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Title: Algorithms as figures: towards a post-digital ethnography of algorithmic contexts

Abstract: This article intervenes in contemporary discussions of critical algorithm studies about the meaning of the notion “algorithm”. While many critical scholars as well as most public and private organisations understand this concept as a computational procedure instantiated by a programming code in a software stack, I argue that the algorithm is better understood as a “figure”: a discursive short-hand pointing to diverse modes of procedural governance and not always digital ones. Since algorithmic figures are generated by a bundle of heterogeneous contexts, their emergence leads to conflicting visions about the reality, materiality and effects of algorithmisation. This article provides four ethnographic strategies to describe the contexts of production and circulation of algorithmic figures: observing the observers of algorithms; mapping and creating algorithmic figures; drawing relations across contexts of figuring; and analysing the transformative effects of algorithmic figures on the attempts to govern them.

Key words: Algorithms, ethnography, post-digital, figures, contexts, governance, methodology.

Introduction

In everyday settings, we navigate through situations where attributes about us and the world are calculated (Cardon, 2015; Amoore, 2020a), classified (Fourcade and Healy, 2013), sorted (Sandvig, 2014), ordered through information architectures (Yeung, 2016), anticipated by predictive techniques (Salganik et al., 2020) and enriched by personalisation methods (Lury and Day, 2019). Our worry regarding the power of algorithms is justified by many critical studies rightly pointing to their roles as pervasive backstage devices, participating in the constant optimisation of experience (Dieter, 2015) and infrastructural surveillance (Gekker and Hind, 2019). In these studies, authors understand algorithms as digital objects part of a broader software system. But they could also be portrayed more broadly as infrastructures, assemblages, protocols of actions, sets of policies and practices — or different combinations of these elements. In this paper, I use an ethnography of algorithmic regulation in French public organisations to show how regulators and judges redefined ‘administrative procedures’ as ‘algorithms’. The empirical study has been conducted between

March and October 2018 at the French open data task force, Etalab, as well as through meetings with regulatory bodies and citizens impacted by algorithmic decision-making. Etalab is a service attached to the French Prime Minister and through which the digital transformation of the French State is announced and developed using innovative practices such as the resources of data science and algorithmic simulators; incentives to open up state data and create digital commons; the promises of State platformisation and a provocative hacking spirit. Etalab is the service that initiated the Lemaire Bill of 2016 leading to the creation of a new right to explanation of algorithmic decision-making. As I will explain later, when used by regulators this powerful device rebranded many bureaucratic procedures as procedural ‘algorithms’. Mapping and questioning the transformations provoked by a transparency initiative (re)opens questions about the technological conduct of State organisations, the role of infomediaries and task forces as well as the uses of machinic metaphors — algorithm, platform, system — as devices triggering State reorganisations.

In doing so, this paper contributes to critical algorithm studies concerned by the politics of algorithmic transparency and accountability (Neyland, 2015). Due to the difficulty to allocate the blame to what causes the suspicion of being oriented by obscure computational forces, the ‘algorithm’ emerged as the perfect catchy word symbolising an opacity and growing dehumanisation. Blaming the so-called ‘algorithm’ for the inherent opacity of computational technologies is a current attempt to circumscribe the problem to an identified cause: one that could be easily attacked for its errors, bias, unfairness and complexity. Nevertheless, when we scratch the surface of what lies behind the ‘algorithm’ we often see known elements: rigid laws putting in action predictive models (Amoore, 2020b), mundane office softwares (Dencik and Kaun, 2020), engineers in action (Seaver, 2018). The problems to accurately locate and unpack the cause of our suspicion rapidly arise, especially since discourses about algorithms suffer from a ‘terminological anxiety’: a stigma due to the impossibility of fixing the meaning of these evanescent entities (Seaver, 2017: 2). To cope with this, some critical scholars suggested that humanists and social scientists engage more with debates in computer science (e.g. Dourish, 2016), while others show that even in the field of computer science, what algorithms are has never been clear (Sack, 2019: 82–83). Despite the important intervention of Science & Technology Studies (STS) in criticising the reification of the term “algorithm” (Ziewitz, 2015; Seaver, 2017), the use of this concept — and its capacity to unify disparate entities — is still an attempt to catch the problematic rise of computational technologies in everyday settings.

Instead of closing the debate by providing once and for all a normative definition of an algorithm, I wish to provide in this article a program to ethnographically follow the use of this notion and to study how processes that are not entirely or necessary digital ones (e.g. administrative

procedures) are rebranded as ‘algorithms’. This process of reframing is occurring when the ‘algorithm’ becomes a ‘figure’: an expression portraying in a particular way the manifestations of procedural actions leading to a decision-making. Beyond our vision, an algorithmic figure force us to reflect on the relations between (dis)joined human and non-humans actors, as well as digital and analog objects participating in calculation processes. I am inspired here by STS scholar Malte Ziewitz who asked: ‘What would it take to understand algorithms not as techno-scientific artifacts, but as a figure that is mobilized by both practitioners and analysts?’ (Ziewitz, 2017: 2).

Following a genealogy of STS analyses on technological problems, in my approach, the controversial technology becomes not simply a flexible and interpreted ‘text’ subjected to different ‘readings’ (Woolgar, 1991) but a dramaturgical character (Pfaffenberger, 1992) socially sustained by figurations that regulates its interpretation: the algorithm ‘resembles a literary genre, in which a text’s meaning changes as it falls into new hands and new situations’ (Pfaffenberger, 1992: 284). To avoid any misunderstandings: I do not mean that algorithms are *just* texts and do not have a material reality, but I argue that we need to account for the transformative force of the concept.

The ethnographic program I will sketch in this paper is useful to question the ontology and discursive power of algorithms, I see it as complementary to others ethnographic forms of engagement sensitive to the crucial work of software engineers and data scientists (Seaver, 2018b), the limitations visible in the translations from an everyday language to a machine language (Sack, 2019:105-106) or the comparison of algorithms across sectors (Christin, 2020). As it will be made clear in the following sections, the methodological originality of the contribution consists in adopting a ‘post-digital’ sensibility grounded in media aesthetics and theory (Cramer, 2015) in order to ethnographically account for the troubling encounters with analog processes reclassified as digital and algorithmic ones.

Since algorithms are difficult objects to observe and access, figuring them is a strategic move: language provide resources to reframe and rename their agency. The algorithm can then be ‘fabulated’ to suit our needs of understanding computation (Amoore, 2020a: 103). Here, figuration goes into two directions: speculating/fabulating on the agency of algorithms as a way to tease our imagination and show how they create ‘new connections and traits, forging attributes that will attach to other beings in the future’ (Amoore, 2020a, p.103); and weaving into a single entity the disparate actors constituting the algorithm — the invention of a story or a synthesis. Stories of algorithmic fabulations are told about lurkers (Goriunova, 2017), monsters (Suchman, 2018) and algocrats (Danaher, 2016). In these studies where algorithms become ‘conceptual characters’ the analytical and methodological process of figuring is undefined, what is foregrounded and

particularly compelling is the narrative use of figures. By proposing an ethnographic program of study, my contribution aimed at providing a broader account of the value, pitfalls and surprises of algorithmic figuring: a set of strategies applicable to various sites of study. My attention will be directed to moments where figures trigger a semantic shift, reclassification, or a process of synthesis between many entities — for example when the messiness of ‘bureaucratic procedures’ are rebranded under the clear rigidity of ‘algorithms’. I contribute then to an interdisciplinary program of research aimed at elucidating the methodological value of figures, figuring and figurations and their role in composing problems (Lury et al., forthcoming). In the first part of this article, I will show how the ‘algorithm’ has always been a figure to describe certain kind of procedural actions — be they digital or not. In the second part, I will propose an ethnographic program to describe and analyse the effects of algorithmic figures on their contexts of governance.

Algorithmic figures in contexts

In her history of rules, historian of science Lorraine Daston developed the idea that algorithms have always been figurations of rules rooted in the mechanical arts of writing and materialised in formats such as patent law, how-to books, recipes and cookbooks (Daston, 2019; Sack, 2019: 84). This idea of algorithms as sets of instructions or recipes corresponds to their pre-modern conception. More generally, the pre-modern understanding of an algorithm arises from the arithmetisation of logics, and the many attempts to mathematically formalise judgments. For example, in an earlier work, Daston made the case that the quantification pursued by the early mathematical probabilists was deeply rooted in the formalisation of legal concepts (Daston, 1988). She recently reiterated the example of the calculus of ‘uncertainty degrees’ as a way to historicise our contemporary attempts to quantify judgment: ‘a much ridiculed doctrine of the arithmetic of proof, highly developed in 16th-century legal and casualist thinking, in which the testimony of different witnesses and different kinds of evidence are assigned different weights’ (Daston, 2020). From the history told by Daston, we learn that algorithms are hybrid figures that could be formalised through the joined heritage of legal and mathematical formalisms. Their essentialisation as purely mechanical entities is way more recent.

If the rise of computers provided a fantastic tool to accelerate and automate the quantification and formalisation of judgements, however, during the first half of the 20th century, an algorithm is simply a set of formulae — a recipe written by hand — as well summarised by software studies scholar Warren Sack (2019:79):

‘Paradoxically, the push to automate people out of the picture cemented an image from the history of algorithms into their contemporary foundations. Alan Turing [early thinker of artificial intelligence] and Donald Knuth [father of the computer science analysis of algorithms] both based algorithms on an image of a man with paper and pen that could have been taken from a fourteenth-century Venetian reckoning school’.

The modern definition of an algorithm is in fact a conceptualisation coming from 1970’s software engineering and more specifically from its structured programming movement (Burke, 2019). This intellectual tradition of computer science advocated for a more limited language of instructions, organised in reusable parts, a way to simplify and solidify the writing of programs. The aim was to transform the way programming languages are organised and structure a top-down approach for planning the building of massive software systems. From a computer science point of view, the definition epitomising this evolution of the meaning is the following:

‘An algorithm is any well-defined computational procedure that takes some value, or set of values, as input and produces some value, or set of values, as output. An algorithm is thus a sequence of computational steps that transform the input into the output.’ (Cormen et al., 2009: 5).

This type of definition put in circulation the idea that an algorithm could be portrayed as a computational *procedure*. Unsatisfied by this uncertain understanding of algorithms, software theorist and developer Bernhard Rieder prefers to talk about ‘algorithmic techniques’ (Rieder, 2020: 81). For him, algorithmic methods are simultaneously: ‘material blocks of technicity’ (concrete artefacts such as programming codes); ‘units of knowledge’ (expressions of a scientific rationality, for example, a legal or mathematical formalism); ‘vocabularies for expression in the medium of function’ (a language for describing problems in procedural terms); and ‘constitutive elements of developers’ technical imaginaries’ (a speculation/fabulation about what software is capable of producing). Following feminist STS studies of figurations (Castaneda, 2002: 3; Suchman, 2007), we could then say that the flesh of algorithmic practices and their significance are drawn in a whole figure: the material, the semiotic, the scientific and the imaginary are then tied together. Algorithmic figures cannot then be completely reduced to discursive analogies or metaphors (seeing something “as if” it was an algorithm) or “vernacular” elements belonging to the imaginary of experts or users. Figures are organisational in the sense that they *configure* a ‘process of continuously changing

relations between elements in sociotechnical arrangements' which in itself 'gives meaning to each element as well as the arrangement as a whole' (Dahlman et al., 2021: 4).

Rieder's idea of "algorithmic techniques" is a recent attempt to specify the link between the reservoir of scientific knowledge programmers are using and the pragmatic constraints of digital materiality. Nevertheless, the type of abstract computer science definition of algorithms from Cormen et al. cited earlier has gained prominence since the 1970's. Following HCI researcher Paul Dourish (2004: 21–22), we can say that when computer science sees the specification of an algorithmic context as 'a representational problem' where software-making is concerned with representing and integrating elements, the field has then four assumptions about what an algorithm is:

-it is *made of* languages and symbols in *code*;

-it must be *delineable* since writing an algorithm is working at a certain level of abstraction, typically a higher level than the implementation in a particular software and hardware;

-it is a *stable entity* that must be *separated from other entities* because implementing a particular process or operation of calculation has to be separated from "system problems" addressing issues of interface, interaction, scale, and infrastructure (see Sack, 2019:81).

-it is a technological entity *made and acting "in" a context*. Activities of programming are considered as separated from their context of production. Social life is not shaped but "impacted" by an algorithmic system.

This vision from computer science of an algorithm as a purely digital object ordering a set of procedures has been recently criticised by empirical STS studies. One main criticism of STS points to the fact that no matter how well defined the computational steps of the procedure are, and despite the attempts of structured programming to separate data from program, an algorithm is folded into its methods, tools, data and users (Lee et al., 2019). Put simply, an algorithm is nothing without its enactment by a whole socio-technical system: there are no algorithms but only algorithmic systems made of cultural practices that can be potentially situated outside the realm of software (Seaver, 2017). Complementary to Dourish's vocabulary, in a STS critique of 'fair' machine learning methodologies Selbst et al. (2019) identified five traps leading computer scientists to fail in the contextualisation of algorithms:

-the *framing trap* where the sociotechnical context of data inputs is reduced to a mathematical formalism,

-the *portability trap* constituting an impossibility to recontextualise and then transfer an algorithm from one context to another,

- the *formalism trap* where the complex philosophical and ethico-legal contexts of social concepts such as ‘fairness’ are abridged to an algorithmic modelling,
- the *ripple effect trap*: the failure to see how algorithms gets recontextualised by social settings and transformed by the frictions of reactive behaviours, adaptations and negotiations,
- the *solutionism trap*, a technological determinism pushing actors not to carefully understand the context and directly argue for using algorithms as technological fixes.

Therefore, for STS, an algorithm is better understood as a global system connecting human and non-human entities. If we use again the vocabulary from Paul Dourish (2004:22), we can say that when social science or humanities scholars frame an algorithmic context as an interactional or ecological problem, they have four assumptions about what an algorithm is:

- it is not simply made of information but *achieved through relations* between human and non-human entities, some may not be relevant for specifying an algorithmic context;
- its borders cannot be known in advance since they are ordered by *the progression and open-endedness of interactions and contexts*;
- it is a *situated and contingent entity* that *cannot be separated* from the developers’ practices as well as from the legal, geographical, economic and or organisational cultures shaping it,
- it is *made by a very specific context* of production understood as a set of programming activities, scientific rationalities and material constraints. The social and cultural spaces where algorithms have agency are shaped, ordered and generated by algorithms themselves.

To summarise I would draw on post-digital thinker Florian Cramer (2013) and say that while the ‘digital aesthetics [aligned with computer science] privileges symbols (abstract codes), post-digital aesthetics [as well as ethnography and STS] tends to privilege indexicality (traces and contextual signs)’. The algorithm is then a figure or short-hand to describe a complex assemblage of interactions, a way to synthesise a bundle of entities shaping a ‘borderless’ algorithmic context (Ananny and Crawford, 2016: 11). If I now position the figure of the ‘algorithm’ in the ‘cultural logic of computation’ (Golumbia, 2009; Franklin, 2015), it strangely oscillates between an emblem pointing to the need to develop a language for understanding computation and a ‘means’ to describe the corresponding material reality of algorithmic processes (see, Hayles, 2005: 17–19, and for a discussion; Tkacz, 2015: 146–147). This ambiguity generates an interesting empirical problem for ethnographers: does the discursive figuration of an algorithm always coincide with its clear ontological status? Instead of settling the meaning of what an ‘algorithm’ is, I propose to investigate the entangled formation of algorithmic figures as the manifestation of a ‘generative cultural dynamic’ (Hayles, 2005:21) where machinic figures and social constructions of technological

reality are entangled. How then to follow and ethnographically describe algorithmic figures? In the next part I propose an ethnographic program designed to make sense of their contexts of creation and circulation.

Towards a post-digital ethnography of algorithms

If the contemporary imagination often sees algorithms as lines of programming codes in a software stack, what we are concomitantly witnessing is a ‘de-signification’ of such understanding of the algorithm. In my ethnography of algorithmic transparency in French public sector organisations, I observed that the digital materiality of algorithms ceased to be what primarily defined them. For example, in response to freedom of information (FOI) requests, the French administrative regulator Commission of Access to Administrative Document (CADA) qualified the following systems as algorithms: a decision tree used to coordinate the intervention of firefighters and ambulances¹, the calculus of pensions for independent workers² or even a paper-based grid of criteria used to score secondary schools students willing to enter a path of excellence in a special high school³. Neither the jurisdictions nor the administrations seem to consider algorithms to be specific to the computer or digital environment. It is necessary and sufficient if the ‘algorithm’ is a logical sequence of instructions. In the legal context where a clear definition of algorithms was not provided by the French administrative law, the meaning of algorithms have been ‘adjusted’ to the needs of regulatory authorities. Here the algorithmic figure becomes a device *refiguring* bureaucratic practices in algorithmic terms. For administrations as well as for citizens, the term ‘algorithm’ came to redefine administrative practices that were previously not qualified as ‘algorithmic’. In the context of my ethnography, only the CADA and administrative courts have the power to determine the ontological presence of an algorithm in a given administrative procedure. The truth of the legal qualification (Cayla, 1993) redefining administrative procedures as algorithms has its own mode of existence (Latour, 2013) that could be contested by other fields acting as custodian of algorithmic knowledge — domains such as computer science.

As a device, the FOI requests performatively creates the very reality of the entity it is supposed to make accountable. In other words, by trying to find a solution to unfair administrative decisions, the CADA has *provoked* the coming into being of the entity ‘algorithm’. If the algorithm is then not attached anymore to the digital environment it becomes a *post-digital* entity used to envision administrative procedures as ‘algorithmic’ instructions, a practical scheme with explanatory effects. As an ethnographic sensibility, thinking in *post-digital* terms makes the

observable dimensions of algorithmic figuration manifest: its ‘procedural epistemology’ (Abelson and Sussman, 1985:xvi) as well as its associated affordances in everyday life (Berry, 2015: 47). According to media philosopher David Berry (2015:45), the *post-digital* approach is ‘a logic that informs the re-presentation of space and time’. Indeed, the figuring potential of the ‘algorithm’ is used to reframe the temporal and spatial ordering of administrative procedure: it is the concatenation of different instructions coming one after another. What I want to suggest is that there is a performative logic of the digital that is not only material — put in action through computational technologies — but also discursive, to the extent that algorithmic thinking becomes used in many areas of social life and far beyond the study of computational technologies. Following media theorist Florian Cramer (2015) I argue that the ‘digital’ is so embedded within society and culture that it loses its specificity and meaning as a concept, we are then adopting ‘a perspective that finds the distinction between ‘digital’ and ‘non-digital’ to be less clear than it seems when it is rigorously inspected, and also less useful and relevant than it often seems’ (Cramer, 2021).

What Cramer, Berry and Dieter identified in niche and arty media practices — e.g. the epistemology of the ‘digital glitch’ used by artists to describe the breaking of analog processes — should be contextualised in a much broader history of thinking about society and culture in information and computational terms. Indeed, the fact that technological figures such as ‘machine’, ‘system’ or ‘protocol’ help to redefine processes of industrialisation, procedurality, regulation and control has been running for centuries (Giedion, 1948; Mumford, 1967; Agar, 2003). Before me, artist and political geographer Pip Thornton refers to her PhD study as a ‘post-digital (auto)ethnography’, describing her own personal experience as a maker of creative interventions, visualising the immateriality of linguistic capitalism using data gathered from Google AdWords printed on a receipt (Thornton, 2019). If Thornton materialised the digital into an analog form, what I encountered in my study is much more a movement where the analog or ‘not yet digital’ gets reframed as digital and algorithmic.

My contribution to post-digital research consists in taking ‘post-digital’ phenomenons as ethnographic clues figuring technological artefacts in peculiar ways. A post-digital ethnography seeks to unpack the discursive nature of technological activity and how political moves are performed through the transformation and naturalisation of digital concepts and processes. Similar to Cramer, I do not want to indicate that we are experiencing a turn ‘after’ the digital or a massive return to the use of analogue methods and approaches. To be clear, the post-digital is an analytical attention not a period. If the post-digital is not *beyond* and *after* computational realities, its modes of thinking helps to navigate *through* their different visions, in the transversality of their disparate intensities or co-presences, in the local distributions of algorithmic figures and the way they

participate in the broader shift redefining analog and non-algorithmic processes into digital and algorithmic ones. Thinking in post-digital terms is an attention to grasp where the computable and uncomputable generate unexpected encounters (Galloway, 2021). Put differently, it is about the *collages* of the analog and the digital, their “cryptic power of juxtaposition” (Bishop et al., 2016) and the speculative *bricolage* of machinic figures put in circulation. As post-digital research have their roots in artistic and activist circles, engaging with the heterogeneous and multiple “posts” in “post-digital” could then be understood as a practice of resistance against the “computationalism” inherent to tech policy circles: the “belief in the power of computing” (Golumbia, 2009:2).

In my study, the ‘algorithm’, once an entity from software-making is now repurposed and reframed in another context — public sector organisations — to become a figure to describe procedural actions of bureaucracy regardless of their digital nature. Following STS Scholar Malte Ziewitz, a post-digital ethnography of algorithms therefore takes for granted that the concept is more and more used as a figuring device: ‘people see and recognize just what is going on around them when they do so through the figure of the algorithm’ (Ziewitz, 2017:2).

My way of conducting a post-digital ethnography is to centre the focus on how the idea of the algorithm is transforming a field in the context where the concept is used to think about certain objects, processes or practices. Said differently, the movement is to probe how an algorithm ‘folds and unfolds’ data, methods, technologies, social actors and organisations together (Lee et al., 2019). More precisely, a post-digital ethnography of algorithms is about how algorithmic figuration is shaping local knowledge and governance with and about algorithms — while also participating in the broader semantic shifts through which many processes get re-qualified as ‘algorithmic’. Providing a general picture of this shift will require more research and not necessarily ethnographic ones (for an historical account, see Yu, 2021). For now, the analytical focus should be on comparing the different perspectives on the effects of algorithmic figures produced by various actors inside a fieldwork. Inspired by Nick Seaver’s tactics for an ethnography of algorithms (2017), I propose below four strategies to conduct a post-digital ethnography of algorithmic contexts.

Observing the observers of algorithms

Observing the observers of algorithms means to analyse the many practices of actors attempting to stabilise an algorithm through its figuration. A post-digital ethnography is then focused on the way second-order accounts — the publicity of algorithmic figures — orients our modes of observing and making sense of algorithmic contexts. In some instances, algorithmic

figures are a way to come back to the pre-modern vision of algorithms as a formal procedure presenting a mechanics of rules or recipe, in others, the algorithm points to a socio-technical assemblage.

In a moment of pervasive algorithmic figurations, the focus of analysis of a post-digital inquiry is not necessarily the direct observations of algorithms, but it is more certainly an approach where our 'observations must take into account the observations of others' in front of algorithms (Esposito and Stark, 2019: 5). Just like other kinds of performative action studied by sociologists Elena Esposito and David Stark, algorithmic figures provide an 'orientation about what others observe' and how they envision algorithmisation (*Ibid*). Since the epistemology and ontology of algorithms is inconsistent, what actors in the field 'observe depends in turn on what I and the other observers do', this creates a complex situation where 'this inevitable circularity [of observations] makes the issue [algorithmisation] unstable and difficult to manage' (Esposito & Stark, 2019:11). Nevertheless, to cope with this instability many actors may be aligned and figure algorithms the same way, for example as 'black boxes'. Here, the emergence of algorithmic figures are a way to collectively manage the complexity and uncertainty of algorithmisation. Put differently, a post-digital ethnography of algorithms is an 'ethnography of thinking with the logic of the digital' sensible to the various ways individual actors are able to produce meaningful accounts when algorithmic processes are used for 'practical reasoning' (Ziewitz, 2017: 2).

Observing the observers of algorithms orients a strategy of inquiry into studying not exactly how algorithms are present in the field independently of the researcher (first-order of analysis), but more specifically what people think is happening when they figure algorithms in the context where a researcher is present along with them (second-order of analysis). Adopting a second-order approach is a way to observe the production of reflexive accounts on algorithms developed by observers, as well as to reflect on the role of the researcher in contact with this process.

As many ethnographer, when I observe myself observing algorithmic figures, I often portray the algorithm as a distributed, contested, unbounded, and heterogeneous figure. This type of accounts add some fuzziness to the policy debates around the ethics of algorithms where the 'terminological anxiety' Nick Seaver refers to want to be quickly resolved. The assumption and theory of social change in tech policy is that locating and delineating singular 'algorithms' would help govern them in a more responsible way. Adding the post-digital dimension to policy framings might seem counter-intuitive and contradictory to many public, private or civil society actors that only see algorithms as digital object. But when an administrative regulator or judge rebrand administrative procedures as 'algorithms' it appears that computer science does not have the monopoly to define the ontology and epistemology of algorithms. Here, I joined post-digital

researchers in showing that what is digital or analog, and what is computable and what is not are currently under a profound transformation that is both material (digital infrastructures are changing) and discursive (new actors are transforming the semantic register of algorithms).

While I posit that observers of algorithms are generally individuals or organisations, more and more algorithms themselves are ‘enrolled’ in the study of algorithms (Christin, 2020:8) for example to ‘gather empirical data’ (*Ibid*, 12) but also to frame their processes and account about their effects. Following political geographer Louise Amoore, staying and working through these complex chains of algorithmic observations is to acknowledge the many writers of a single system — the way they iterate ‘beyond the moment of its inscriptions’ (Amoore, 2020:100), hence after their settings in scientific labs and policy testbeds — as well as the force ‘distributing the writing [of algorithms] through multiple characters’ (*Ibid*) in the street, the school or the factory.

Mapping the creative provocation of algorithmic figures

The second strategy of a post-digital ethnography of algorithm consists in mapping the discursive enactments of algorithms. Our attitude in the field should not to be evaluate, judge or blame if actors mistakenly identify algorithms where we did not see them. Here, we must follow a classical advice of actor-network theory: to let actors define entities and to draw the trajectory between these conflicting and controversial definitions (Latour, 2005: 22).

In my study, delineating the role of an algorithm as part of an administrative decision is the difficult job public bodies have to go through if they want to be credible accountable actors. Here transparency appears as an experimental practice of identifying and delineating the boundaries of algorithms: a listing of entities parts of their contexts and participating in the decision-making process. Consequently for organisations under the scrutiny of watchdogs, the practice of transparency is in itself a figuring-mapping process. Using the work of sociologist Fabian Muniesa (2011), I will therefore specify the pursuit of transparency (and figuring) in administrative contexts as a ‘trial in explicitness’: the explanations justifying how an algorithm participates in an administrative decision calls for a detailed description of the various unanticipated variables, processes, human and non-human actors participating in the administrative procedure. At the end of this ‘trial in explicitness’, algorithmic figures are expressions summarising sets of entities forming the boundaries of algorithms. For example, in my ethnographic study in France, regulators and fiscal administrators figured the housing tax as an ‘algorithm’ in order to describe this automated calculus as an inseparable system of the State fiscal infrastructure. The housing tax ‘algorithm’ then

became a complex figure composed of tenants, their tax letter, the declarations made by landlords, regional fiscal legislations, parameters decided nationally by the Parliament, and finally technologies of calculation.

For Fabian Muniesa, the underlying theoretical assumption is that a trial in explicitness/figuring is also a trial in specifying the agency of algorithms. In other words: ‘...to make something explicit is not about clarifying or implementing something that is already prefigured as a potential reality, but rather about putting that thing to the test of variable, often conflicting and unanticipated forms of actualization’(2011:2). In this performative and experimental work, the stabilisation of the entity ‘algorithm’ is contingent and may shift. Mapping the various enactments of algorithms is not obvious because there is a tension between the ‘trial of explicitness’ as a process making already existing entities clearer or as a creative, performative, transformative act *provoking* a surprising reality (Muniesa, 2011:2). In other words: is the mapping process accompanying transparency a work of simplifying an existing algorithm and its stable context to make them finally intelligible, or does transparency (and the associated algorithmic figures) also ‘generate’ the coming into being of algorithms? Transparency advocates tend to believe in the first proposition — algorithms simply need to be uncovered and clarified *as they are* — because they often understand transparency as the openness of a source-code. They do so especially when their figuration of an algorithm is aligned with computer science ‘representational’ understanding of it as a stable digital entity.

To summarise, when epistemological and ontological conceptions of algorithms are changing, an ethnographic study informed by a post-digital sensibility helps to analyse their figurations and materiality as not fixed *a priori*, and to consider that different attempts to know them performatively create different visions of their agencies. As feminist STS scholars warned us, figures are locally defined, they could be multiple, transformed and contested by their entanglement in different contexts (Haraway, 1997: 23; Suchman, 2013: 49).

Drawing relations across algorithmic contexts

Tracking the different enactment of the housing tax is complex because this entity is crossing different domains: how can it be at the same time an algorithmic technology, a bureaucratic tool, a fiscal device and an everyday administrative duty? To face the complexity of knowing abstract and decontextualised technological entities, anthropologist Marilyn Strathern proposed that:

‘the [ethnographic] device is that of crossing contexts. [...] it tracks people’s activities and narratives as *they* cross domains, and thereby unpacks the heterogeneous social worlds people pile up for themselves’ (Strathern, 2002: 309).

The mixing of domains between an administrative procedure (the housing tax), objects (the tax letter), people (tenants), technological forms of calculus (the algorithm), institutions and locations (municipalities, the French Parliament) is the complexity creating opacity and generating the claim of transparency. And it is clear that there is no point of view, no utopian situation or context through which all these crossing domains can be made fully accountable. As Strathern noted: ‘ethnographers cannot possibly englobe data within a single context, make it all compatible’ (2002:310). And the point is not to make it compatible but to map the relations between the crossed contexts in order to unpack how the algorithms are differently figured, understood and experienced. To perform this drawing exercise without searching for the ideal context where the algorithm can be finally ‘found’, Strathern (2002, p.310) suggests that: ‘[ethnographers] must instead be explicit about their own preconditions of context production, whether they think of themselves as crossing domains or recovering the dimensions of decontextualization’.

When the post-digital ethnography of algorithms is focused on ‘crossing domains’, the housing tax ‘algorithm’ has many facets: once an entity belonging to the realm of science and technology, when the ‘algorithm’ enters administration it becomes a bureaucratic tool, when the citizen interacts with it, it is seen as an everyday administrative encounter with the State, and finally when a citizen reclaims algorithmic transparency to the regulator or a court it is then transformed as a legal entity. Clashes and alignments between these different figures of the housing tax will surely arise during negotiations leading towards algorithmic transparency. Drawing the relations between clashes and alignments will be key to delineate how the housing tax algorithm is stabilised in order to be made transparent.

Now, when the post-digital ethnography of algorithms is engaged in ‘recovering the dimensions of decontextualisation’ of an algorithm, one must search for ‘the wider context from which it has been carved out’ (Strathern, 2002: 304) In other words, decontextualised, opaque or invisible algorithms have contexts too but they are often inaccessible by ethnographers and or too gigantic and complex. In this case, Strathern suggests that we cannot find all the ‘lost’ contexts of algorithms but must find a way to bring to our analysis the relations between adequate contexts that would specify the reasons, mechanisms and actors of algorithmic decontextualisation. As Strathern explains it:

‘If one is dealing with a phenomenon whose distinctiveness is the very characteristic of decontextualization (hence its “virtual” nature), there is an obvious alternative to the kind of contextualization process that by adding ever more fields of possible relevance increases rather than satisfies the need for context’ (*Ibid*).

It appears that for Strathern, the mapping of ‘decontextualization contexts’ is possibly endless and could be seen as a limit of every ethnographic inquiry. As rightly pointed by Louise Amoore, the distributed governance of algorithms puts the researcher in front of the ‘nonclosure’ and ‘excess’ of algorithmic contexts (Amoore, 2020:105-106).

Analysing the effects of algorithmic figurations

As we have seen in the description of the second strategy, calls for transparency create ‘trials in explicitness’ that would generate algorithmic figures eventually stabilising the understanding of an algorithm. In my ethnography, stabilising a definition of the housing tax as an algorithm was a battlefield in itself where on one hand, fiscal administrators wanted to impose a vision reifying the unity of the housing tax as a strict calculus, and on the other hand, open data managers advocated for understanding the tax as a socio-technical system composed of different algorithms and many heterogeneous entities. Depending on how the housing tax was figured, regulations could not be applicable the same way. Fiscal administrators wanted to simply open the tax source code while open data managers showed how a rich contextual accounts of the algorithm ecology was needed.

Following Muniesa, I find it interesting to see what the figure of the ‘algorithm’ is doing in specific context such as public sector organisations: ‘the central question then became [...] what this register of information made it possible to subjugate: that is, to fix, to subject to the rule’ (Muniesa, 2019: 201–202). If administrative procedures are seen as ‘algorithms’ the question remains whether this surplus of algorithmic figuration is clarifying the administrative procedure or adding confusion, and whether it might also naturalise the use of algorithms in missions of public service.

In short, we can say that algorithmic figures could play different roles. To answer this question, the post-digital ethnography I am proposing consists in tracking the effects of the algorithmic language and its consequences. One role performed by an algorithmic figure in public sector contexts is that such entity is conveying more efficiency or innovation to State actions — the performative figure has therefore normative effects of naturalising the quest for endless optimisation. Here, the staging of algorithms reinforce technological determinism. Another role is that machinic figures such as “algorithms” may trigger the depersonalisation of political action

since the technological artefact can take the blame instead of responsible actors. Here, a bureaucratic device such as an algorithm is used to foster self-invisibility. In this case, the figuration of the algorithm is troubling an allocation of responsibility: who can be blamed? The algorithm or the politician that created a public policy regularising the use of these technologies? A debate will be opened. In other controversial situations, artificial “moral crumple zones” are created where the allocations of blame and responsibility are misattributed to a human or organisation who possess only limited knowledge, capacity, or control (e.g. a human operator or a technology provider) in order to protect both the material integrity of an automated system and other actors who may possess equal if not greater control over the behavior of such technology (Elish, 2019).

Finally, the circulation of algorithmic figures such as the ‘black box’ can order an ‘algorithmic drama’ where the mechanical amorality of computational technologies is hidden. Algorithmic figures consequently may nurture the dualism of a ‘theatre’ where the involuntary effects of autonomous technologies are reified as ‘backstaged’ processes.

Conclusion

In this paper, I have argued for the benefits of describing algorithms as figures entangled in heterogeneous contexts and aimed at experimentally catching the reality, materiality and effects of algorithmic governance. Researching algorithms through a post-digital approach enacts them as discursive and cultural artefacts formed by an ecology of actors encompassing software developers, regulators, users, organisations and, depending on the case under study, a bundle of other contexts where they could be enrolled. Eventually, algorithmic figures constitute heuristic devices to make sense of procedural actions in everyday settings. This way of portraying them contrast with a computer science definition for which algorithms are either digital objects or abstract rules. It differs also from other critical approaches that positioned them as artefacts inherently alien to our sanctified cultural practices and others disciplines of knowledge production (Seaver, 2017). A post-digital ethnography is necessary to describe moments where the figure of the ‘algorithm’ is troubling the ontology of computational technologies. For example, it is a suitable approach in moments where the ‘algorithm-as-recipe’ is used to designate procedural yet non-digitised actions — such as administrative procedures.

Suspicious about considering algorithms as ‘figures’ — rather than understanding them as digital objects — lies in the loyalty that some critics of algorithms have regarding computer science and the belief that this field has a complete authority and monopoly on the ontology and epistemology of digital objects. Instead, this paper shows that regulations such as a right to

explanations use the heuristic potential of the ‘algorithm’ as an analytical tool — a figure — in the service of unpacking the procedural nature of bureaucracy. In a context where the digital nature of algorithms is blurred by legal reasoning and regulatory effects, it becomes clear that computer science does not (or no longer?) have a monopoly on the ontological definition of algorithms. Fundamentally, I argue that the problematisation, discursive circulation and policy responses to technological problems are shaped by ambiguous figures such as the ‘black box’, the ‘biased algorithm’ or ‘ethical AI’. In a context where the materiality and agency of algorithms are heterogeneous, figures fix complex assemblages into a single entity thus configuring their public appearance as well as feeding the algorithmic drama we are living in.

A post-digital ethnography gives resources to inquire fields where the materialities and definitions of algorithms are not yet settled. In this light, the approach offers ways to reopen how these entities are enacted by specific cultural contexts and invented by social actors. Before being blackboxed engines of computational orders, they are everyday techniques of software developers and figures circulating in many areas of society. The ethnographic strategies I proposed provide ways to question how algorithms are brought to existence through figurations and by the crossing of contexts enacted by social actors and their respective organisations. Beyond the important democratic goal of achieving algorithmic accountability, studying algorithms as figures could help to show their work as productive forces of transformation inside our algorithm-saturated world. More broadly, figures are useful devices for understanding the discursive fight for stabilising contested technologies and for unpacking the pervasive spectacle of tech and politics we are witnessing as citizens of liberal democracies.

The paper shows that the device of algorithmic governance — here, a right to explanation — is framed by specific figures such as ‘algorithms’ understood as sets of procedural and temporal instructions. Algorithmic figures affect and tacitly guide how we can limit the agency of computational systems. The contexts of figuring — their seductive imaginary/semiotics and the way they are used by observers — matters as much as other contexts, especially since figures create specific realities and perceptions of algorithmisation. While my study was focused on “algorithms”, studies of the digitalisation of liberal democratic organisations could additionally benefit from this focus on figures in directing their attention on the relation between the materiality and metaphorical uses of notions such as ‘artificial intelligence’ or ‘blockchain’.

My paper argues that when administrative procedures are conflated with algorithms, the opacity of bureaucratic governance and algorithmic decision-making are joined together and situated as the common source of unfair decision-making. The paper then demonstrates how the

French context of algorithmic governance has a performative effect in transforming the perception of what it is supposed to represent. Suddenly, algorithms cease to be computational black boxes and are simply seen as mundane routines. At the end, what has to be negotiated and governed is not only a digital object but a set of protocols and procedures made of organisational habits, legal rules, analog artefacts and technological expertises.

Notes

1. See the FOIA response from CADA: <http://cada.data.gouv.fr/20172357> (Retrieved on 23/10/2020).
2. See the FOIA response from CADA: <http://cada.data.gouv.fr/20175012> (Retrieved on 23/10/2020).
3. See the FOIA response from CADA: <http://cada.data.gouv.fr/20173235> (Retrieved on 23/10/2020).

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