report does not restrict itself to discussing the actions that took place before, during, and after the terror attacks; it also provides recommendations and advice as to how to prevent similar attacks in the future. As part of these preventive measures, the report states that the 'PST [Norwegian Police Security Agency] would like to gain access to a number of [...] information sources, including the Customs Directorate and the Immigration Administration records, as well as Employer and employee registry and the Passport registry [...]'.[99] And so, less than a year later, the access was granted, not just for serious crimes under investigation (as was the case previously) but also for more minor offenses, including 'the *prevention or investigation* of an action that according to law may lead to a higher sentence than imprisonment for six months'.[100]

This particular example of scope creep also demonstrates another tendency in today's society that is vital for assessing the archival situation of the contemporary passport: the increasing emphasis on the precautionary principle in criminal law. To accept that personal information from a passport registry can and should be handed over to the police to *prevent* a criminal action from happening seems to be not just a challenge to the passport as institution but also in conflict with the presumption of innocence,

the principle that one is considered innocent until proven guilty.[101] To risk being charged based on the suspicion that you may think of planning illegal actions is also a threat to the freedom of thought and the freedom of speech and even undermines the possibility of changing one's mind.

The example illustrates that the history of the passport is no longer simply a parallel to the history of the police archive. The two archives converge. The genealogy of the passport can be traced back to nineteenth-century criminal records as an instrument of discipline and subordination to the state. This confirms and exemplifies Jonathan Finn's more general point about the body and the archive in current society:

> In the nineteenth-century archive, the image captured the criminal, representing his identity within its frame. In the new digital space, the image captures the body independently of any such fixed identity. Criminality is less a function of an actual criminal event or body than it is an attribute that all bodies are prone to. As a result, all bodies, not just those identified as criminal, are sites to be monitored and administrated. The body in the digital archive exists as something that is potentially criminal and, therefore, as something warranting continued surveillance.[102]

The passpost is not just an archive; it is a pre-active criminal archive anticipating a future need to know: we are all potentially criminals, and the passport is part of a global surveillance system for monitoring all citizens to prevent and solve crime. This is the archival primise of the biometric passport.

To conclude, the biometric passport defines individual identity as machine-readable body measurements and personal data recorded in governmental and other public archives mediated by an electronically enabled document (or micro-archive) owned and managed by the state. This small archive is part of an archival assemblage of national, bilateral, and international hubs. The passport is thus not just 'Man's Most Travelled Document', as Martin Lloyd put it. Its archival condition has radically changed since the paper-based archives of Alphonse Bertillon, which depended on the telegraphic transmission of information to communicate across countries and regions. It is not just less space-based and hence to a lesser extent dominated by spatial order.[103] Today, the archive is, in principle, ubiquitous, premised not just on networks but also on transfer speed. Temporal efficiency –achieved through the combination of machine readability, connection between

microchip and aerial, and biometric templates that match high-resolution chip images against various types of archives –underpins the impression that the passport is increasingly interwoven in a system of ubiquitous surveillance. Accessing information in close-to-real-time also stimulates scope creep and other challenges to the rule of law. The biometric passport has thus transformed travelling individuals from being socially defined by peer recognition to bodies of information sorted according to ever-changing political perspectives on who is on the inside and the outside of a 'we' defined by its vulnerability to crime, terrorism, or other threats.[104]

Notes

1. See Salter, p. 93.
2. Robertson, 2006.
3. For a thorough discussion of early modern passport history, see Torpey.
4. Robertson, 2006.
5. Ibid.
6. The safe conduct pass is well known since at least the early thirteenth century. See, for instance, Salter, pp. 12-20.
7. The birth of the modern passport system is a complex topic with wide variations within and across different countries, but if the US can serve as an example, the historic moment in time may be indicated by the political decision giving the Department of Foreign Affairs the responsibility of issuing passports in the name of the state in 1782. See Robertsen, 2010, p. 253.
8. See Featherstone and Manoff.
9. Vol. 2, II-15 and I-1. See also Stanton, p. 256.
10. Ernst, p. 42.
11. Vismann; Gitelman. Vismann's book *Akten: Medientechnik und Recht* (2000) was first published in German and then abridged and translated into English as *Files: Law and Media Technology* (2008).
12. See Torpey, Robertson (2010), Lloyd, Groebner.
13. Salter.
14. The notions ePassport and biometric passports are used interchangeably. However, the ePassport does not necessarily contain biometric information. E-passports are, rather, electronically enabled passports with biometric identification capability.
15. Doc 9303 contains current ICAO specifications for machine-readable travel document (MRTD), including machine-readable passports (Part 1), visas (Part 2), and ID cards ('travel documents') used in crossing the borders (Part 3). Parts 2 and 3 will not be dicussed here. For simplicity reasons, I will henceforth refer to Part 1 in its sixth edition (2006) only as Doc 9303. After the deadline for phasing out non-machine readable passports 24 November

2015, Doc 9303 has been reorganized and divided into 12 parts. The regulation of biometric information is specified in Volume 9 without significant changes since the previous edition.

16. Today, machine-readable passports are required globally. Admittedly, the ICAO has no supranational authority. Therefore, of course, the requirement applies only to contracting states. For these, the deadline for phasing out all non-machine readable passports was 24 November 2015. Contracting states shall ensure that the expiration date falls before 24 November 2015, so that all non-machine-readable passports should be out of circulation by this date. See http://www.icao.int/Security/mrtd/Pages/24-NOV-2015.aspx [accessed 2 May 2015]
17. See vol. 1, IV-13.
18. Vol. 2, II-5.
19. See vol. 2, I-1 and II-11.
20. See vol. 2, II-1.
21. Vol. 2, II-5 and II-15.
22. Vol. 2, II-10 and II-11.
23. The League of Nations lasted for 26 years before the United Nations (UN) replaced it after the end of the Second World War in 1946. The UN inherited a number of agencies and organizations founded by the League. The responsibility for setting passport standards was passed to the ICAO (the International Civil Aviation Organization) when that authority was founded in 1947. The ICAO had then 188 contracting states. See Salter, pp. 78-86; Stanton, p. 254.
24. See Lloyd, p. 97.
25. See ibid., p. 7. Lloyd refers to these descriptions as 'physiognomic'. Without going into the complex history of physiognomy, I will here use the more neutral term physiology.
26. See, for instance, Jain et al., *Handbook of Biometrics*.
27. See, for instance, Jain and Kumar; Paveši and Ribari.
28. Vol. 2, II-4.
29. See Lloyd 2003 p. 107.
30. See http://www.passportland.com/images/chevremont-jean/chevremont-jean.html.
31. Vol. 2, II-3.
32. Vol. 1, IV-11.
33. For a critical discussion of biometrics with regard to gender and race, see Magnet.
34. See Nandakumar et al., 2008; Jain, Dass and Nandakumar, 2004.
35. For people who cannot write a signature, 'a usual mark of the holder' is required (see vol. 1, IV-8).
36. Jain and Ross, 2008.
37. Ratha et al., 2001, p. 454.

38. See Federal Public Service Foreign Affairs of the Kingdom of Belgium, http://diplomatie.belgium.be/en/services/services_abroad/belgian_passport/biometric_passport/belg_in_belgie/new_procedure/. For Swedish passport regulations, see https://polisen.se/Service/Pass-och-id-kort/Fakta-om-pass-och-nationellt-id-kort/[last accessed 18 February 2015.]
39. Idrus et al.
40. See, for instance, Gates, p. 9.
41. See, for instance, Gates, p. 11.
42. Currently, both the Swedish and Belgium biometric passports have included fingerprints on the chip.
43. An exception to the rule of not including titles, professional and academic qualifications, etc. is if the issuing state considers these to be *legally* part of the name. Se Doc 9303 vol.1, IV-18 and IV-19.
44. It does not always refer to the place where the parents of the new baby live but rather the place where the person was born, for instance in a hospital. In many countries, this also means that the government requires that the birth of the new baby be registered at the place of birth. In other countries, such as Sweden, there is a concept of 'domicile of birth', which means that the domicile of the baby's mother is the registered place of birth. See *Statens offentliga utredningar, 1994:44,* 1994, p. 32. In all these cases, place of birth indicates entries in a range of databases.
45. Vol. 1, IV-11.
46. Under the law of most countries, passports are government property.
47. Place of birth as an unconditional basis for citizenship is the predominant rule in the Americas but is rare elsewhere.
48. Vol. 1, IV-44.
49. See Doc 9303 vol. 2, II-3.
50. 'Identification' may be contrasted to 'verification', which means 'to perform a one-to-one match between proffered biometric data obtained from the MRP holder now and a biometric template created when the holder enrolled in the system.' See Doc 9303 vol. 2, II-3.
51. Vol. 2, II-7.
52. Vol. 2, II-3.
53. Ibid.
54. Vol. 2, I-1. See also vol. 2, II-1.
55. Vol. 2, II-3
56. Vol. 2, II-11
57. See vol. 1, III-20
58. Vol. 1, IV-29.
59. Salter, p. 93.
60. Asbourn, p. 114.
61. See, for instance, Doc 9303 vol. 2, II-3.
62. See, for instance, vol. 2, II-7.
63. Vol. 1, III-3.

64. Doc 9303, vol. 1, foreword, p. iii.
65. See vol. 2, II-14. Cf. also III-12.
66. Vol. 1, I-1. In 1980, the specifications and guidance material developed by this panel were published as the first edition of Doc 9303, titled *A Passport with Machine Readable Capability*, which became the basis for the initial issuance of machine-readable passports by Australia, Canada, and the United States.
67. Vol. 1, I-1.
68. Vol. 2, II-10.
69. Sekula, p. 18.
70. Ibid., p. 33.
71. Ibid.
72. Ibid., p. 56.
73. Ibid., p. 17.
74. Ibid., p. 18.
75. Ibid., p. 33.
76. Ibid., p. 25.
77. Ibid., p. 57, cf. also Robertson, 2006.
78. Robertson, 2006, italics added.
79. Vol. 1, foreword, p. iii.
80. Ibid.
81. Vol. 1, IV-18.
82. Vol. 1, IV-23.
83. Arabic numerals should not be confused with the Eastern Arabic numerals (also called Arabic-Indic numerals and Arabic Eastern numerals), which are the symbols used to represent the Hindu-Arabic numeral system in conjunction with the Arabic alphabet in the countries of the Arab east and its variant in other countries.
84. Vol. 1, IV-9.
85. Vol. 1, IV-13 and 19.
86. Vol. 1, IV-13.
87. Vol. 2, III-12.
88. Vol. 2, II–9.
89. Ibid.
90. Vol. 2, II-5 and II-15.
91. See http://www.icao.int/Pages/default.aspx [accessed 6 April 2015]
92. See Finn, p. 107.
93. Ashbourn, pp. 166-7.
94. Ibid.
95. Cf. Ashbourn.
96. Translated by the author. http://lovdata.no/lov/1997-06-19-82/§ 8 [accessed 6 April 2015]
97. Translated by the author. https://www.regjeringen.no/nb/aktuelt/politiet-far-utvide-bruken-av-passregist/id726715/

98. NOU 2012: 14 *Rapport fra 22. juli-kommisjonen*, 2012.
99. NOU 2012: 14 *Rapport fra 22. juli-kommisjonen*, 2012, p. 387. Translated by the author.
100. Translated by the author; italics added. http://lovdata.no/lov/1997-06-19-82/§ 8a [accessed 6 April 2015]
101. More officially stated as (Lat.) *Ei incumbit probatio qui dicit, non qui negat*: the burden of proof is on the one who declares, not on the one who denies.
102. Finn, p. 105.
103. See de Certeau 1984.
104. Lyon, 2002.

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Socialities

Chapter Eleven

A Neomonadology of Social (Memory) Production

Tiziana Terranova

Hypotheses fingo
– Gabriel Tarde, *Monadology and Sociology*

On the evening of the 7th of January 2015, a crowd of over 100,000 people assembled in one of the main squares of the city of Naples in southern Italy for the funeral mass of Pino Daniele – a beloved musician who had been overwhelmingly popular with his hybrid and soulful version of Mediterranean blues.[1] His sudden death due to a heart attack at the age of 59 had hit the social networks first, as is increasingly the case with celebrity deaths. A mass sharing of songs, videos, and personal memories had flooded the walls of Italian Facebook starting from the night of the 5th, peaking on the 6th and the 7th, only to quickly peter out when displaced by comments and articles relating to slaughter of the French journalists of Charlie Hebdo in Paris.[2] Standing in the silent and sombre crowd, it was impossible not to notice how, when Daniele's most popular songs sounded through the loudspeakers, the dark sea of people sparkled with the bright glow of thousands of small screens, which they lifted up to film and record the crowd softly singing along. Sri Lankan vendors criss-crossed the packed square with their latest street wares: extendable stick monopods made in China that allow 'group selfies' to be taken from above. The day before the funeral, photos and videos of a 'flash mob' immediately summoned through the Facebook event page had also presented the same images of bright blue screens lighting up and filming a vast crowd of guitars and voices singing Daniele's songs in a spontaneous social memorial.

Watching both scenes, the first one live, the second one through Facebook's newsfeed, I could not help thinking that these acts of social memorization, of social production and sharing of memories, were producing 'value' for somebody else. Undoubtedly they were registered by the corporate owners of the social Internet as a local spike in activity generating views on YouTube, suggesting consumers' propensities to algorithms, raising the income streams of telecom operators, and providing free content for news outlets.[3] The event, one of many that agitate and animate transnational

digital networks, pointed to the process whereby the generation of a social memory becomes a direct productive force in the economic domain. At the same time, such acts also genuinely produce what Marxists would call 'use values' that are not consumed by marketization: a feeling of solidarity, social meanings, a moment of collective reflection, the sharing of memories producing a sense of belonging.[4] These 'use values' could be further qualified: a sense of beauty (aesthetic or cultural values such as the sound of Naples as a 'black' European city) and of truth (truth values about one's life to which Daniele's songs had been a soundtrack or about the city and its history of interrupted modernity)[5]. The scene I witnessed is, of course, both *unique* in its singularity and *common*, as photographing, filming, recording, and sharing have become, thanks to digital technologies, a daily practice for many, thus constituting a new mode of social memorization. The production of economic value (exchange and utility), cultural and social values, technology and memory are inextricably enmeshed. Remembering and sharing by technological means produce surplus value for netarchical capitalists but also an excess of affects, desires, and beliefs materializing a 'common ground'.[6] It struck me how this strange effect was enabled by technologies that, while constructing an undoubtedly social experience, would read this event as predicated on the existence of a (social) network composed of individuals and/or 'dividuals' but also exceeding both.

Two tales of social production

There is a constitutive tension between the network (a diagram composed of nodes and links), the individual (the concept of the autonomous, rational subject), and the 'dividual' (its datafied digital shadow) in that strange phenomenon called 'social production' or 'social cooperation', which both mainstream and Marxist theorists have identified as a key source of the production of value in contemporary societies. Acts of social memorization such as the one presented above constitute just such a case of a larger continuum spanning the extremes of 'mechanical' and 'non-mechanical' cooperation, which Yochai Benkler calls 'social' or 'p2p production'.[7] Theorists of social and peer-to-peer (p2p) production have registered the efficacy of organizational strategies that enable individual autonomy and voluntary participation in the field of information and knowledge production. They have explained social production as the result of the 'falling costs of access to the means of production' coupled with the action of the 'invisible hand of the social' enhanced by a peer-to-peer architecture or

scale-free networks somehow harmonizing individual wills activated by 'social motivations'.

For Benkler, but also more recently Jeremy Rifkin, the key factor at work in social production is internal to the movement of capital, so to speak: the falling costs of access to the capital needed to be an actor in the information economy allow for an amplification of the powers of decentralized individual action.[8] Social production is based on the coordinate effects of non-coordinate actions in as much as one does not need to be consciously cooperating in order to be actually cooperating.[9] Just the act of recording and registering events of daily life and putting them online is enough to be cooperating from the point of view of the creation of economic value in a networked economy. For Benkler, the combination of individual social motivations and efficient coordination resolves the 'tension between the values promoted by liberal markets and the values of liberal democracy'.[10] A collective or social event that produces value brings together the individual capacity to choose, the social motivations which imply a kind of 'peer pressure' on individual choice (such as acquiring social capital or standing with others), the consolidation of a feeling of similarity and belonging which constitutes society, and also the effect produced by a commercial network of smart devices which allows for memories to be registered as traces to be stored, tagged, classified, related, and made available for current and future consumption. Techno-social memory thus starts as a series of actions (recording, uploading, tagging, posting, commenting, storing) that precipitate into digital objects producing value for the market and value for the social in what would appear as a seamless continuum that increases market value while consolidating social order.[11] Post-workerist Marxists, on the other hand, following Marx's *Grundrisse,* have instead argued that social cooperation is not simply a new source of value but the specific historical expression of living labour in an economy defined by the hegemony of immaterial value production and financialization. From this point of view, social co-operation is involved at every stage and throughout every layer of value production in post-industrial economies, involving not simply the completion of a task and the reproduction of a template but the production of new values and the socialization of invention. Daniele's music, emerging out of a proletarianized urban milieu ravaged by a crisis of industrialization, relied on the cooperation of a number of musicians and the re-invention of musical and cultural memories constituted by the social circulation of sounds, instruments, techniques, media, and rhythms in a transnational and transcontinental space spanning Europe, Africa, the Caribbeans and North America. The devices, protocols, platforms, and programming languages

that allow for the storing and sharing of the products of such cooperation are the means through which the productive powers of living labour are appropriated and captured by contemporary capitalism – turning rent and financialization into the new mode of extraction of surplus value.[12] The relational, linguistic, and technological abilities released by post-Fordism become crucial components in the market-based production of value, but they can no longer be organized within the boundaries of the firm and the form of waged work. In as much as it enacts a reappropriaton of portions of fixed capital, this new source of value also retains an autonomous potential that is not exhausted or captured in advance by marketization. For post-workerist Marxists, this potential constitutes the (virtual) engine of a post-socialist and post-capitalist *common*, a co-poietic production that holds together the collective and the singular.[13] Here, as in Paolo Virno's adoption of Gilbert Simondon's philosophy, the common or social is the pre-individual (such as species-specific expressive capacities) and at the same time that reserve of being which allows the individual to undergo ever new transformations.[14] It is the social memory of music but also the singularizing tendencies that each one brings to such memory and the new productions that it enables (including the production of new forms of social life). Among the autonomist Marxists, however, nobody has gone as far as Maurizio Lazzarato in posing 'autonomous and independent' social cooperation as the ontological and historical presupposition of economic valorization and the division of labour.[15] Monetization and the creation of social wealth depend on the primary flow of social currents that mobilize 'mnemonic work' or the 'labour of attention'. The creation of value, from this perspective, depends only secondarily on capital and the division of labour while resting primarily on the 'cooperative dynamics of inter-cerebral psychological forces which are not unilaterally contained in the relation capital-labour. Cooperation, in fact, is social in so far as it is not founded on work or capital, but on the activity of the 'spirit, soul, or memory."[16]

If value is first of all a social production mobilizing the powers of memory, in what way is it reconfigured by the digital networking of the social, by the ubiquitous social activity of recording, storing, and sharing?[17] Theories of social production or cooperation also need to account for the series of elements included in an event such as the one described above: the individual holding up her digital device and looking at the scene through the mobile screen in a posture that recalls a kind of neo-monadic architecture of subjectivity; the simultaneous process of aggregating a multitude of audio-visual and linguistic digital traces that are recorded and stored in databanks and that constitute her at a micro-scale as a 'dividual'; the social flow of

currents of values that individuate the 'common ground' of the crowd; the relational recursiveness of the network as digital objects are posted, shared, and diffused; the multiplication of agencies at the technological level (screens, interfaces, protocols, programmes, code, algorithms, bots, buttons, etc.); and also the international and ethnic division of labour and the logistical arrangements that assemble the devices and bring Southeast Asian migrants to the streets of Southern Europe.[18]

While Marxist theorists of social cooperation maintain the common and co-operation as the presupposition of economic valorization, liberal theories tend to emphasize the action of autonomous individuals – even as such actions at a collective level somehow obey a kind of mechanical coordination or even intrinsic social laws. If a networked society presents itself as a 'society of individuals', this is possibly also due to the ways in which devices are constructed as first of all 'personal'. The social life of digital media presents the recurring image of individual users interacting with their devices, so that the networked society comes across as 'a "society" of individual users connected by an information architecture.[19] Devices are constructed for individual use (desktops, laptops, tablets, smartphones), and individuals can be spotted in both public and private spaces staring or talking at their screen, shifting their attention in and out of their physical environment. The design of digital devices and interfaces mobilizes a 'monadic' architecture of subjectivity where 'users' are individually enveloped by their devices in ways that allow them to abstract themselves periodically from their physical surroundings in order to engage in communicative acts. As Sherry Turkle has put it, digital devices pose 'being alone' as a 'precondition for being together because it is easier to communicate if you can focus, without interruption on your screen'.[20] Individual users 'prehend' and are 'prehended' by their devices including the network as a series of actions and relations (searching, clicking, opening, commenting, liking, posting, sharing, filming, photographing, reading, watching, 'digging', blogging, sharing, chatting, listening, following, friending, etc.). As it unfolds itself in the network, the individual 'monad' is 'divided' in the act of constituting a digital double or 'dividual'.

Monadology and digital media

This relationship between the irreducible singularity of the agent and the infinite divisibility of the ideal mathematical continuum is crucial to the set of problems that led the Baroque German philosopher Gottfried Wilhelm

Leibniz to articulate his strange concept of the monad in *Monadology* (1714). Nominated by Norbert Wiener as the patron saint of cybernetics for his 'calculus ratiocinator', Leibniz's strange hypothesis of the existence of simple substances called *monads,* who are also true agents in the world, stimulates speculation on the nature of social production in a situation such as the one described above.[21] It is, of course, thanks to Gabriel de Tarde's *Monadology and Sociology* (1893) and his lectures on *Economic Psychology* (1902) that Leibniz's monadology was first turned into a component of an economic theory where the 'general form of activity' is no longer the form of work through which a social expenditure of thermodynamic energy transforms nature into an object but rather 'inter-cerebral or social labour' involving a relation between agents 'acting-at-a-distance'. Such labour follows the logic of the multi-form work of the 'soul', 'spirit', or 'memory', which is that of mutual influence rather than unilateral appropriation.[22] The domain of production and that of conduct, which Foucault understood as the conduct of oneself as well as others and involving a creative and inventive relation with resistance and counter-conduct, are thus seen as inextricably intertwined.[23] Deleuze, of course, dedicated an important book to Leibniz called *The Fold,* which seems to provide a particularly fruitful entry point into the relationship between monadology and digital media. In Leibniz, the monad is an image of 'enclosure' or 'self-envelopment' and indicates the 'soul or subject as metaphysical point'. Leibniz had borrowed the term from the Neo-Platonists 'who used it to designate a state of One, that is a unity that envelops a multiplicity'. If Giordano Bruno's monad had allowed the Neo-Platonist emanations to give way to a larger zone of immanence (even as formally respecting the rights of a transcendent God or higher Unity), Leibniz, in Deleuze's view, stabilized the concept of the monad through his 'mathematics of inflection, which allowed him to posit the enveloping series of multiples as convergent infinite series – through the metaphysics of inclusion which posits enveloping unity as irreducible individual unity'.[24] Far from presenting a self-enclosed, individualistic subjectivity, the monad is a model of networked subjectivity and social production that composes a number of different elements in network culture. 'Leibniz's most famous proposition', in fact, held that 'every soul or subject (monad) is completely closed, windowless or doorless', while containing 'the whole world in its darkest depths' and 'illuminating some little portion of that world, each monad a different portion'.[25] As a simple substance (without parts), 'each monad includes the whole series of predicates' (actions and relations) and conveys the entire world but *expressing 'more clearly a small region of the world, a "subdivision", a borough of the city, a*

finite sequence'.[26] Deleuze explains well the architectural model that informs Leibniz's vision of the monad: more than an atom, the monad is a 'cell' with its dark background out of which everything is drawn out, 'like those places which have existed for ages where what is seen is inside (cell, sacristy, crypt, church, theatre, study, print room)'. The Baroque monad is lit by a 'crushing light' coming from 'openings invisible to their very inhabitants' and presents zones of clarity.[27] The clear region of the monad is, as Deleuze again recounts, *extended* in the clear portion of another, and in a same monad the clear portion is prolonged infinitely into the obscure zones, since each monad expresses the entire world as *convergent infinite series*.[28] Deleuze suggested that if the Baroque monad can be read 'politically and socially' and represents a mutation of the 'system window-countryside or window-painting' with the dyad 'city-information table',[29] then it can be also read historically as an architecture of subjectivity. Such architecture then presents a series of historical cases: the system 'car-windscreen' (exemplified by Tony Smith's famous description of his minimalist sculpture in terms of a car speeding along a dark motorway lit only by the car's headlamps, with the tarmac hurtling by in the windscreen) or 'a computer screen in a closed room'. But we could also think about today's 'hand held screens' on the interior walls of a subject moving as much in closed rooms as in open spaces. The walls of the networked monads are covered with 'black mirrors' or screens through which, in Deleuze's terms, they 'read' the world more than they are actually 'seeing it', in the sense that reading is here described as a relation to the concepts of universals and singularities rather than to a thing.[30] If the monad thus expresses the architecture of the interiority of the 'node' or the irreducible singularity that each individual brings to the network experience, in Leibniz this also involves the existence of a material 'façade' which corresponds to what contemporary network cultures might call the 'wall' or 'profile' – a standard component of the architecture of social media. It is through the 'wall' or 'profile' that the networked monad, which envelops the world through the screen, can be said to first appear. From the wall or profile it emerges as part of an infinitely divisible digital continuum that constructs it as a 'dividual' or 'digital shadow'' – an object among other objects caught up in a continuum of variations (other profiles but also software, algorithms, protocols, plugins, and audiovisual objects in general, etc.). If on the inside, the monad represents the simplicity and closure of the soul that reads the world, its outside corresponds to an infinitely divisible digital ideal, where indivisibility is displaced by an infinitely divisible 'dividual' acting like a node or relay in a 'collective' represented by the image of the network. For Leibniz, infinite divisibility belonged to the

'mathematical or ideal continuum', while matter as such was constituted by folds. In thinking about the strange materiality of social quantities such as data, for example, one can consider the difference between the ideal mathematical continuum composed of points and what Leibniz called the physical point of inflection or 'the ideal genetic element of the variable curve or fold or the active spontaneous line, the authentic atom'.[31] In Deleuze's words again, 'inflection is the event that happens to the point or the line', thus complicating what Anna Munster calls 'the foundational cartography of the network as a map of links and nodes that have become the representative image of network design.[32] As a predicate or event of the point and line, 'inflection is that which makes a fold from variation and brings it to infinity': as such, it is a 'site of cosmogenesis'.[33] In Deleuze's re-reading of Leibniz, the physical line of inflection 'cannot be separated from an infinite variation or an infinitely variable curve, passing through an infinite number of angular points and never admitting a tangent, enveloping an infinitely porous world constituting more than a line and less than a surface'.[34] As such, the mathematics of inflection turns the ideal diagram of nodes and lines into the infinitely variable curve of social value production: the local event of a large crowd assembling to mourn a beloved musician (like many other social events of different kinds) are recorded in the network as a series of variations, made continuous by meta-data in relational databases connecting disparate recordings to be stored and shared in large data farms. As in the 'metacommunities of code' project, which is analyzing 'code-sharing practices in free and open source software repositories with a particular focus on GitHub', variation is the basic form of the production of networked value, and small differences or variations are less subject to division than to various forms of inflection.[35] Leibniz's monadology establishes a basic relation between variation and point of view – the second component of his reinvention of the Neo-Platonist monad. Leibniz established the problem of point of view on the model of the sections of the cone, leading him to argue that 'there are as many points of view as inflections in inflections.'[36] In Baroque mathematics, as Deleuze recounts, the point of view is 'the point where the lines perpendicular to tangents meet in a state of variation…not exactly a point, but more a place, a position, a site, a "linear focus", a line emanating from other lines'.[37] This concept of point of view establishes 'perspectivism' not as 'dependence on a pre-given or defined subject but as that which turns the subject into what comes to or remains in the point of view'. Every point of view is a point of view on variation, as it is not what varies for the subject but the condition in which an eventual subject apprehends a variation (metamorphosis) or equivalence

(anamorphosis). For thinkers such as Leibniz, Nietzsche, and William and Henry James, point of view is the condition in which the truth of a variation appears to the subject.[38] Finally, the metaphysical point, or the point of inclusion, is defined as the entelechia or the *final cause of the fold.* What is folded is the included or the inherent. The monad (which has no windows) is working from a *condition of closure or envelopment* and could hence be posited as a soul or subject.[39] The mathematics of inclusion helped Leibniz to stabilize the monad by presenting enveloping unity as an irreducible singularity, foreclosing the risk of making individuals relative in the sense that they would simply melt into a universal spirit or soul of the world as seen in the Neo-Platonist monad or contemporary notions of collective intelligence.[40] Monadology recasts the very distinctions between the dividual, the individual, and the collective that are so crucial for theorizing networked subjectivity. The monad is an 'agent' but an 'infra-individual' one: it refers to the multiplicity of forces that compose the 'individual' and hence the 'social'. It is neither the 'dividual' because it cannot be divided, being without parts; nor is it is the 'individual' as usually understood, because individuals as such are aggregates of simpler parts, involving complex hierarchies of dominant and dominated monads. Yet the monad, in all its irreducible unity and singularity, is the agent of sympathetic cooperation or, as we might call it today, social production: this is how it is presented in Tarde's economic psychology. It can be argued that Leibniz's monad corresponds neither to the definition of the 'individual' as a rational subject of choice in theories of social production nor to phenomenological accounts of the embodied (human) subject. In *Monadology,* Leibniz described the monad as a 'simple substance that enters into composites': 'simple means without parts' or 'indivisible'; and substance, as he put it elsewhere, 'is a being capable of action', which is, however, 'altogether immaterial' or a 'metaphysical point'.[41] Every monad is thus first of all an *agent,* 'each different from all other ones while at the same time endowed with an internal principle of change and the internal complexity of that which changes'.[42] As 'incorporeal automata' that are to some extent perfect and self-sufficient, they are ultimately 'the source of their own internal action'.[43] Monads are thus not necessarily human, nor do they correspond to the individual; rather they indicate 'anything that has perceptions and appetites'. What distinguishes souls properly speaking from simple monads is the fact that their perception is more distinct and that they have *memory.*[44] Every single portion of matter can thus be seen as animated by an infinity of tiny agents or souls, turning the monad into a *posthuman* concept resonating with the contemporary return of *panpsychism* in speculative realism.[45] Gabriel Tarde, who developed his

own esoteric concept of the monad in his 1895 essay *Monadology and Sociology,* defined the monadologists as 'monists who believe that all matter is spiritual' (or subjective) but who, unlike what he called the 'idealists', do not think that matter is simply 'the projection of the mental states of an I'. For monadologists, the whole universe is populated with 'souls distinct from my own, but fundamentally similar'. Unlike the idealists who claim that 'one knows nothing of the *being-in-itself of a stone* or a plant, and at the same time stubbornly persist in saying that it *is*', Tarde described monadologists as those who believe that if this being of a stone or a plant 'in itself is fundamentally similar to our own being, then it will no longer be unknowable, and may consistently be affirmed'.[46] Tarde notably 'opened' the monad up to 'action-at-a-distance' by other monads. He criticized the impenetrability of Leibniz's monads and their reliance on a 'pre-established harmony', arguing instead for 'open monads which would penetrate each other reciprocally rather than being mutually external'.[47] In as much as they act, and act at a distance, they are no 'points' but:

> [e]ach element, hitherto conceived as a point, now becomes an indefinitely enlarged sphere of action…and all these interpenetrating spheres are so many domains proper to each element, so many distinct though intermixed spaces, perhaps, which we wrongly take to be a single unique space. The centre of each sphere is a point, which is uniquely defined by its properties, but in the end a point like any other; and besides, since activity is the very essence of the elements, each of them exists in its entirety in the place where it acts.[48]

A neo-monadological model of social cooperation

It is possible to think of ways in which a (neo)monadological concept of the social could make an actual difference in modelling key processes of network culture, introducing a new concept of social memory. Contemporary theories of social or peer production seem like particularly reductive versions of monadic inter-penetration, reducing the monad to the human individual, bracketing off the fact that what we conceive of as an individual is in fact the 'final term' of a previous series (physical, biological) which does not stop with it. Such an interpretation downplays the relation with other non-human elements and forces while retaining from Leibniz the closure of the soul within itself and most significantly his notion of harmony. For reasons that are personal and autonomous, we are told, individuals choose

to 'act together' or 'cooperate' (even when such cooperation involves the simple act of converging on a city square for a celebration). Technology allows such cooperation to become immediately productive of social memories that flow through the timelines and newsfeeds of social network sites, only to be copied and stored more or less permanently in individual devices or on centralized server farms. For a key theorist of social production such as Benkler, individuals –defined as 'the moral anchor and actual moral agent of political economy' –voluntarily and efficiently coordinate with others, driven by social motivations in producing informational goods whose specific characteristics (the marginal cost near zero of information) enables peer production in certain sectors of the economy.[49] Technologies such as digital objects are here just tools that individuals use to cooperate, while agency is allocated exclusively to the human individuals and the value of the products of peer production is defined by utility and exchange. The methodological individualism that is at the core of liberal theories of social production is introduced to make the phenomenon intelligible– or rational–in the eyes of mainstream economists. In explaining how voluntary cooperation is successfully performed without the promise of financial rewards and without the display of command lines within the firm, the notion of utility value is central. To freely and voluntary cooperate, the individual needs to be motivated, and this motivation can only be linked to the actualization of a satisfaction (hence a pleasurable sensation) such as that induced by the growth of one's social capital or influence with others. Even if for Leibniz the individual was not the monad but an aggregate of monads, theorists of social production maintain his notion of individuals as closed unities harmoniously cooperating with other closed monads, identifying the social as the combination of the 'internal' drive of the individual with the external mechanisms of harmonization (or social laws): the social motivation to gain pleasure by accumulating social capital in one's circle of peers somehow submits to the laws of social physics. The invisible hand of the social, which supplements the invisible hand of the market in theories of social production, is a model of coordination that poses the origins of value in individual initiatives of exchange and production – the equivalent of the pre-established harmony of Leibniz's monadology.[50] Tarde objected to the notion of pre-established harmony, arguing that sympathetic cooperation was the far-from-pre-established result of complex processes through which monads unilaterally or reciprocally capture each other's attention, leading them to follow, adapt, or oppose other monads. Cooperation is not based on exchange but on an asymmetrical relationship of mutual or unilateral capture which presupposes a whole social and psychic economy

of power. It is difficult to underestimate the importance of the notion of motivations for liberal and mainstream theories of social production – a notion that illustrates a crucial difference with Tarde's neo-monadology of sympathetic cooperation. For Benkler, motivations are a universal of human behaviour, relaying a utilitarian model of pain and pleasure or utility value. A simple model of human motivation is what gives economics analytical tractability, in Benkler's words – to the extent that all human motivations can be more or less reduced to something like positive or negative utilities translatable into a universal medium of exchange or money.[51] From this perspective, the key to understanding social production is catching the difference between money-oriented motivations from socially oriented motivations, but the difference seems to be only one of orientation: in as much as they are oriented towards social standing or capital rather than economic standing (and ultimately pleasure), social motivations still obey an economic logic (positive/negative utilities) even as they bypass the question of money.[52] Motivation is thus closely linked to interest, a concept that Dardot and Laval examine in their critique of neoliberal rationality. Following Foucault, they point out how in classical liberalism, interest is the other name of *desire,* a principle of action that is endowed with its own principle of internal regulation and whose foundation is the liberal government of the self. To reduce pain and increase pleasure according to the right calculation of the consequences of action, makes the ability to calculate interest the first great secular principle of the regulation of conduct.[53]

From the point of view of monadology, we might say that the concept of the liberal individual moved by motivations and interests that define its 'appetite' for the satisfaction of a certain sensation seems, remarkably enough, to lack the dimension of belief. Liberal theories of the social thus produce what we might call a 'mutilated' version of the infinitesimal forces that for monadologists are the truly infra-individual social agents. While they assume a heterogeneity of motivations, they present a univocity of desire (reducible to the sensation of pleasure derived by the act of cooperation) and a homogeneity of beliefs (a presupposed agreement on the goals of cooperation). In as much as social production relies on the principle of utility, which is in turn based on sensation, it thus mobilizes a qualitative element in the monad that, like interest in liberal political and economic theory, is non-transferrable. In contrast, Tarde's neomonadology pushed him to criticize the exclusive emphasis on sensation in the emerging neo-classical economic paradigm and to argue for the key importance of the *transferrable*: that is, *social quantities*

such as desires and beliefs. For Tarde, the qualitative element of sensation was not transferrable and hence not social. What made the monad social was not the drive to acquire pleasurable sensations (and the individual memory of pains and pleasures undergone in the past) but its being constantly immersed in the objectifiable flow of social quantities such as beliefs and desires. Beliefs and desires express the objectification and quantification of the two main virtual mnemonic forces of the soul that belong to every existing monad (inorganic, organic, or human); that is, the static force of belief and the dynamic force of desire (in Leibniz, *perception* and *appetite*).[54]

> By the universality of their presence in all psychological phenomena, both human and animal, by the homogeneity of their nature from one end of their immense gamut to the other, from the slightest inclination to believe or to want up to certainty and passion, and finally by their mutual penetration and by other no less striking signs of similarity, belief and desire play exactly the same role in the ego, with respect to sensations, as do space and time in the external world with respect to material elements.[55]

Unlike sensation, belief combined with desire is not only transmittable, it also comprises unconscious states of being and is present in even a protoplasm or a spore. When applied to the field of social cooperation as the source of the production of value, we can say that we do not just join a project, subscribe to a platform, or turn up at a social event advertised on social media because it makes us feel good but because we desire something and refuse something else, because we believe in somebody or something and no longer believe in something else. The actions of believing and desiring re-actualize the forces of time as memory. They are transmittable social quantities of variable intensity that inform the production of value in sympathetic cooperation. They make the difference between success and failure, underpin the reproduction of the existent, and constitute the power of the true event. Tarde's merit, for some, was not so much to have 'opened up' Leibniz's monad and hence made it 'social' but to have inserted Nietzsche's forces into Lucretius' atoms, to have disposed of the transcendence guarantee by God and his pre-established harmony in order to grasp the monads as avid and possessive elements driven less by the urge to preserve their being than with a plan to conquer the world and pattern it on itself. To do away with the emphasis on 'harmony' as the modality of cooperation and to introduce dissent, conflict, hostility,

and avidity at the core of social cooperation is an operation that does not necessarily lead to the postulation of a need for a new social contract. It is true that every monad – every simple element without parts that brings unity or enfolds a multiplicity –wants not so much to preserve itself as to spread. Every idea, affect, belief, truth, but also digital object, virus, protocol, or image aims for maximum diffusion or to express its power to the maximum. Not a substance like the selfish gene of neo-Darwinism but a force or agent individuated by its milieu, each monad has its 'design': it strives to expand and proliferate to the point where it will have become the whole world and have patterned the world after itself. The Nietzschean will to power of Tarde's monads only come to a halt when it encounters a limit in the resistances and wills emerging from other monads. The complex architectures of physical, biological, and social assemblages are the outcome of these strange subterranean struggles – the oppositions, adaptations, and inventions that constitute monadological production. If this avidity were the only thing that defined a monad, we would in fact find ourselves in a cosmological version of Hobbes' concept of war as the basis of sociality. But Tarde considers that the sympathetic side of the monad is as important as the hostile or combative side: no single monad is able to carry out such a conquest on its own. By being attracted to the similar in others, they also form bonds with others – that is, form societies. This interdependence of hostility and sympathy, combined with the drive to expand, constitutes the key to understanding the relation between subjectivation and subjection, freedom and domination in the neo-monadological social universe of Gabriel Tarde. The coexistence of sympathy and hostility, like and dislike, and the interplay of autonomy and dependence is essential to social production. '[I]n every atomistic or monadologist system, every phenomenon is nothing other than a cloud which depends on actions produced by a multitude of agents which are so many invisible and innumerable gods (polytheism or miriateism)', and yet these microscopic gods mostly appear to us as having given up their absolute freedom, becoming 'prisoners or subjected'.[56] In their drive to realize their design, i.e. their particular combination of beliefs and desires, monads are drafted into the projects of other monads. They let themselves be hegemonized and place themselves voluntarily under somebody else's lead – they 'follow' or 'combat' others. Since the relation between monads always plays out in the space of freedom afforded by distance, what we have then is not physical combat but a subtle process of mutual suggestion involving an asymmetrical and more or less reversible capture of 'followers'. It is almost as if the Gramscian concept of hegemony – the

ability to govern by consensus and to wage a war through persuasion that produces the relationship between dominating and dominated, hegemonic and subaltern – is taken to a microscopic (or infra-individual) *and* social level, making it reversible and unstable. Hegemony is, so to speak, almost ontologized. The engine of voluntary and collective social production is, in fact, a willingness to follow, to copy, to imitate (even one's own self), to become part of a flow, to join somebody else's design, all the time hoping to realize one's own small or great invention.

Conclusions

A neo-monadology of social memory production is a speculative experiment that allows us to understand ordinary events of social memorialization in networked cultures as an expression of social co-operation that breaks with theories of motivation and the harmonization of individual choices entailed by concepts of 'social laws' and also of 'emergence'. Understood in neo-monadological terms, social cooperation rests on a multiplicity of relations of mutual influence and capture: it engages infinitesimal forces and directly mobilizes the capacity of memory to retain time and introduce difference as well as its ability to act at a distance according to a logic of mutual appropriation or unilateral subjection. The social action of memory thus explains the production of values – utility but also truth and beauty – as a force of repetition and difference, where every repetition and difference is also a social action (even when it takes place in the multiplicity that constitutes each individual). Such is the action-at-a-distance in social digital media in which avid yet essentially *connective* forces are synthesized by new media objects: widgets and plug-ins such as 'like', 'share', or 'tweet' buttons. Societies of monads produce and are characterized by asymmetrical relations of micro-hegemony that are more or less stabilized but always open to internal revolt. Social memory production must therefore be understood in terms of the infra-individual relations that haunt the individual, the capacity of memory to retain time and introduce difference, as well as its capacity to act at a distance according to a logic of mutual appropriation. The human aspects of social memory must therefore be understood in terms of their implication in larger societies of inorganic, organic, and technical forces that constantly reinvent mnemonic actions such as possessing and being possessed, sympathy and hostility, leading and following, and – finally – conducting oneself and conducting others.

Notes

1. On the Mediterranean blues of Pino Daniele, see Cavallo, Chambers, as well as Festa.
2. On the morning of the 7th of January 2015, a commando of three men attacked the offices of the satirical French magazine Charlie Hebdo in Paris, killing twelve people, mostly journalists and two policemen. The three men, all of whom were later killed by the French police, hailed Allah while shooting their kalashnikhovs, thus placing the massacre under the rubric of 'Islamist terrorism'. The massacre soon became a mass event on social networks, where the twitter tag #jesuischarles was one of the most popular ever in the history of Twitter (see Whitehead).
3. On the political economy of 'propensity', see Thrift.
4. On use values as essential sites of struggle exceeding exchange value and fully investing the production of subjectivity, see Mezzadra.
5. On the 'interrupted modernity' of the Mediterranean, see Chambers.
6. For Kostakis and Bauwens, netarchical capital 'is that fraction of capital which enables cooperation, but through proprietary platforms that are under central control' (2014: 38). On the production of 'common ground' as a political stake, see Gilbert.
7. While postulating that social production is at the core of the production of value in the networked economy, Benkler posed a difference between mechanic cooperation (as that enacted in cases such as Nasa Clickworkers or by corporations such as Google and Amazon) and non-mechanic cooperation, involving deliberative processes such as in Wikipedia (2006: 75).
8. See Benkler 2006: 32-34; On the 'zero marginal cost' revolution, see Rifkin.
9. Benkler, p. 3.
10. Ibid., p. 2.
11. On the biopolitical genealogy of social networking sites as technologies of stabilization of the social, see Terranova.
12. For an account of digital technologies as mechanisms of capture, see Pasquinelli; on rent and financialization as new measures of value, see Fumagalli and Mezzadra.
13. For a political theory of the common, see Hardt and Negri.
14. For Paolo Virno, the 'social' indicates what Simondon calls the 'pre-individual' but also in a 'strong sense' the whole of productive forces historically defined as much as the biological features of the species (2001: 238).
15. Lazzarato, p. 8
16. Lazzarato, pp. 35 and 39.
17. In Lazzarato's account of Gabriel Tarde's *Psychologie Économique* (1902), Tarde is presented as a critic of both the labour theory of value, grounding the latter in the division of labour, and of utility value in neoclassical economics (Lazzarato 2002: 8).

18. On the intrinsic connection between racism and the capitalist process of valorization, see Curcio and Mellino.
19. Munster, p. 11.
20. Turkle, p. 155.
21. In his introduction to *Cybernetics,* Wiener so articulated the importance of Leibniz for his new science: 'If I were to choose a patron saint for cybernetics out of the history of science, I should have to choose Leibniz. The philosophy of Leibniz centers about two closely related concepts – that of a universal symbolism and that of a calculus of reasoning. From these are descended the mathematical notation and the symbolic logic of the present day. Now, just as the calculus of arithmetic lends itself to a mechanization progressing through the abacus and the desk computing machine to the ultra-rapid computing machines of the present day, so the calculus ratiocinator of Leibniz contains the germs of the machina ratiocinatrix, the reasoning machine. Indeed, Leibniz himself, like his predecessor Pascal, was interested in the construction of computing machines in the metal. It is therefore not in the least surprising that the same intellectual impulse which has led to the development of mathematical logic has at the same time led to the ideal or actual mechanization of processes of thought.' (1965: 12).
22. Lazzarato, p. 18; Gabriel de Tarde's *Monadologie et Sociology* was originally published in 1893 but according to Filippo Domenicali composed mostly in 1875. Domenicali argues for an esoteric Tarde who expresses himself in his monadology as 'secret metaphysics' but which he tended not to make so public or central for fear of going against the positivist spirit of the time (See Tarde 2012; Domenicali). For a Tardean reading of digital networks that deploys Tarde's concept of imitation to think virality, see Sampson; for a perspective on the relation beween Tarde and social psychology, see Blackman.
23. On the notion of conduct and counter-conduct in Foucault, see Davidson.
24. Deleuze, 1993, pp. 23-24.
25. Deleuze, 1995, pp. 157-158.
26. Deleuze, 1993, p. 25.
27. Ibid., p. 27.
28. Ibid., p. 50.
29. Ibid., p. 27.
30. Deleuze, 1995, pp. 156-158.
31. Deleuze, 1993, p. 14.
32. Munster, p. 21.
33. Deleuze, 1993, p. 17.
34. Ibid.
35. 'Metacommunities of Code' is a collaboration between Matthew Fuller, Richard Mills, Adrian Mackenzie, Stu Sharples, and Andrew Goffey (see http://metacommunitiesofcode.org/). See their contribution to this volume on pp. 87-101.

36. Deleuze 1993, p. 20.
37. Ibid.
38. Ibid., pp. 18-19.
39. Ibid., p. 22.
40. Deleuze, 1995, p. 24.
41. Rescher, p. 45.
42. Ibid., p. 71.
43. Ibid., p. 87.
44. Ibid., p. 91.
45. On the post-human and the post-humanities, see Braidotti; on the return of panpsychism in contemporary philosophy and media theory, see Shaviro; on machinic animism, see Melitopolous and Lazzarato.
46. Tarde, 2012, p. 15.
47. Ibid., p. 26.
48. Ibid., pp. 26-27.
49. See Benkler, p. 20.
50. Lazzarato, p. 11.
51. Ibid., p. 92.
52. Ibid., p. 97.
53. Dardot and Laval, p. 297.
54. Tarde, 2012, p. 24.
55. Ibid., pp. 24-25.
56. See Tarde 2012, p. 66.

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Chapter Twelve

On the Synthesis of Social Memories

Yuk Hui

> *We must therefore expect a completely transposed* Homo sapiens *to come into existence, and what we are witnessing today may well be the last free interchanges between humans and the natural world. Freed from tools, gestures, muscles, from programming actions, from memory, freed from imagination by the perfection of the broadcasting media, freed from the animal world, the plant world, from cold, from microbes, from the unknown world of mountains and seas, zoological* Homo sapiens *is probably nearing the end of his career....*
>
> – André Leroi-Gourhan[1]

This essay is about the synthesis of social memories rather than social memory *per se* and discusses such a synthesis in the light of digital technologies. Synthesis here is understood in the Kantian sense of 'putting together different representations and grasping what is manifold in one [act of knowledge]'.[2] Synthesis thus demands an active unification of parts in contrast to an unconscious or mechanical repetition. To remember something is always a reconstruction in which the fragmented past and the projected future are brought into the present. In the early twentieth century, Maurice Halbwachs introduced the concept of social memory in order to critique a psychological approach that understands memory as personal and individual activity. Since memories in his view do not reside in the individual but 'are recalled by me externally, and the groups of which I am part at any time give me the means to reconstruct them', the social conditions of memory should be the object of study.[3] This psychosocial account of memory notably emerges alongside the new discipline of social psychology.

In *L'individuation à la lumière des notions de forme et d'information*, the French philosopher of technology Gilbert Simondon offers a concise summary of the conflict between the psychical and the social. Pure psychology understands reality according to the motivation of the psychical individual; pure sociology understands reality by reducing the individual to a product of the social. However, neither of these approaches, which start from extreme propositions, are able to explain individuation. Hence, Simondon outlines a

principle that he calls a psychic and collective individuation. The synthesis of memories must be grasped as a psychic as well as a collective process in which memory individuates precisely by overcoming the tension between the psychological and the collective as well as the inconsistencies of the psychological individual.[4] According to Simondon, 'social memory' is an ambiguous concept since all memory has a social dimension, even genetic and the phylogenetic memories. A narrower concept of social memory is thus needed, one that focuses on what is shared among individuals and serves to unify a social group. But, in addition to the concepts of the social and the psychical, Simondon's theory of individuation included another decisive dimension, notably the technical and the technological, too often understood as the mere background of the psychic and the social. By following Simondon's emphasis on the centrality of the technical, it is possible to extend Halbwachs' analysis of social memory to a more contemporary situation in which digital technologies take centre stage.

This essay will argue that the synthesis of social memory is fundamentally technical. In recent decades, the externality of remembrance and hence the technicity of the mind has gained much attention. Early twentieth-century research on memory in biology, especially Eric Kandel's work on cellular and molecular brain mechanisms that help explain short and long-term memories, opened up new terrain for the study of memory.[5] While certain researches in neuroscience have the tendency to reduce the mind to the brain and the technical and social to the physiological, recent cognitive science has questioned this reduction and brought to light a new understanding of the role of technics in the functioning of the brain and memory. Andy Clark and David Chamber's extended mind hypothesis, in which they propose that the mind thinks beyond the skull so that the technical apparatus becomes an interiorized function of the brain, is one notable example[6]; John Haugeland's concept of the embedded mind[7] and Fred Dretske's externalism are others.[8]

Yet the question of the externality of the mind has long been addressed in fields such as anthropology and philosophy of technology, opening up inquiry concerning not just the mechanism of the synthesis of social memory but also the relation between nature, culture, and technics. How, then, is such a synthesis to be addressed in relation to exteriorization? And how will the emphasis on exteriorization affect our understanding of social memory in the digital age? I will try to address this question by outlining three syntheses of social memory as found in the works of André Leroi-Gourhan, Gilbert Simondon, and Bernard Stiegler.

Three syntheses of social memory

In contrast to Halbwachs' effort to account for the *social* condition of memory, my aim is thus to describe the *digital* condition of social memory. For this purpose, my concept of social memory is broader than that of Halbwachs': social memory here designates all products that result from the operation of *transindividual relations*. I take the term transindividual from Simondon, who saw all involvement with technical objects –whether invention or use –as a fundamental form of communication. The 'technical object taken according to its essence, that is to say the technical object as it is invented, thought and wanted, assumed by a human subject, becomes the support and the symbol of the relation that we would like to call *transindividual*.'[9]

The twentieth century is a century in which the question of social or collective memory becomes critical due to the consequences of world wars and the rapid changes caused by urbanization. Walter Benjamin stated that it is more difficult to honour the memory of the nameless than that of the famous; the nameless are those who are not inscribed and who *cannot* be inscribed in historical writings.[10] Martin Heidegger, for his part, endeavoured to deal with the question of the forgetting of Being, amplified by the advancement of a modern techno-science that marks the end of metaphysics and pushes it towards total oblivion. The effort to retrieve that which is about to disappear or be forgotten thus becomes a key philosophical task of the twentieth century. This task encompasses two contradictory trajectories. The first consists of the effort to document, in the name of history and humanity, what has happened; to leave a record through writings, monuments, archives, museums, etc. The expansion of social memory in the twentieth century was therefore a *mise en scène* of intensive writing circulated globally thanks to the accelerating technologies that are paradoxically also the cause of forgetting. The other is the effort to remember that which cannot be retained or memorized – in particular the trauma of the Holocaust. If, on the one hand, one tends to exploit the anamnesic nature of technical artifacts, on the other hand, there is an effort to get beyond the merely factual level of memory documents in order to reach the wounds that remind us of the unmemorable. This contradiction is further amplified in the twenty-first century due to the digital revolution and intensified globalization processes.

Bernard Stiegler, following Jacques Derrida, tried to resolve the opposition between mnemotechnics and the unmemorable by considering mnemotechnics as a support that provides the access to the unmemorable.

If the unmemorable is the infinite since it cannot be recorded or written, this infinity is only possible as conceived in the finite. In other words, technics becomes the condition of possibility under which the anamnesis of the infinite is possible. For Stiegler, technics is thus a *supplement* to the retentional finitude or limitation of human beings, producing the (im)possibility of the infinite. Hence we encounter two different syntheses of social memories, or two modes of existence of historical memory and historicity.

The two syntheses govern the operation of transindividual relations, yet they also result from the crystallization of transindividual relations. But since the transindividuality of technical objects extends beyond historical memory and its writings and monuments, we need to discuss another, earlier synthesis of social memory. This first synthesis is not necessarily related to any historical events but is expressed in the invention and use of technical objects, for example in a new method of metallurgy or the construction of a well. Both invention and use are significant terms here, designating at once the ideal and the real. Invention is not the production of the object itself; it is, rather, the invention of a *scheme*, activating a theatre of images, signs, and symbols.[11] These signs and symbols suppose transindividual relations, social and aesthetic. Invention is the realization and restructuring of these relations and also the introduction of an element of indeterminacy within the *determination* of the scheme. The evolution of technics entails the constant crystallization of these structures, from the biface of the Australanthropus to the modern chopping machine.

According to Simondon, technical objects create an inter-human relation that is transindividual in the sense that the technical object already involves both functionality and protocol.[12] This synthesis springs out of need, and its traces are retained in the technical objects and their wider networks of relations. The conception of technical objects as a form of social memory is also found in Stiegler, where they constitute an epiphylogenetic memory, a 'past that I never lived but that is nevertheless my past, without which I would never have had a past of my own'.[13] Stiegler's notion of the epiphylogenetic memory draws on the work of anthropologist and palaeontologist André Leroi-Gourhan, for whom memory is the constant process of exteriorization in the ethnic group:

> Like tools, human memory is a product of exteriorization, and it is stored within the ethnic group. This is what distinguishes it from animal memory, of which we know little except that it is stored within the species.[14]

Epiphylogenetic memory is distinct from genetic memory as well as epigenetic memory (the memory of the central nervous system); in the words of Stiegler, it is a 'techno-logical memory',[15] which we can find in languages, the use of tools, the consumption of goods, and the practices of rituals. For Leroi-Gourhan, signs and symbols represent a progressive 'intellectualisation of sensation', which liberates and exteriorizes the gestural and the figural to idealized objects.[16] Symbols are not purely pragmatic or functional; they are products of a genesis from the physiological, modulated by the rhythm introduced by technical objects. Stiegler associates epiphylogenetic memory with what Leroi-Gourhan calls 'social memory in expansion'. The first synthesis of social memory is then also an epiphylogenesis. This genesis is not linear but functions like a cycle, in the sense that whatever is exteriorized is reintroduced to the body so that a new process of exteriorization takes place.

However, this first synthesis also overlaps with the second one, fundamentally because both rely on all sorts of technical objects. The anthropologist Tim Ingold has produced a diagram that concisely illustrates the relation between memory and technics in Leroi-Gourhan's concept of human evolution.[17]

If we paraphrase Pierre Nora, we could say that what distinguishes the second synthesis from the first is that the second is based on the conscious construction of memory based on historical events or on the description of a particular *longue durée*, as well as on archives and monuments. Jan Assmann has since produced a slightly different schema: he distinguishes between communicative memory, cultural memory, and political memory. For him, only the latter two correspond to what we call the second synthesis.[18] The first synthesis can be lived and transmitted to the next generation through

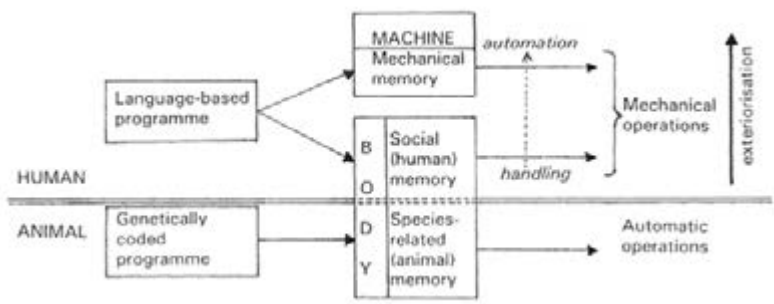

Fig. 12. 1: Scheme of Leroi-Gourhan's understanding of technics and memory in evolution by Tim Ingold.

a variety of practices, without being explicitly expressed. It is within such lived forms of transmission that social or collective identity is formed and also reconstituted through acts of invention. This is probably a more primordial and necessary process than the *explicit exteriorization* of the second synthesis, which is usually politically constructed. Put differently, writing as such probably has a more significant role in the definition of ethnicity than writings on historical events. Yet the two cannot be separated, and indeed Leroi-Gourhan also observed that progress in writing technologies accelerates the production of explicit memories, as seen in the expansion of printing in Europe in the eighteenth century, and the digital technologies of the twentieth century.

The three syntheses of social memory are, then, as follows: the exteriorization of memory by means of tools, rules, and rituals; the construction of explicit historical memories; and the anamnesis of the unmemorable. There is a clear reference here to Jean-François Lytoard's analysis of the synthesis of time in habits, memorizing, and what he calls '*passibility*'[19] as well as Gilles Deleuze's analysis of Humean habits, Freud's concept of *Nachträglichkeit*, and Nietzsche's eternal return. However, in our context, the synthetic nature of social memory is no longer a mere function of the mind; it is fundamentally exterior in virtue of its technical nature. Social memory is like a sphere that englobes the individual and represents the universal incarnated in the individual at the same time as the memory of each individual contributes to the universal. When Leroi-Gourhan comments on social memory, he emphasizes this two-way traffic: the human being is a zoological individual and also a creator of social memory.[20] Such memory does not reside 'in' the brain but, like human evolution, starts with the feet that *liberate* the hands for using and inventing tools.[21] This is a reflexive model of social memory which includes the participation of individuals as well as of technical objects, processes of invention and use, as well as the conscious and explicit assemblage of idealized memory traces. With this tripartite schema of the three syntheses of memory in place, I will attempt to describe the impact of the digital on our understanding of the first synthesis and partly on that of the second.

Memory, ethnicity and the technical milieu

As we have seen, the first synthesis refers to an implicit form of social memory that is embedded in and communicated through technical objects in everyday use. This provides us with a rather vague concept of

social memory, since there are innumerable technical objects. However, Leroi-Gourhan's concept of the technical milieu outlines the associations of technical objects in a way that lends more specificity to the question of their social relations. In *Speech and Gesture* (1964, 1965), Leroi-Gourhan describes the evolution of *homo sapiens* as a history of the living being and its milieu, shaped through technological interventions. In an earlier book *Milieu et Techniques* (1945), Leroi-Gourhan analyzes the formation of ethnicity through the concepts of the exterior and interior milieu. Put simply, the exterior milieu consists both of unchanging nature and dynamic exchanges with other groups with different technologies. The interior milieu consists of affairs that are internal to the physiological and biological needs and social operations within the ethnic group. Within the interior milieu, Leroi-Gourhan identifies what he calls the technical milieu. The technical milieu is always geographically and historically specific but also modifiable. It functions as a membrane in the sense that it filters and hence protects the interior, and it is also able to adopt forces from the exterior milieu. Ethnicity is therefore always, as Leroi-Gourhan emphasizes, a process of becoming.[22]

The technical milieu thus maintains the internal dynamics and the exchange with the exterior milieu. Simondon also noted that competition between the ethnic groups is part of a dynamic of *adaptation* an d *adoption* of technicity.[23] When a group develops new technologies, the neighbouring group, which has more advanced technologies, can easily adopt it and integrate it into its own social and economical system. But when the other group has a lower degree of technicity, it will have to adapt to the new modes of production in order to keep abreast of them. These are the extreme cases, but between them we can register different types of exchanges between different groups based on analyses of their technical milieux. In the extreme case of adaptation, the technical milieu is no longer able to function as a membrane: its function as a filter and protection is lost, and the separation between the interior and the exterior will be reconfigured. This results in disorientation, which needs to be resolved in order for the group to attain another metastable identity. The industrial revolutions initiated in England probably had such an effect on other European countries, but it seems that the similarities in cultures and the long history of wars and other exchanges allowed industrial production to be quickly absorbed into their interior milieus. Another example is the importation of Western technologies to China after the two Opium Wars (1839-1842 and 1856-1860). When the defeated Ching dynasty had to import military and industrial technologies from Europe and the United States, the technical milieu that had been strong and stable in China before the sixteenth century was totally

broken. Colonization always starts with the disruption of the technical milieu, which of course is partly defined by military technologies. When the technical milieu stops functioning as a membrane, the exterior and the interior becomes antagonistic entities, since metastability is no longer attained.

In such a situation, it is the first synthesis of social memory that is before all else disrupted and transformed. The second synthesis – the documentation and analysis of these historical events– always arrives later, and such a synthesis is often placed at the service of nationalist or fascist fantasies. The disrupted technical milieu invariably seeks a metastability that has to be reconstructed through inventions that produce new kinds of technical facts. As Leroi-Gourhan saw it, these may be aesthetic or decorative functions that are compatible with cultural traditions as well as the military technologies that keep the country abreast of other countries.

The second and later synthesis also demands a technical medium as well as a technical reality that reconstitutes the interior and the technical milieu. If we follow Simondon's analysis, archives and monuments are the key points [*les points clefs*] of reticulation in modern societies – the nodal points in their network formations. To briefly summarize the speculative history of technology outlined by Simondon in the last part of *Du Mode d'Existence des objets techniques*, primitive society is considered to be of magic origin, so that society is reticulated by means of a number of magic nodes, for example tall mountains, special trees, or animals. Once society bifurcates into religious and technical spheres of authority, producing further separations between science and technology or theory and practice, technical objects slowly take on the role as nodal points in the processes of social reticulation.[24] Simondon's point is that the progress of civilization can be described in terms of changing modes of reticulation, which become more and more dependent on the formation of the techno-geographic milieus:

> Look at this TV antenna of television as it is … it is rigid but it is oriented; we see that it looks into the distance, and that it can receive [signals] from an emitter far away. For me, it appears to be more than a symbol; it seems to represent a gesture of sorts, an almost magical power of intentionality, a contemporary form of magic. In this encounter between the highest place and the nodal point, which is the point of transmission of hyper-frequenies, there is a sort of 'co-naturality' between the human network and the natural geography of the region. It has a poetic dimension, as well as a dimension having to do with signification and the encounter between significations.[25]

The question is how digital technologies affect the dynamic techno-geographic milieus of social memory. The first effect is the *technical tendency* of digital technology to turn various forms of manual production into exteriorized memories through all sorts of computational operations and apparatuses. I take the term 'technical tendency' from Leroi-Gourhan, who distinguishes it from technical facts. While technical facts are accidental, a technical tendency is necessary: the invention of wheel is a technical tendency, but whether or not wheels will have ray structures is a matter of technical fact. The digital exteriorization of memory is of course not a new phenomenon, but contemporary technologies have pushed it to a new stage: the advancement in artificial intelligence replaces ever more human activities, with the result that automation no longer simply takes over human physical movements, as in nineteenth-century industry, but increasingly also cognitive processes. Tools converge in terms of functionalities and become increasingly removed from the specific geographical sites.

A typical example is social networking platforms, which have penetrated into almost all cultures with their particular functionalities and aesthetic. The convergence of the technical milieu thus is one of the consequences of the technological globalization and new forms of industrial standardization. We may as yet only have a vague idea about the consequences of these changes, but we can already observe that the invention of technical tools has tremendous effects when it comes to the synchronization and assimilation of gestures and thoughts. The truly planetary scale of these technical changes will probably be even more evident to people outside of the European cultural sphere.

Second, digital technologies have further accelerated the already rapid expansion of social memories that, according to Leroi-Gourhan, started in eighteenth century in Europe:

> The eighteenth century in Europe marked the end of the ancient world in printing as well as in technology … Within the space of a few decades the social memory had engulfed in books the whole of antiquity, the history of the great peoples, the geography and ethnography of a world now definitely acknowledged to be round, philosophy, law, the sciences, the arts, the study of technics, and a literature translated from twenty different languages.[26]

As Leroi-Gourhan points out, human memory is no longer able to encompass these exteriorized memories and instead relies on index systems, punch cards, and artificial intelligence. He uses the term 'mechanical

memory' to distinguish between human and animal memory, defining it as 'constituted through experience within the channel of a preexisting program and of a code based on human language and fed into the machine by a human being'.[27] Mechanical memory is, in other words, an *explicit* form of exteriorization in which what exists implicitly as collective memory is explicitly expressed in technical terms. While this formulation might lead us to believe that mechanical memory is mainly part of the explicit memorizations of the *second* syntheses of social memory, I will argue that it should also be analyzed as a constituent part of the *first* synthesis.

Concretization of transindividual relations

If today we must address the question of social memory in new ways, it is because a new dynamic between the three syntheses has emerged. The complexity of this dynamic is yet to be formulated – at this point I would only like to draw attention to the contingency of memory and the diversity brought by their digital systematization. Digital networks affect the very definition of social groups and things, and in a way that contrasts with Simondon's description of the philosophical task of future humanism. Towards the end of *Du Mode d'Existence des objets technique*, he suggests that philosophy should reunite the separated subjects and disciplines, since their divergence has created problematic oppositions between theory and practice, religion and science, culture and technics, etc. However, one of the consequences of the digital revolution is that it has led to the convergence of previously separate realms of knowledge and practice by reducing the distance between things and individuals and by synchronizing memory through media technologies.

In other words: once digital networks become the primary tools and reservoirs of social memory, the distance between the first and second synthesis diminishes. First, all the traces produced by the first synthesis become recordable, a fact that becomes even more evident with the realization of smart cities, smart homes, and smart objects; ordinary users are already faced with the recording and exploitation of their behaviour on Google, Facebook, and Amazon. Behaviour thus forms a new kind of 'live archive'. Since behavioural data are already structured when they are captured, they are no longer simply raw data but are replete with semantic meanings that make them available for search. (I here refer to the use of formal or web ontologies in the semantic web or any other form of data classification).

Second, explicit forms of social memory such as historical archives are currently in the process of being digitized. This process takes place at a much higher speed in post-colonial countries, where the building of national identity demands a destruction of colonial memories, reducing them to disembodied sensual effects. In economically advanced countries, this is also happening at the pace of urbanization, so that whatever is destroyed by gentrification is transferred to digital images and archives. Numerous institutions are forced to open up their archives through digitization or to deploy digital strategies such as interactive models, crowd sourcing, open access, etc. Every second, billions of images document ongoing events, attesting to a constantly ongoing and unconscious effort to create living memories out of the past. Increasingly, the synthesis of memory is reduced to the production and consumption of data, with the implication that collective memory is often the result of big data analysis, digital behaviourism, etc.

The question of archive therefore needs to be understood in terms of the technical milieu and viewed from an anthropological perspective.[28] However, we first need to examine the technological condition of exteriorization in the digital age. Following Simondon, the evolution of technical objects can be understood in terms of the concretization of technical individuals. They are assimilations of nature to the extent that, like natural objects, they can only be understood in terms of always ongoing processes of becoming. Even so, Simondon's conception of technical objects is relatively limited. He lived at a time when the principles of quantum physics were mainly used for the development of electrical devices, and so his examples tend to revolve around diodes, triodes, tetrodes, pentodes, etc. His understanding is also limited by the working principles of these devices, which primarily depend on physical contact. The operation of a diode is based on the transmission of electrons from the anode to the cathode, and the same is the case with a triode, which in addition to the anode and cathode has a gate in between them to amplify the current. In digital technologies, by contrast, physical contact as the foundation of reciprocal causality is displaced by a causality operated through data. I use the word 'displace' instead of 'replace', since we can never replace a causality based on physical contacts: my point is simply that within the dynamic of the technical development, direct physical contact is no longer the only reality. Data, which are essential to understanding the digital, have become the new material medium of operation. For this reason, I want to distinguish between digital objects and Simondon's technical objects, even though I retain other features of Simondon's analysis.

Fig. 12.2: The evolution of diodes as a process of concretization. Photo by Stefan Riepl, licensed under Creative Commons Attribution-Share Alike 2.0 Germany.

Simondon understands technical objects as intermediaries between humans and nature, as the organizer of relations between the user and the milieu. However, with digitization, the role of technical objects becomes less easy to define, since the escalated processes of exteriorization make the lifeworld increasingly technical. Digitization is a process that renders digital objects ubiquitous and hence also naturalizes them. Data thus becomes the medium that unifies the two syntheses of social memory. This description exceeds Simondon's description of technical ensembles, which is based on examples such as factories, clusters, and other interconnected technical objects whose power of reticulation is limited in space and time. This is no longer the case, and had Simondon lived today, he would probably have revised his concept of the technical ensemble.

If we can speak of the temporality of concretization (i.e. the evolutionary process in which the technical object spatializes by materializing its relations), then we may today speak of the concretization of temporality itself as one of the consequence of this technical progress. Spatialization leads to an enlargement of the networks that extend from objects to objects and from ensembles to ensembles. The temporization of concretization, in contrast, leads to ever more finely calibrated synchronization. It is because causality is now also increasingly mediated through logical inferences rather than mechanical contact that we can talk about real time as well as micro-temporalities. Acceleration approaching the speed of light is an effect of the digital concretization of temporality, and systematization is an inevitable part of the process.

It is from this perspective that we may consider the *concretization of transindividual relations* in the digital age. As already noted, Simondon understood transindividual relations as implicitly expressed through invention and usage. The functionalities of a technical object define its essence and also define its transindividual relations. For example, when a book is used as a wedge or a pedestal, it doesn't bring any information. Information is the result of a relation between forms, and the book loses information once its form is misused or misrecognized (e.g. when the book is used as a wedge or a pedestal).[29] Transindividual relations are therefore not just interpersonal and functional, they are also mediations in the sense that they emerge in operations that cannot be fully captured in material terms. Simondon is absolutely right to attribute the concept of the *apeiron* (unlimited, infinite, or indefinite) to technical objects.[30] There is something in the technical that cannot be exhausted and that goes beyond its functionalities. Yet between the concept of concretization and the concept of transindividual, there is a tension that Simondon did not address and that concerns the concretization of transindividual relations.

I suspect the reason that such thought is not present in Simondon is largely due to his reluctance to discuss materialism, which he saw as mere reduction.[31] This may also be the reason why Simondon did not emphasize the material aspects of the operational relations inside technical objects and the transindividual relations outside them. Since materialization is a genuinely transformative process that also produces new types of immaterial relations, there is no contradiction between placing emphasis on the open or indeterminate aspects of technologies and focusing on its material mediations. Leroi-Gourhan is clearer on this point than Simondon. Simondon understands individuation in terms of the play of information: having overcome Aristotelian hylomorphism, he saw information as more primordial than form. In contrast, Leroi-Gourhan saw matter as the fundamental cause, more fundamental than form. Even so, latent materialist perspectives also inform Simondon's discussion of how human memory and machine memory become compatible despite their differences in nature. For while human memory is characterized by a unity of form and order, machine memory is multiplicitous and disordered. Nevertheless, these two memories can communicate:

> The coupling of human and machine starts to exist from the moment when a common code between the two can be discovered, so that one can realise a *partial convertibility* of one in the other, for that a synergy is possible.[32] (my italics)

The example that Simondon gave is the use of magnetic ribbons to record telephone calls, in which machine memory and human memory can efficiently communicate. Such convertibility has passed from the analogue technology that Simondon described to the digital technologies of our time. The cybernetic auto-regulation that interested Simondon now seems to be extended from the human-machine relation to a wider human-technical network that is at once intimate and social. The productivity of data in every aspect of our life is not just what Leroi-Gourhan called a technical tendency but what I would call an *industrial* technical tendency that emerges less out of the need to solve a specific problem (defined by Simondon as invention) than by forces of innovation fuelled by market and economic factors. This intensified relation between technology and innovation is then the key feature of the concretization of transindividual relations in the realm of digital technologies. Data technology is thus all at once the key technology of both the first and second syntheses of social memories. For sure, there is still an explicit production of social memory – the historical archives, museums, monuments, and landmarks that emerge as a result of urbanization and the culture industries. But they no longer necessarily function as nodal points of social reticulation. It is just as likely that digital images and videos of such monuments – ensembles of digital objects – function as nodal points, since they amplify and distribute the impact and meaning of such memories. The significant and positive impact of digital technology is that it reactivates the explicit memory production of the second synthesis by connecting it to the more implicit life practices of the first synthesis. Today's informal and 'instant' access to archives, facilitated by navigational tools and semantic technologies, attests to this perspective.

Rhythm and the becoming of social memories

Social memory is related to the question of rhythm, and changing processes of reticulation necessarily also produce new types of rhythms. In Leroi-Gourhan's *Rhythm and Memory*, he describes rhythms as creators of space and time. While the exteriorization of memory is produced according to one rhythm, the reintroduction of that memory product in everyday life produces another rhythm, which is all at once physiological, gestural, psychological, and social.[33] The domestication of nature is also a rhythmic process: the rhythm of walking gives the measurement of miles (or kilometres), and the rhythm of hands leads to the 'immobilisation of volume'.[34] Rather than giving form, rhythm modulates: according to Michel

Guérin, Leroi-Gourhan's materialism is thus *hylo-rhythmic* rather than hylo-morphic.[35] Rhythms also synchronize, and social memory is unified by the compatibility of rhythms performed by individuals and groups. Here Leroi-Gourhan notably distinguishes between musical and mechanical rhythms: if musical rhythms mediate between the natural world and humanized space, technical rhythms 'transform untamed nature into instruments of humanization.'[36] Mechanical rhythm is an exteriorization of musical and poetic rhythms, reducing them to the repetitive standards of synchronization: the standards of metronomes, clock time, calendars, assembly lines, computational time, and real time.

To understand the technical tendency of today's mechanization, automatization, or digitization and the specific ways in which it produces social identities or ethnic becoming, we need to consider the rhythms of these new industrial programmes. As Leroi-Gourhan saw it, 'individuals today are imbued with and conditioned by a rhythmicity that has reached a stage of almost total mechanicity (as opposed to humanization). The crisis of figuralism is the corollary of the dominance of machinism'.[37] Simondon also described the rhythm of industrial technical objects as a major source of alienation:

> With the passage to industrial motricity, the situation was profoundly changed. (...)The worker was placed in the presence of sections of networks measured out by the machine's *rhythm*, of series of movements that left the subject on the outside, a complete 'technical deculturation' occurred, conjointly with the loss of belonging to a group with a clearly defined personality and on a comfortable scale.[38]

Rhythm here is understood as a mere repetition of patterns. In *Technics and Time 2*, Bernard Stiegler returns to this critique, asserting the importance of rhythm for the diversification of gestures and idioms: 'this notion of an aesthetic requires a typological description of programs as rhythms even more than as memories.'[39] He then describes the relation between rhythm and the industrialization of memory, which takes place first through transportation networks, and then through telecommunication networks:

> Networks affect and dis-affect, organize and disorganize *rhythms* and *memories*. The network in general is, in this sense, programmatic. And further, transmission of programmatic *rhythms* suspends, from outside, other *rhythms* and programs through its opening to the other, while the becoming-material of frameworks, the objectification or exteriorization

> of territorialization in deterritorialization is subsumed within the technological tendency.[40]

The rhythm embedded in the industrial programme leads to disorientation. It is necessary to constantly reassess the relation between rhythm and technics. With automatization, Leroi-Gourhan observed, the diversification of rhythms decrease, and the very question of rhythm shifts from the metaphysical to the political and pragmatic. This is an obvious feature of the automatized recommendation systems of Amazon, Google, and other digital corporations. The new nodal points of social reticulations are built through 'algo-rhythmic' modulations of transindividual relations, as seen in this passage from an article published by the leading consultant firm McKinsey & Company:

> Employing advanced analytical methods, algorithmic marketing provides real-time offers targeted to individual customers through a 'self-learning' process to optimize those interactions over time. That can include predictive statistics, machine learning, and natural language text mining. It harnesses big data such as customer location and behavioural information along with powerful computing systems to match customers with context-sensitive products and services.[41]

At this point we may finally evoke the third synthesis of social memory: namely the memories of that which is unmemorable. The unmemorable is something that cannot be inscribed in memory and remains always a line of flight. Like the Kantian sublime, it does not reside in things but interrupts the concepts supported by the memory system. Such memorizing is only possible when transindividual relations are not exhausted by automatisms or repetitions that pre-empt or preclude imagination. In the last chapter of *Rhythm and Memory,* Leroi-Gourhan speculates on the future of *homo sapiens*, given the regression of the use of the hand and the liberation of other biological organs. For centuries yet, predicted Leroi-Gourhan, 'reading will go on being important…but writing is probably doomed to disappear rapidly, to be replaced by dictaphonic equipment with automatic printing.'[42] Fifty years later (the book was published in 1965), we see that handwriting has been replaced by keyboards and autocompleting programmes, and that the question of what to read is always already submitted to calculation, another 'liberation' through exteriorization.

The question we face is thus whether social memory is entering a phase of technological exteriorization, where global processes of automatization

and synchronization have accelerated to the point of pre-empting the imaginative dynamics of living memory – i.e. the environmental adaptations that take place through rhythmization and invention. However, an overly totalizing critique of the synchronization and the homogenization of rhythms may be dismissed. Not only has this not yet taken place, given that a large part of the world's population is not even connected to the digital networks; more significantly, absolute synchronization is not even possible since it essentially equals death. Under any circumstance, opinions on this matter are divided. For example, in a 2012 debate on search engines, Michel Serres – countering the perspectives of Bernard Stiegler – argued that the exteriorization and objectivation of the cognitive automats were extraordinary liberations.[43] It is beyond the scope of this article to explore the debate between Stiegler and Serres (and the thorny issue of 'liberation'), but the current transformations of the field of social memory urgently call for a debate that passes beyond the familiar issues of technological optimism and pessimism. The focus should instead be on the technopolitics of rhythm – a research agenda that re-opens the question of anthropo-technics in the digital age. Hopefully my outline of the three syntheses of social memories and their relations to the industrial programme of digitization can provide a framework for analyses of the new fate of social memory in the twenty-first century.

Notes

1. Leroi-Gouran, 1993, p. 407.
2. Heidegger, p. 186.
3. Halbwachs, p. 38.
4. Simondon, 2005. See chapter 3 of the second part, where Simondon reproaches the psychology of ignoring the tensions produced within the psychical individual against itself.
5. Ameisen, pp. 168-188.
6. Clark and Chambers.
7. Haugeland.
8. Dretske.
9. Simondon, 2012, p. 247 (my translation).
10. Benjamin, p. 124.
11. On this point, Simondon emphasizes that in comparison with machines, human beings have the capacity of transforming the *a posteriori* (empirical facts) into *a priori* (symbols, signs). See Simondon, 2012, p. 175.
12. Ibid., p. 248.

13. Stiegler, 1994, p. 140.
14. Leroi-Gourhan, 1993, p. 258.
15. Ibid., p. 177.
16. Bidet, p. 22.
17. Ingold. Even though Ingold admires much of Leroi-Gourhan's programme of exteriorization, there is, however, something very doubtful when he says 'regarding the machine as a perfect substitute for the tool-assisted human organism, he feels justified not only in treating the operations of the organism as mechanical, but also in describing the machine itself as just another kind of organism whose physical existence is nevertheless external to the body'. It should be reasserted that for Leroi-Gourhan, exteriorization does not imply at all an equality between organism and machine but rather an equivalence of certain functionalities; moreover, it is not a replacement of such function but rather a cycle as I have described above.
18. See Assmann, p. 122.
19. Lyotard, pp. 57-67.
20. Leroi-Gourhan, 1993, p. 208.
21. Ibid., p. 209.
22. Leroi-Gourhan, 1945, pp. 340-343.
23. Simondon, 2013, p. 319.
24. Simondon, 2012, Part III, Chapter 1, 'Genèse de la technicité'.
25. Simondon, 2009, p. 111.
26. Leroi-Gourhan, 1993, p. 262.
27. Ibid., p. 258.
28. Hui.
29. Simondon, 2012, p. 336.
30. Ibid.
31. Simondon, 2005, p. 159.
32. Simondon, 2012, p. 173.
33. Leroi-Gourhan, 1989, p. 310.
34. Ibid.
35. Guérin, p. 103.
36. Ibid., p. 310.
37. Ibid., p. 311.
38. Cited by Stiegler, 2009, p. 75.
39. Ibid., p. 82.
40. Ibid., p. 144.
41. Goff, McInerney, and Soni, 2012.
42. Leroi-Gourhan, 1989, p. 404.
43. Serres and Stiegler, 2012: 'I am not very Simondonian on this point, I find that philosophers of technologies a bit limited on certain things, therefore objectivation in the cognitive automats are extraordinary liberations.'

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Contributors

David M. Berry is Professor of Digital Humanities in the School of Media, Film and Music, at the University of Sussex.

Ina Blom is Professor at the Institute of Philosophy, Classics, History of Art and Ideas at the University of Oslo.

Wolfgang Ernst is Professor and Chair at the Institute for Musicology and Media Studies at Humboldt-Universität in Berlin.

Matthew Fuller is Professor of Cultural Studies and Director of the Centre for Cultural Studies, Goldsmiths, University of London.

Andrew Goffey is Associate Professor in the Faculty of Art at the University of Nottingham.

Liv Hausken is Professor at the Department of Media and Communication (IMK) at the University of Oslo.

Yuk Hui is postdoctoral researcher at the Centre for Digital Cultures of Leuphana University Lüneburg.

Trond Lundemo is Associate Professor in Cinema studies at the Department of Media Studies at Stockholm University.

Adrian Mackenzie is Professor of Sociology at the University of Lancaster.

Sónia Matos is a designer and lecturer at the Design School at the Edinburgh College of Art.

Richard Mills is a researcher at Lancaster University with a background in statistics.

Jussi Parikka is Professor in Technological Culture & Aesthetics at the Winchester School of Art in the United Kingdom.

Eivind Røssaak is Associate Professor at the Film and Media Section of the National Library of Norway, Oslo.

Stuart Sharples is Lecturer in Mathematics and Statistics at Lancaster University.

Sean Snyder is a visual artist based in Berlin.

Tiziana Terranova is Associate Professor in New Media and Cultural Studies at the University of Naples (L'Orientale).

Pasi Väliaho is Senior Lecturer in Film and Screen Studies at the Department of Media & Communications, Goldsmiths College at the University of London.

Name index

Page numbers in italics refer to images.