Migration information infrastructures: power, control and responsibility at a new frontier of migration research

Fran Meissner¹ and Linnet Taylor²

Abstract:

The nature and production of migration statistics are in flux. State bureaucracies are no longer the primary source of migration data.. Instead, there are a myriad unofficial data sources and processing collaborations which produce migration and mobility data as a by-product of both commercial and governmental processes. This has implications both for international processes of migration assessment and control, and for states' domestic policies with respect to migrants. This paper brings together migration studies with Science and Technology Studies (STS) literature to take stock of these new data sources' theoretical and empirical implications for both migrants and the links between migration and broader social processes. We identify migration information infrastructures: configurations of data assemblages which involve private and public sector actors, where data originally collected for one purpose (billing customers, sharing social information, sensing environmental change) become repurposed as migration statistics. We explore the implications of such migration information infrastructures for migration researchers: what are the entanglements that such infrastructures bring with them, and what do they mean for the ethics and practicalities of doing migration research?

Keywords:

Big data, mobile phones, information infrastructures, STS, statistics, research ethics

¹ITC, University of Twente, ORCID: 0000-0001-8237-9875, Corresponding author: f.meissner@utwente.nl

² TILT, Tilburg University, ORCID: 0000-0001-7856-7611

Introduction

The nature and production of migration statistics and the way migration is made knowable through data is in flux. Where there used to be 'migration data' produced by states and collated by (supra)national agencies with the aim of understanding and recording migration flows, now there are myriad unofficial data sources and processing collaborations. These produce migration and mobility data as a by-product of both commercial and governmental processes (Badger 2013; Kinstler 2019). Such data may then make its way into official statistics, as advocated by the IOM and McKinsey (IOM and McKinsey & Company 2018), and by internal European Commission migration policy researchers (IOM and European Commission 2017; Spyrtatos *et al.* 2018). This shift has an immense impact on border and migration management (Leese *et al.* 2021) and on claims about the knowability of migration (Scheel 2021). At the same time, moving towards large-scale data on migration is creating what we suggest should be termed migration information infrastructures (MII). We have discussed previously (Taylor and Meissner 2020), how as a result of technological advances in the capacity to analyse more and more complex datasets, migration has increasingly become the subject of new forms of datafication and analysis. Those processes entail that various new forms of data, new analysis and policy practices and new sets of actors enter migration research. Taken together, these are what we here refer to as migration information infrastructures (MII). Those infrastructures have to become a concern for migration and mobility researchers - not least as they are introducing new commercial interests in the field and the possibility of repurposing technologies from other contexts and vice versa. In this paper, we explain why and how this matters for migration research.

The effect of new landscapes of integrated computational infrastructures and data flows - it is claimed - makes it possible to observe and make informed predictions based on past flows and forecasting based on real-time information deriving from sources other than administrative data. From the original objective of establishing ground truth about flows of people, new and hybrid (public-private) forms of migration information infrastructure offer the technological capacity to open up new modes of migration control that are primarily probabilistic, based on profiling, forecasting and on conceptualising migration as risk (Taylor and Meissner 2020). We argue that this deserves to be addressed as a new phenomenon with implications for both empirical migration research and theoretical work in STS, migration studies and related disciplines.

These new hybrid infrastructures also merit consideration based on their practical implications for migrants. Any protection from interventions based on profiling through the new data they produce ceases to apply once the data are detached from their original source (for example, by 'data philanthropy' or cooperation between the private sector and international organisations), aggregated or de-identified, and fed into migration surveillance and control systems. The result is that data becomes detached from both rights and purpose limitation provisions. Data thus becomes a fungible commodity from which any actor with the technological capacity to connect to these information infrastructures can derive control and power - and those actors are not necessarily nation-states. Despite these power imbalances, the sudden availability of data in a field where it used to be scarce

raises questions about how migration researchers ought to engage with large complex datasets that are the by-product of informational capitalism (Cohen 2018).

Neither entirely ignoring the data, leaving its exploitation to non-academic players, nor being co-opted by the lure of a knowability of migration seem viable options. There is a demand for work that lays out how researchers can responsibly engage in migration research in light of new data realities.

Researchers are frequently asked to ensure that their work is ethically sound, rigorous and, from a theoretical perspective, to critically assess data assemblages - but rarely to pay attention to the circumstances that make those assemblages possible in the first place. To address this latter shortcoming, a focus on MII is pertinent. More concerted research efforts are needed to recognise how migration research is increasingly taking on relevance beyond better understanding migration itself.

To develop this line of argument, we first think through the empirical examples and theoretical underpinnings that MII necessitate. We then identify some of the most prominent problems with new migration data before reflecting on the task of advising on using large scale data in migration research. We outline how the default request from those conducting and commissioning new forms of data analytics on migration is for responsible and ethical research guidelines and explain why such a focus is insufficient, maybe even counterproductive. We then explain our understanding of the notion of migration information infrastructures to highlight why revisibilising these may be more important than developing guidelines for making migration knowable. Our advice is to move beyond trying to find ways of getting this type of migration research 'right' instead we need to rethink established research agendas in the field. We finally propose some ideas about how researchers can engage with processes of revisibilising by adopting critical data studies methodologies.

Empirical examples and theoretical underpinnings

This paper aims to reorient attention from assuming that the state is the primary actor in assembling and analysing migration data. Instead, we need to understand the relational processes that intertwine data, data technologies, states and both for- and not-for-profit organisations in these larger migration information infrastructures. We contend that these infrastructures produce feedback loops that affect society, migrants and system designers, particularly when states and regions act to control migration based on them. These feedback loops are not (easily) visible to researchers. They are seldom published as scientific research, seldom labelled or publicised by policy researchers as 'making migration data', and are often only discoverable via press releases that offer a snapshot of a long-term, complex set of activities. For instance, Mastercard's data on refugee cash transfers (Musser and Kapadia 2017), Silicon Valley firms' ventures into identity verification technologies (Kinstler 2019) and Facebook's production of inter-urban migration analyses based on user data (Badger 2013) are not at their point of origin migration statistics in any conventional sense. They derive from infrastructures that can contribute to migration management and control while also underpinning advertising markets, social networking applications, and business models (see Figure 1). Therefore, these broader hybrid infrastructures are differently governed and capitalised from administrative modes of producing data and are characterised

by motives of experimentation, expansion, and market capture rather than by contributing to migration governance. Those changes also constitute a shift in how migration research contributes to questions about what kinds of migration statistics might be needed. For example, previous large scale migration projects (European Commission 2010) were the result of lengthy consultations about how and what data ought to be migration data. They involved debate about how that data ought to be collected - within MII, this is often skipped or left to non-academic players and market interests.

In considering new hybrid infrastructures, we should also incorporate an understanding of the underlying technologies that make these modes of producing data possible, but which similarly were not developed with migration governance in mind. For instance, the iBorderCtrl group of technologies incorporates machine learning methods for fingerprint, palm-vein and facial recognition, radar and acoustic sensing for detecting hidden passengers in vehicles, 'deception detection' for interviews, and other ML tools (iBorderCtrl 2016). These can be brought together to make an assemblage that can be deployed to police borders. Yet these derive from all-purpose models and techniques with genealogy in commercial and scientific domains. In another example, the EU-funded HumMingBird project, whose aim is to facilitate 'enhanced migration measures', offers to 'demonstrate non-traditional data sources for migration research including various types of big data (such as social media or telecommunication)(HumMingBird 2020). The project applies big-data techniques using them to classify migration-related signals in social media posts and mobile phone billing records and from this to derive indicators of individual and group mobility (Sibru *et al.* 2021). Those techniques, for example, sentiment analysis, were developed initially for marketing analytics (Taylor *et al.* 2014). This matters because it raises questions about the transplanting of methodologies between low- and high-stakes applications, and from the commercial to the social sphere.

It is vital to connect the analysis of these technologies and infrastructures in the commercial sphere with analyses that address them in the context of society and migration. Doing migration research by visibilising information infrastructures, as STS researchers do, enables us not to know migration but to know what interests and narratives are driving the migration data game. We, therefore, propose bringing together the lenses of STS and migration studies. The former helps us understand the effects of infrastructures on society. The latter focuses on how statistics are created from and about migrants. Consequently, such linking can help uncover which infrastructures are being brought to bear on migration and when and how they are used as migration statistics. Yet much of this infrastructure, and its effects, must be inferred from external signals such as corporate communications, research project outlines and media reports rather than encountered fully formed in the shape of formal statistical datasets.

Similarly, the link to ethics can be seen on two levels. First, in the use of these infrastructures to control and influence migration, and second, in the way informational capitalism imposes its logic on societal processes in general, including migration and migration governance. The literature on data justice (Leese *et al.* 2021; Sánchez-Monedero and Dencik 2020; Taylor 2017; Taylor and Meissner 2020) is relevant because it centres technological and datafied power as an object of ethical scrutiny, and places

the firm alongside the state and the individual as relevant actors. Thus we move from addressing 'big data analytics' or 'AI' as a feature of the landscape, without actors or incentives, to addressing the constellations of private and public actors who both build and use such analytical tools and who are therefore duty-bearers toward the subjects of those analytical processes.

Furthermore, this approach takes us beyond data ethics as currently framed (Vallor and Rewart 2018), because we are no longer assuming that taking action (for example, on migration) using data is linked to agency in the shape of either decision making or control. Instead, those who manage infrastructures and partake in their constituting assemblages can have agency concerning migration control without having either knowledge or intent, simply by selling or lending data, techniques or models originally produced for entirely different purposes. Thus we find actors from the technology world straying into migration control either inadvertently by being producers of data (as in the case of Facebook and Twitter) or due to branding and marketing efforts. One example are mobile data challenges that have shaped migration statistics over the last decade (Salah *et al.* 2019; UN Global Pulse 2014), in what Sharon (Sharon 2020) has termed a 'sphere transgression', rather than a conscious engagement with migration policy. Such considerations lead us to move beyond individual rights to more political ethics that look at data production's structure and political economy, both currently gaps in the migration studies literature.

To explain how we align our notion of Migration Information Infrastructures with existing theory: we propose that these offer a way to bridge between the theoretical apparatus of STS, migration studies and critical data studies. To illustrate what we mean by MII and justify asking migration scholars to pay more attention to them, we offer Figure 1. The figure shows that MII do not come into being through a process of design and purposeful formation. Instead, they have to be thought of as encompassing any number of relevant 'data assemblages', each of which constitutes a distinct supply chain of data (or set of supply chains) toward a particular end. We borrow our understanding of data assemblages from Kitchin, who uses the term to describe a 'complex socio-technical system, composed of many apparatuses and elements that are thoroughly entwined, whose central concern is the production of data' (Kitchin and Lauriault 2014: 6). MII's thus have a dual character: on the one hand they have an emergent character – meaning they are not infrastructures of conscious design. On the other hand, they take the shape of infrastructures that are 'sunk into' the social fabric (Star, 1999: 381) and thus both invisibilised and perceived as relatively stable. Their use is now common in migration control efforts and in efforts that try to make migration knowable with more data from more sources.

Figure 1 – Visual representation of possible migration information infrastructures

As Figure 1 illustrates, the data assemblages involved in MII go far beyond those that are purposely set up to monitor and control migration. This broader scope is important because the types of data and assemblages that come into view are distinct in terms of their original objectives, but also entangled with databases created to know migrants and migration (Ruppert and Scheel 2021). Indeed, their original objective is often far from knowing migration - it may be related to communicating, identifying or engaging in financial transfers. These types of hybrid migration information infrastructures inevitably embed corporate interests in designing and marketing the technologies involved, whether through ownership of the cloud servers on which their components run, design of the underlying models or databases, or ownership of the data products. This means that the dynamics of how MII are governed and capitalised are defined by more than just how states want to know migration; instead, they are often driven by motives such as experimentation, expansion or market capture. This means that they come into being as much through 'push' as 'pull' dynamics. With the former, independent actors from industry or management consultancy will posit new uses of already-existing infrastructures as ways to visibilise migration dynamics, and government will then explore those uses (IOM and McKinsey & Company 2018). With the latter, government will purposely procure systems that are effectively data assemblages based on marketing by a particular actor (Taylor & Meissner 2020).

The notion of assemblages has become interesting for migration scholars thinking about new data technologies and technologists interested in migration. Notably, Bigo (2014: 220) identifies 'the border control assemblage', whose central meaning is as 'the locus of practices of sovereignty and exception'. The notion of assemblages is attractive because it allows us to link infrastructures to their effects. It has also been doing some additional work by shifting attention in the field towards questions of state and supra-state interventions. We can here borrow from debates surrounding methodological nationalism and their critique of migration research as too often taking the nation-state as "the natural social and political form of the modern world" (Wimmer and Glick Schiller 2002: 302). A similar focus

is apparent in researching new data technologies and migration. That observation orients our attention to theorising with and through Foucauldian frameworks of state power. While recognising the importance of this work, we argue that a new layer is becoming worthy of attention: MII involving data assemblages that are not originally conceptualised as tools for migration control. As such, they affect both migration control and society more broadly, and these effects will inevitably interact with each other. For example, when Twitter becomes a source of signals on people's intent to migrate, researchers turning those signals into policy inputs rely on the platform's advertisers to make those data flows possible. They should also be aware that the visibility of tweets relies on an algorithm formulated solely to drive advertising revenue (Gonzalez-Bailon *et al.* 2012). Thus business models matter in what data becomes visible to research and what can be transmitted to policy.

The emergent nature of MII's also means that they cannot be effectively studied through a strategy of 'infrastructural inversion' (Bowker 1994). If we look at the 'technicalities of infrastructures as key sites where shifts in institutional authority and accountability can become visible' (Pelizza 2016: 299), we find that the kind of commercial infrastructures we analyse in this paper are oriented toward logics of expansion and profit, not governmental or administrative power and control. Thus, rather than leading back to the system's originating logic, adopting a methodology of infrastructural inversion would offer multiple forking paths, some relating to the conscious design of the system involved and others to the secondary uses that it acquires. It makes no sense, for example, to seek out how Twitter's originators conceptualised migration control in their platform and algorithm design. In highlighting the broader relevance of MII and the transnational infrastructures that make the various data assemblages possible, we thus emphasise the need to also pay attention to the interests, revenue streams and business logics that become invisibilised within MII. These have to be treated as influencing what is digitally knowable about migration.

An infrastructural lens focuses less on individual choices about using data in research and policymaking. It leads toward shaping concepts such as informational capitalism (Castells 2010) - the availability of commercially generated data on human behaviour and mobility - and how this is transforming migration research and policymaking. Cohen (Cohen 2018) has described informational capitalism as leading to a 'biopolitical public sphere' where the by-products of everyday technology use, in the form of digital traces and profiles, themselves become a tradeable resource that can be used for control and manipulation. This conceptualisation of data as a by-product of both technology and social life is useful in thinking about how most data systems are inherently multi-purpose.

Challenging the new processes of migration information gathering

There are three main concerns with the way big data, channelled by MII, is currently being used in migration research and policy: the first focuses on the right to use the data itself in research (Jacobsen and Landau 2003; van Liempt and Bilger 2009); the second, on how data is employed to control and influence migrants and migration (Knight and Gekker 2020; Taylor 2015); and the third raises concerns with broader issues of discrimination and other rights violations which come into play with the datafication of migration policy (Achiame 2021; Molnar 2020). These problems are being

identified by different circles of academics and practitioners from sociology, geography, surveillance studies, law, and other disciplines but come together around questions of the prevention of injustice and harm and preserving the rights and safety of migrants. Together they imply that if authorities and researchers incorporate new data sources and actors, they also incorporate new risks and responsibilities. These require not only engagement and understanding but strategies to prevent harm.

The first problem centres on identifiability, both on the group and the individual level, in remotely sensed migration data and its possible repercussions on migrants and refugees. Although data protection and privacy laws have long recognised identifiability as a source of power asymmetries and potential harm, this problem is amplified by the use of remotely gathered data such as social media data and their geolocation metadata, remotely sensed data such as satellite and drone footage, and remotely sourced commercial metadata from personal devices such as phones, which people are often not aware of emitting. For these data sources, consent to use them in migration control is given not by the individual, even indirectly, but by the commercial firm which collects and processes them. For example, where migrants are tracked using their mobile phone geolocation data, this is made possible by the sale or donation of metadata by mobile network operators who collect it as billing data (Taylor 2016).

Similarly, using satellite data from the European Space Agency, migration surveillance involves technology originally intended to map weather systems and observe environmental change. Many of the new migration data sources are what might be considered open-source intelligence, with open data on humanitarian operations, social media posts and online reporting being brought together with these more quantitative sources. Creating migration data by repurposing other sources causes problems with data quality. Can we be sure what is being measured is actually migration? Another issue is the violation of people's autonomy and possible false positives - many of those being surveilled have not crossed a border - yet their data is used as migration data. In fact, this type of analysis usually constitutes the kind of profiling in public space that preoccupies the framers of European data protection law.

Theorists of group privacy (Taylor *et al.* 2017) and among them especially Sandvik and Raymond (Sandvik and Raymond 2017) have warned that although these data are not officially identifiable on the individual level and thus are not regarded by authorities as violating privacy or other rights, they constitute 'demographically identifiable data' which tell a story about the movements and activities of groups, and as such can be more harmful than individual data. If you are a hostile actor with access to big data, Raymond (Raymond 2017) argues, you are probably less interested in tracking individuals than in locating and harming groups. Who a hostile actor is will change overtime and as data moves through MMIs. Commercial companies may be interested in the data not as migration data per se but as data that they can use to train (military) intelligence models. Governments may change over time and become hostile actors. Therefore, the group privacy argument can be made about remotely sensed data used for migration control: being able to track groups through space arguably affords more leverage in terms of control and power over those people than having to track them individually.

Any data-related harms are also more likely to go unscrutinised and unaddressed, given that data harms are conceptualised in law as individual. Harms might include being singled out for migration control measured based on one's computationally assigned group affiliation and associated risk scores. Notably, the data protection authority dealing with EU migration surveillance programs - the European Data Protection Supervisor - has begun to pursue privacy violations on the collective level. One example is their 2019 warning to the European Asylum Support Office for its surveillance of migrants in North Africa through social media analytics (EDPS 2019).

The second concern visible in debates on datafication of migration control is about the risk of experimentation on migrants and refugees, stemming from the pressure to innovate (Sandvik *et al.* 2017), experimentation via migrants' own digital devices as a way to 'rearrange precarity' along neoliberal lines (Aradau 2022), and the pressure to use the new data sources, commercial actors and techniques available (IOM and McKinsey & Company 2018). Molnar (Molnar 2020) interrogates the testing of unproven technologies and analytical methods on migrants and refugees in precarious situations. She points out that emergencies shield the technologies being used on migrants from scrutiny; that migrants do not have access to mechanisms of redress and oversight that usually apply when new technologies are used to track, sort and manage citizens, and that the 'global digital rights space' has not yet attempted to meaningfully include migrants and migrant-specific concerns. Her work further highlights that new digital bordering technologies such as AI used in interviewing migrants and predictive analytics on population movements seem all to be oriented toward migrants as a source of risk (something that supports our findings in Taylor & Meissner 2020). She suggests (2020:3) that migration researchers ask some fundamental questions of these new technologies and data sources, namely: 'Who gets to participate in conversations around proposed interventions? Which communities become guineapigs for testing new initiatives? Why does so little oversight and accountability exist in this opaque space of high stakes and high risk decisionmaking?'

The third concern relates to more structural matters of justice: how migration and bordering surveillance technologies are optimised to filter for certain classes, ethnicities, places of origin and other target characteristics in ways that constitute illegitimate discrimination and often racial profiling. Achiume (Achiume 2020) points to the blurring lines between corporations and government around the creation of migration data and its application in bordering technologies. She argues that technologies such as biometrics and border sensing tools and tools that form the border's administrative landscape, such as visa systems, are designed and deployed to create disparate impacts. They thus have effects on racial equity. She also notes 'many [...] corporate actors exert great influence in domestic and international decisionmaking related to the governance of the digital border industry' and there is frequently a revolving door between technology corporations and the government offices who use their services. Achiume asserts that these technologies are problematic because they expand both governmental and private actors' control over migrants, refugees and stateless persons while shielding their power from legal and judicial scrutiny and constraint (2020:8). These systems are being challenged. For example, in the UK we saw a fight against the Home Office's use of risk scoring for migrants (Salam) and in the Netherlands 'predictive profiling' by border

control has now been declared illegal (2021). Among the technological interventions Achiume highlights is the use of 'social media intelligence' by government officials or by companies contracting for government. The report does not mention the central role academic researchers play in developing and conducting research and tools and in using many of the methods and tools she outlines in her report. That role is worth considering - and forms our central concern in this paper.

The Usual Response: Ethics and responsible research

Despite those concerns, there remain strong incentives for researchers to draw on large and complex datasets about migration. To justify this, the usual response is to foster responsible research by providing ethics guidelines and institutionalised procedures to ensure research integrity. Chapters guiding researchers in times of big data are multiplying (Ash *et al.* 2018; Mak *et al.* 2018). The authors of this paper have, for example, been asked to provide a handbook commentary that: "consider[s] how researchers use large datasets about and involving mobile populations, and in particular the ethical issues arising from those uses ". It is implied in such statements that the prime concern is not with whether this type of research should be conducted but what the ethical concerns are once it is underway and how they might be addressed. In thinking about how to advise migration researchers on the use of large-scale migration data, we think that ethics is a necessary but not a sufficient concern. To explain why we will briefly explain the problem of institutionalised guidelines and principles being too rigid to address the emergent nature of migration phenomena and potentially subject to co-optation by powerful actors that researchers are not necessarily aware of.

A benchmark for whether newly evolving systems are equitable or not is often whether the identified data practices allow better knowledge of migration (IOM & McKinsey, 2018). While those drawing on new data sources will emphasise that this is their *raison d'être* and why their services or analysis is so valuable, legal controls on such research often lag behind their implementation. We have offered an example of this in social media monitoring. Scraping social media output, it is claimed, can render migration patterns visible (and controllable) (IOM and McKinsey & Company 2018: 47). The lure of providing these kinds of insights has resulted in the funding and implementation of various academic research projects drawing on these techniques. Despite the need to respond to ethics guidelines, such projects went ahead and were not picked up by the frameworks in place at the time as problematic. Collating data about migration through social media monitoring, however, has recently come under scrutiny from the perspective of data protection because the legal basis for collecting and storing the data is not well enough defined and does not sufficiently meet data protection principles set out in the GDPR (EDPS 2019).

While many projects have been put on hold, work in this field continues either by moving outside of the European regulation ambit or by branding research as testing sites of technology rather than migration monitoring (as we discussed in terms of the second problem above). What this example shows is threefold. First, while much can be achieved by pushing for responsible data treatment and data retention principles, these do not always work well enough to detect unreasonable practices *ante facto*. Further, in an unevenly regulated global data market, legal workarounds can be found if

legislation is focused on data use only, rather than also looking towards the technologies that make the retention and analysis of that data possible. Finally, researchers are not only involved in critiquing how migration data are collected, conceptualised and made sense of. They are also involved in creating a market for data and analytics (Perceptions 2020). In principle, such practices should be kept at bay, and internal and increasingly mandatory ethics reviews should catch problems better in an academic context. However, precisely the institutionalisation of such guidelines and, more importantly, the formalised rigidity with which they are often used means that the evolving nature of the problems at hand is potentially missed as formalised guidelines do not leave sufficient room for considering nuance and context.

We are concerned that what we see in the academy is a replication of now well-established processes in corporate tech circles. Here Metcalf et al. (Metcalf *et al.* 2019: 449) note that 'ethics is the hottest product' owned by dedicated staff, installed to identify ethical issues and asked to develop frameworks for those developing the technology or doing the data analysis. Metcalf et al. (2019) identify several problems with this practice of 'owning ethics'. One issue they highlight is that those installed to do ethics are also expected to operate as part of industry logics. Those logics prioritise meritocracy and with it the assumption that if the goal is to do good, the work is valid. The merit claim of improving migration statistics and doing sophisticated analysis to predict, organise and optimise migration flows works similarly. It also leaves little to no room for a positive framing of how new tech and data can be used to do analytics that do not render migration more dangerous and precarious. This is something which almost inevitably happens where the overarching agenda is to regulate and control migration (IOM and McKinsey & Company 2018; Rango and Vespe 2017).

A second problem with owning ethics is that it often occurs in a context of technical solutionism, which entails that new technical solutions can always address social problems created or perpetuated by the industry. Here, ethics guidelines and research practice might act as fostering technical solutions to render concerns over projects admissible. Finally, Metcalf et al. (2019) note that market fundamentalism is another by-product of owning ethics. By this, they mean that the work done is ultimately driven by market logics. Those logics entail developing and implementing procedural ethics frameworks that can be replicated in multiple projects and that are visible if ethical problems arise, to deflect the responsibility of those building the technical systems. The performativity of ethics that results is often focused on the most risky ethical problems. Still, it does not pay sufficient attention to more project or domain-specific, day to day concerns. There are thus some alarming parallels between corporate and academic practices. For example, through the formalisation of ethics procedures, it becomes possible to outsource ethics to specialists creating the possibility for ethics to no longer be a core aspect of project governance. Research ethics in academia are increasingly shaping up to be a priority area. Still, no checks are being put into place to avoid the pitfalls of overly focussing on procedural ethics. This leaves little to no room to question whether certain technologies and analytical approaches should at all be offered up as solutions to purported problems, such as the analysis of migration.

In addition, what follows is that it is not helpful to ask actors developing analytics tech commercially to self-regulate for ethics when this is a very profitable field. At the same time, researchers adopting new data methodologies run the risk of getting implicated in the problematic ethical frameworks of the industries from which they source their data. This aspect is outside of the academy's internal procedural approaches. We should thus focus on how data is used and try to reorient researchers away from a solutionist approach that leads to dodgy methods and datasets (Reece *et al.* 2019). Our argument is not that ethics procedures should be abandoned but that it is necessary to view these as part of a reflexive social science that can engage with the positionalities of the actors involved in the research (Bourdieu 1990). Indeed, some more nuanced methodologies are being developed in the academy (Verbeek and Tijink 2020) that are precisely calling for such an active and continuous engagement with responsible research. It remains to be seen how widely those will be adopted and how applicable they are to amalgamations of already existing tech such as we discussed in this article. What is evident is that such approaches cannot be upheld without fully interrogating the problems and origin of those data.

Ultimately calls for ethical and responsible research are valid but will not be enough to highlight the invisibilising of relevant infrastructures that underpin any research involving new and large-scale migration data. This is because such approaches neglect to question the research priorities in migration research. Such priorities lie in charting the movement of migrants, understanding push and pull scenarios and making migration knowable to policy makers. Other priorities in migration research that are less easily formalised but point us to the complexities of migration are less likely to surface with an increasing lack of migration domain specialists being engaged in the production and transformation of migration data. Given contemporary migration control, much policy work is undergirded by a logic of ordering and optimising migration flows (Meissner 2017) often intending to stop some movements while facilitating the movement of those assumed to be economically beneficial.

This critique of logics of optimisation concerning migration control parallels critiques of the big tech approach to informational capitalism (Gürses *et al.* 2018), where optimisation is applied in ways that decrease autonomy and feed processes of datafied discrimination across all areas of social and economic life. Optimisation has political origins and implications. Although ethical choices are features of both the political and technical operations of migration control, if we study the informational infrastructures that support and operationalise these logics of optimisation, this implies a primarily political, rather than an ethical lens.

Using a purely ethical lens on this process is inadequate because it lacks traction on the question of actors, incentives and constraints. Recognising this has a practical implication: once we, as researchers, adopt a relational view we can no longer claim to be analysing the ethics of information infrastructures because by exposing them, and their relational characteristics, we are addressing politics instead. It also has an ethical implication: ignoring this and analysing migration information infrastructures as neutral tools of policy renders an ethical lens - ironically - ethically problematic. It is for this reason that in the remaining paper we turn our attention to precisely the question of migration

information infrastructures as a crucial element in how migration researchers ought to engage with large complex data sets branded as migration data.

Research through a relational information infrastructure lens

Migration information infrastructures have often remained invisible in migration studies, in comparison to the high visibility of their effects in policy approaches to sorting and categorising migrants (Broeders and Hampshire 2010). To counter this, a relational infrastructure lens allows us to explain and analyse the role informational infrastructures play in transforming new, and often apparently unrelated, types of digital data into migration data. Bowker and Star have warned that 'good usable systems disappear almost by definition. The easier they are to use, the harder they are to see. As well, most of the time, the bigger they are, the harder they are to see' (Bowker and Star 2000: 33). The new migration information infrastructures, and the systems for collection and management of big data which feed them, share this characteristic: if we do not catch them at the moment of their formation when their logic and intent is articulated and thus exposed, they become invisibilised through use with the result that we can only see their effects. Bowker et al (Bowker *et al.* 2010: 99) advocate that to avoid this invisibilisation we pay attention to 'the social and organisational dimensions of infrastructure' as 'a set of interrelated social, organisational, and technical components or systems'. Studying these offers up what, in line with Goffman (Goffman 1959), can be termed 'the backstage' of data systems. This perspective opens up the construction of those systems to analysis. Systems are thus not only analysed in and of themselves but can also be seen as the product of specific social, ethical and political choices by particular actors and economic forces influencing those choices.

An STS lens is helpful in considering how to visibilise these structures. However, as noted above, it requires us to take a different path from infrastructural inversion if we wish to keep in focus the broader uses and ownership of the infrastructures – who developed the algorithms, who owns the computational resources they run on, and how their other purposes interact with migration analysis. We also risk losing sight of how migration control affects us all downstream as a way of shaping society. One answer is to build on Bowker et al's 2010's vision of infrastructures with Gurses and van Hoboken's insight (Gurses and van Hoboken 2017) that the move to cloud-based architectures of software production and operation have made continual profiling of people through digital devices and services the norm. These new real-time architectures demand that when we research infrastructures we pay attention to economic and political actors, and understand the agency of data analytics firms, platforms and mobile network providers, among others, as the producers and owners of the (meta)data that transmit a real-time story of users' location, movement and behaviour. In this view, the capacities and interests of firms such as Palantir or Microsoft determine what migration information infrastructures can do *for* traditional migration management authorities, and *to* migrants themselves.

As Amoore (Amoore 2020) might argue, such moves call for a very different conception of ethics. A conception where the focus is not on how to fix the tech or how to fix the analysis but where the focus

is on paying attention to how a multiplicity of possible outcomes is constrained by way of analytic interventions and infrastructures. What she refers to as cloud ethics is grounded in complexity thinking and "concerned with the political formation of relations to oneself and to others that [are] taking place, increasingly, in and through algorithms" (p. 7). A sense of ethics that is as such emergent is not compatible with how ethics is increasingly formalised in academic settings. Understood in such a way ethics does "not belong to an episteme of accountability, transparency, and legibility, but on the contrary begins with the opacity, partiality, and illegibility of all forms of giving an account, human and algorithmic." (p.8). Ethics guidelines tend to treat data ethics as separate from AI or technology ethics. These are intertwined in information infrastructures. As we argue here, this matters because of the actors involved and interrelated and the economic and political motivations that shape invisibilising infrastructures.

Looking at the relationships built between policy and technology during the 2010's offers insights into how migration information infrastructures come about. EU-led initiatives (e.g. Big Data 4 Migration Sandvik *et al.* 2017) are connecting migration statisticians to commercial firms who analyse data produced by commercial technology providers (Taylor and Meissner 2020). In the US, operational agreements between the Department of Homeland Security and firms such as Microsoft, Palantir and Amazon (Mijente *et al.* 2019) have led to the development of new data sources and analytics in relation to migration (Ajana 2020). These collaborations mark the adoption of the notion that all data is migration data, something advised over the last decade by consultancies looking to broaden the market for collaborations between government and private sector (IOM and McKinsey & Company 2018). The result of this new policy and set of collaborations is that irregular migrants become part of a dragnet consisting of all possible online activities, from payments to social media use or connections with necessary public services such as education and healthcare (Georgetown Center on Privacy & Technology 2022).

Many of the sources these EU and US collaborations are based on can be described as commercial intelligence: data stemming from social media, from people's online activities and from mobile phone metadata. The idea of using commercial data as a main source for tracking and describing migration has only gained traction over the latter part of the 2010's, meaning that most migration researchers dealing with these methods are adapting skills and epistemology acquired from dealing with traditional administrative data sources. They do not bring with them an understanding of the particular risks and harms of the new data sources and techniques, nor is this understanding transferable from earlier forms of migration research and teaching. The new research data is not just statistics-as-usual. The new infrastructures bring with them new actors and relations and with those new troubles, new hierarchies and new forms of power (Savage and Burrows 2007) which remain invisible as long as researchers do not look too closely.

Clearly, there is a growing number of studies that, in extremely insightful ways, point our gaze to (migration) information infrastructures as the object of analysis, and some authors also take a relational view to deliberate the workings and politics of them (Bellanova and Goede 2020; Glouftsiou and Scheel 2020). We might, however, argue that there is still one step missing in order to

continuously re-visibilise migration information infrastructures, and that is the step of taking seriously and making more apparent not just the politics but also the political economy of those infrastructures to identify possible loci of resistance and to demand alternative systems - to take a cloud ethics position and uncover those possible outcomes that are being constraint.

Conclusion

In this paper, we have developed and discussed the idea of migration information infrastructures (MII) and their relevance to the field of migration studies. Our main argument has been that MIIs entail a shift in how migration is made knowable and demand new sensitivity on the part of migration researchers. We specifically highlighted shifting modes of data production and the accompanying impacts of new actors and interests in the data production game. Focusing on migration control solely through a state-centric lens helps us highlight a lot of the changes in digitalised migration counting and policy making, however thinking about MII reminds us that a broader view is needed. Migration can then be seen as a window on broader socio-political and economic processes that go hand in hand with an increasing datafication of migration and social life in general. In a landscape that consists of limited governmental databases, bolstered with ever-growing new sources of data – data that is mostly the by-product of modern technology - several pertinent questions arise about problems with new data sources, but also with how to approach migration research.

In this article, we have illustrated how we set apart our concerns with MII from ongoing research in the field. We then engaged specifically with some of the main issues with new modes of data production and eventually with debates on research ethics to carve out how the migration literature can gain from incorporating science and technology thinking in methodologically and theoretically engaging with MII. In doing so we have repeatedly hinted at the question of whose game it is that we are playing in drawing on new data sources. Asking that question points us to a different research focus. This focus recognises but also moves beyond identifying problems with the data and how they can be fixed. We need to demand a better understanding of how migration information infrastructures affect both society and migrants. We argued that this entails taking a different stance towards ethics and the need to fully and continuously excavate the political economy and market forces that have made the existence of the data possible and what inequalities those might entrench. We can draw a parallel with how training can bias AI models to reproduce social inequalities and injustices. If we enter the field with an assumption that migration is a problem of controlling both risk and mobility, then we will use data (sources) that reflect that. We will only get answers about control. Such concerns might already be addressed through ethics assessments and practices that take social implications of data use and production into account – focussing on these types of solutions alone however might miss a broader relevance of our discussions. Instead we might want to ask what lessons we can learn from better understanding and continuously re-visibilising MII about the social processes that those information infrastructures bring about. Thus decoupling migration research from risk framings, we would move migration research forward by allowing it to be less self-referential, and we could better make sense of the role of data technologies in this field. What we have described makes us consider

that what is at stake in researching relational migration information infrastructures is not only technological lock-in but also conceptual lock-in.

We run the risk, that data technologies' effects will inevitably reproduce the conditions of their construction and that researchers become complicit in this unless we explicitly work against it. The data we can access is constructed and channelled by mainly commercial infrastructures, which are tightly bound to the political and economic objectives of the high-income countries where they are developed and owned. These objectives, in turn, rely on assumptions about migration as a threat to both cultural cohesion and security. We need to recognise that the othering of migrants occurs as actively within government and commercial technological infrastructures as it does in policy and public discourse, and when we as researchers use commercial data to profile migrants, or engage with statistics co-produced by the architectures of informational capitalism, we may make it impossible for our research to provide any alternative vision of migration, or any alternative ways of engaging with it.

To push back against the prevailing framing of risk and control and to find some emancipatory potential of technology and data for migrants, Gangadharan and Niklas' (Peña Gangadharan and Niklas 2019) advice that we 'decentre the technology' can be instructive. By this, they mean that we should not treat technology as exceptional, or as determining a particular path for policy or public imaginaries, but should analyse the ways in which it replicates existing problems and inequities. By not assuming technology-driven problems require entirely new solutions, they suggest, we can use existing tools such as political representation, rule of law, and social movements to address them. In the case of migration information infrastructures, it is tempting to be exceptionalist and to posit that their creation is irreversible. However, we can alternatively address them as new mechanisms that reproduce and amplify inequities in the way migrants are addressed by policy. If we ask what an ethical and sustainable migration policy is, research suggests that it is one that addresses migrants as members of society, possessing autonomy and deserving of protection. This leads us to ask what kind of MII could support this vision of migration. Such a reframing highlights that in addition to being vigilant about MIIs and what kinds of framings of migration they engender, it is time to think about how, in the field of migration research, we can contribute to using data technologies to 'undo optimisation' (Powell 2021) through grassroots initiatives that help to envisage alternative MIIs – as difficult as these might be to imagine in current times.

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Biographical note

Fran Meissner is Assistant Professor of Critical Geodata Studies and Geodata Ethics at the University of Twente, Netherlands. Fran has previously worked as Assistant Professor of Urban Studies at the University of Leiden. Among other positions, she has held a highly competitive Marie Skłodowska Curie Fellowship at the TU Delft and a Max Weber Fellowship at the European University Institute in Florence, Italy. She is also a long-term research partner at the Max Planck Institute for the Study of Religious and Ethnic Diversity. Her research focuses on contemporary urban social configurations and how, in times of datafication, these are transformed through international migration.

Linnet Taylor is Professor of International Data Governance at the Tilburg Institute for Law, Technology, and Society (TILT), Netherlands. Her research focuses on digital data, representation and democracy, with particular attention to transnational governance issues. Her work on group privacy and data justice is used in discussions of technology governance in countries around the world. She leads the ERC Global Data Justice project, which aims to develop a social-justice-informed framework for governance of data technologies on the global level.