CHAPTER 5

Migration Multiple? Big Data, Knowledge Practices and the Governability of Migration

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Introduction

The production of knowledge on migration is a growing field of both institutional practice and academic research. On the one hand, there is a "*migration knowledge hype*" (Braun et al. 2018, 9) among states, international organisations, and non-governmental organisations. An example of this "hype" is the recent establishment of three international knowledge hubs on migration: IOM's Global Migration Data Analysis Centre (2015), the European Commission's Knowledge Centre on Migration and Demography (2016) and the UNHCR-World Bank's Joint Data Center on Forced Displacement (2018). On the other hand, migration research itself is increasingly focusing on the production of knowledge in the field of migration governance (Casas-Cortes and Cobarrubias 2018; Nash 2018; Bartels 2018; Boswell 2009; Boswell et al. 2011) and on the critical analysis of its own processes of knowledge production (Nieswand and Drotbohm 2014; Dahinden 2016; Hatton 2018).

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This chapter will focus on the big-data-based production of knowledge on migration. Recently, migration has become an object of study for data scientists and computational social scientists employing algorithms to analyse social media data, search engine data and mobile-phone positioning data. The big-data-based production of knowledge takes place in universities and public research institutions, in data hubs of international organisations, in Internet and technology companies as well as in NGOs and private–public partnership arrangements. The urgent calls by states and international organisations for better migration data and more evidence-based migration policy in recent years, as well as a growing information and communication technology sector, have fuelled this development.

So far, this new development has been studied through the lens of data challenges in the name of development and humanitarianism (Taylor 2016), through the lens of the market-making strategies of big-data analytics firms (Taylor and Meissner 2020) as well as through the lens of a reassembling of methods by statisticians working in national statistical offices confronted with new big-data-based migration statistics (Ruppert and Scheel 2019). In this chapter, I propose to explore this development through the lens of the emergence of a new sub-discipline of migration research. Therefore, my analysis will focus on big-data-based research papers on migration produced by data scientists and computational social scientists based at universities and public research institutions. Following Annemarie Mol (2002) and Stephan Scheel et al. (2019), I will explore how migration is enacted through data practices, and precisely how migration and migrants are enacted through big-data-based research papers. I will argue that migration and migrants are enacted in multiple ways and that this multiplicity—or inconsistency—is held together by reference to three mainstream migration narratives—demography, integration and humanitarianism—which all frame migration as something that needs to be governed and that can be governed better through better data. With this study, I would like to contribute to the larger debate on the role of scientific knowledge production for migration policy and governance (Boswell 2009; Boswell et al. 2011; Geddes 2015).

In the first section of this chapter, I will frame the emerging transnational network of actors involved in the big-data-based production of knowledge on migration as an apparatus that emerged in response to two discourses of urgency related to the crisis of migration governance and the UN Sustainable Development Goals. The second section reflects

on a praxiographic approach to studying the production of knowledge on migration. In the third section, I present the findings of an analysis of 17 big-data-based research papers and carve out the multiple enactments of migration and how they are held together by reference to three mainstream migration narratives.

The Big Data and Migration Apparatus

In June 2018, the Knowledge Centre on Migration and Demography of the European Commission and the Global Migration Data Analysis Centre of the International Organization for Migration launched the Big Data for Migration Alliance. The aim of this alliance is to "advance discussions on how to harness the potential of big data sources for the analysis of migration and its relevance for policymaking" (Knowledge Centre on Migration and Demography and Global Migration Data Analysis Centre 2018). In December 2018, 164 states signed the Global Compact for Safe, Orderly and Regular Migration. The compact's first objective is to "collect and utilize accurate and disaggregated data as a basis for evidence-based policies" (United Nations 2018, 6). Among the proposed actions is the use of big data for the governance of international migration. What is so fascinating about big data for migration policymakers? Why would they like to make use of social media posts, web search histories and mobile-phone positioning data? Employing the term *evidence-based policy*, the official explanation presented is that the more accurate knowledge policymakers have about migration, the better they can develop policies and tools to manage it (Geddes 2015; Stielike 2017, 129ff.). In this respect, it seems promising to access big data that is virtually real-time or can be updated frequently, that covers geographic areas with no or limited official migration statistics and that has much larger sample sizes and more flexible definitions of migration than traditional surveys (Rango and Vespe 2018, 6). Of course, the use of big data for migration governance must be seen as part of a larger trend to employ algorithms for political decision-making (see e.g. Yeung and Lodge 2019).

I frame the growing interest for big-data-based migration research and governance among European migration policymakers as an effect of a newly established big data and migration apparatus. Michel Foucault describes an apparatus as "a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical,

moral and philanthropic propositions – in short, the said as much as the unsaid" (Foucault 1980, 194). Following Foucault, I understand an apparatus as a network ("réseau") consisting of different elements such as discourses, institutions and modes of subjectivation. According to Foucault, an apparatus is established in response to a discourse of urgency and interferes in power relations that stabilise and destabilise certain types of knowledge (Foucault 1980, 194–197; Raffnsøe 2008; Agamben 2008). The big data and migration apparatus can be described as an emerging transnational network of international organisations' data hubs, data researchers at universities, internet and technology companies and non-profit organisations involved in the big-data-based production of knowledge on migration.

The big data and migration apparatus has evolved since 2015 in response to two discourses of urgency. The adoption of the Sustainable Development Goals in 2015 established a discourse of urgency related to the improvement of data on migration. Altogether, 10 of the 17 Sustainable Developments Goals contain targets and indicators of relevance to migration or mobility. So far, measuring the progress towards achieving the migration-related targets has not been possible as there is insufficient data on migration. Also, the Agenda's core principle to "leave no one behind", including migrants, requires data disaggregation by migratory status, creating significant migration data needs. Therefore, the UN Statistics Division issued an urgent call for the improvement of migration data and for innovative means of data collection, namely big data (UN Statistics Division 2017; United Nations Expert Group Meeting 2017).

The second discourse of urgency consists of four problematisations in the migration crisis discourse that evolved in the summer of 2015. The dynamics of autonomous movement of migrants across European borders questioned the states' ability to control migration; the EU's unwillingness to finance an effective search and rescue operation in the Mediterranean Sea questioned the humanitarian principles of the European Union; the chaotic situations with regard to registration and accommodation of migrants questioned government agencies' ability to properly integrate migrants; and the populist debates on migration in the aftermath of 2015 challenged the objectivity of information on migration. The use of big data for the study and governance of international migration promises to resolve the crisis of European migration governance as it responds to all four problematisations: control, humanitarianism, integration and objectivity. Policymakers believe that big data can be used to strengthen

migration control through the monitoring, forecasting and now-casting of migration dynamics, to improve humanitarian action related to migration, to enhance integration policies and to deliver objective information on migration.[1]

Enacting Migration: Knowledge Practices and Migration Multiple

A common question asked in big-data-based migration research is whether the data used represents reality. To verify this, data scientists and computational social scientists often compare their results to conventional statistics. They conceive conventional statistics as a "gold standard" that represents the "ground truth" or reality as closely as possible. Following the thoughts of Annemarie Mol, we can argue that there is not only one reality. In Mol's praxiographic perspective, reality is multiple and done in practice. Instead of asking the epistemological question of whether representations of reality are accurate, she studies the ways in which "objects come into being – and disappear – with the practices in which they are manipulated" (Mol 2002, 5). She calls this coming-into-being *enactment*: "It is possible to say that in practices objects are *enacted*" (Mol 2002, 33, emphasis in original). This shift from asking "how to find the truth?" to "how are objects handled in practice?" pushes the philosophy of science to develop "an *ethnographic* interest in knowledge practices" (Mol 2002, 5, emphasis in original).

Mol argues that "reality multiplies" as "objects tend to differ from one practice to another" (Mol 2002, 5). In her book *The Body Multiple*, she shows how in a Dutch hospital, the disease atherosclerosis is enacted in various diagnostic and therapeutical practices and thereby brings into existence several versions of atherosclerosis. In other words and related to the social sciences, "different research practices might be *making multiple worlds*" (Law and Urry 2004, 397, emphasis in original). John Law and John Urry speak of the "*performativity* of method", meaning that a specific research method "helps to produce the realities that it describes" (Law and Urry 2004, 397, emphasis in original).

However, if method is interactively performative, and helps to make realities, then the differences between research findings produced by different methods or in different research traditions have an alternative significance. No longer different *perspectives* on a single reality, they

become instead the enactment of different *realities* (Law and Urry 2004, 397, emphasis in original).

However, in her book, Mol makes a "double move" (Mol 2002, 82). She not only studies "the multiplication of a single disease" but also "the coordination of this multitude into singularity" (Mol 2002, 82). In other words, she identifies how the different versions of atherosclerosis enacted in the hospital "hang together" (Mol 2002, 84) and identifies four "forms of coordination" (Mol 2002, 55) or "recurrent patterns of coexistence between different enactments" (Mol 2002, 181) of the disease: addition, translation, distribution and inclusion. Addition means to add different objects together and thereby turn them into one either by establishing a hierarchy or through cumulative arguments (Mol 2002, 55–72), translation means to make the results of distinct practices comparable (Mol 2002, 72–85), distribution means to keep incoherent objects separated between different sites in order to prevent a clash between them (Mol 2002, 87–117) and inclusion means that some objects mutually include and constitute each other (Mol 2002, 120–142). By focusing on these modes of coordination, Mol stresses that the singularity of an object—such as a disease or migration—is "an accomplishment" and "the result of the work of coordination" (Mol 2002, 119).

In their special issue "Enacting migration through data practices", Stephan Scheel, Evelyn Ruppert and Funda Ustek-Spilda draw on Annemarie Mol's—and John Law's (2004, 2008, 2012)—work to study the enactment of migration through data practices. More precisely, they argue that the "enactment agenda" should be put to use not only at conventional sites of knowledge production such as laboratories and hospitals but also in "politically highly contested contexts" such as migration governance (Scheel et al. 2019, 583). They understand practices not as mere techniques or technical operations but as "*activities* performed by humans in relation to materials, technologies and shared understandings" that "occur within specific fields" (Scheel et al. 2019, 583, emphasis in original). Examples of data practices are "judgements and tacit knowledge of practitioners", "rules, standards and struggles within a community of practice" as well as "the affordances and constraints of technologies" (Scheel et al. 2019, 583). Finally, they ask "how – and through what kind of data practices – migration-related realities are enacted as objects of government" (Scheel et al. 2019, 582). Consequently, most contributions to their special issue focus on sites and actors more or less directly involved in the governance of migration, such as administrative offices,

refugee camps, border patrols, national statistical offices and international organisations (Plájás et al. 2019; Pollozek and Passoth 2019; van Reekum 2019; Schultz 2019; Scheel and Ustek-Spilda 2019). By comparison, this chapter chooses a more conventional site of knowledge production by focusing on big-data-based research produced by data scientists and computational social scientists at universities and public research institutions. However, I will show that even though the sites and actors are not directly involved in governmental practices, the knowledge they produce on migration is closely linked to the field of migration governance.

While building mainly on ethnographic techniques of observation and writing, Mol points out that "[a]nother quite different but equally interesting resource for praxiography is found in the *material and methods* sections of scientific articles" (Mol 2002, 158, emphasis in original). This piece of writing is part of a larger research project on the knowledge practices involved in the big-data-based production of knowledge on migration, which employs a multi-sited ethnography including observations, interviews and document analysis. However, for this chapter, I follow Mol's suggestion and draw on big-data-based research papers on migration, paying particular attention to their material and methods sections. I focus on how multiple versions of migration are enacted in these papers and how—at the same time—migration "hangs together" as a singular object. In this chapter, I will not engage in the debate on the extent to which big-data-based research (on migration) is representative, biased, legitimate, ethical or trustworthy (see e.g. Taylor and Dencik 2020; Ho 2020).

Enactments of Migration in Big-Data-Based Research Papers

The following analysis is based on 17 big-data-based research papers related to "migration" or "mobility" published between 2011 and 2020. I chose the papers for their wide range of big-data sources (call detail records, geo-coded e-mail logins, LinkedIn profiles, geo-located Twitter tweets, geo-coded Skype login data, geo-coded Google+ data, Facebook advertising platform data, Facebook interests, Facebook Network data, Google Trends Index) and for their great variety in addressing "migration" or "mobility" (international migration, international mobility, high-skilled migration, daily travelling, transnationalism, assimilation, segregation, relocation between three countries, forced mobility after natural

disasters, forced migration due to economic and political crises). All the selected papers present original research. Most of them were co-authored by researchers who have been among the first to use big data to study migration, have become central figures in the field and have offered advice to government agencies or international organisations. I have not included papers that have been produced for international organisations (e.g. Hughes et al. 2016; UN Global Pulse and UNHCR Innovation Service 2017; Spyratos et al. 2018) or that provide an overview of the field but no original research (e.g. Sîrbu et al. 2020). Although the selection cannot be considered representative in a statistical sense, in my view, the selected papers give good insight into the field.

At the time of publication of the selected papers, 32 authors worked at universities or research institutes in Europe, North America, Asia, the Middle East and South America. Five authors were employed at technology companies (Microsoft, Yahoo, LinkedIn, Positium) and ten authors worked for international, supranational or non-profit organisations (OECD, the European Commission's Knowledge Centre on Migration and Demography, IOM's Global Migration Data Analysis Centre, UNICEF, iMMAP Colombia, Global Protection Cluster Switzerland). On the basis of their given names, it can be estimated that five authors are female and 40 are male.

The large majority of research papers consider the lack of timely, reliable, comparable and disaggregated data that build on consistent definitions of migration and have a wide geographical coverage as the central problem of migration research. In response to this identified problem, most papers argue that big data provide a solution. Big data sources promise timeliness, consistency, disaggregation, higher spatial resolutions, coverage of developing countries and hard-to-reach populations and the capture of forms of migration and mobility that are not represented in official statistics. The new data sources not only promise to complement traditional statistics but also to deliver data that can be used for predictive purposes such as now-casting and forecasting: "The main goals of our work are to complement existing migration statistics, and to develop methods for harnessing publicly available online data in order to improve forecasts and our understanding of populations of migrants" (Zagheni et al. 2014, 1f.).

Multiple Enactments of Migration: Data-Driven Definitions

Inconsistent definitions of migration play an important part in the recurring "lack of data" problematisation summarised above. While it is seen as a problem of official migration statistics that "different countries collect data for different purposes and thus use different definitions of migration", the possibility to "use the same definition of migration consistently" (State et al. 2013, 1) is considered a major advantage of working with big data. Thus, every research paper provides its own definition of migration or migrant based on the specific data source used for the study. This practice produces a multiplicity of definitions that are highly data driven. In the following, I focus on two definitions of migration and three definitions of migrant.

In their paper on the use of e-mail data for estimating international migration rates, Emilio Zagheni and Ingmar Weber "define migration as a change of usual residence between the period from 09-2009 to 06-2010, and the period from 07-2010 to 06-2011" (Zagheni and Weber 2012, 3). This definition builds on the data they use for their study: A large sample of Yahoo e-mail messages sent between September 2009 and June 2011. The authors know the self-reported date of birth and gender of the e-mail account holders as well as the dates the messages were sent. Based on the users' IP addresses, they can also estimate the country from where the messages were sent. Simply put, in the view of the authors, a "change of usual residence" has occurred when in the first time period, a user has sent most e-mails from country A and in the second time period from country B.

Zagheni and Weber's definition of migration resembles the definition proposed by the International Organization for Migration (IOM) inasmuch as it also refers to a "place of usual residence".[2] In contrast to IOM's definition, movement itself does not play a role in Zagheni and Weber's definition. They focus on a change of location that has occurred between two time periods but not on the process of mobility or movement itself. Unlike often-used definitions by national statistical offices.[3] Zagheni and Weber's definition is not linked to notions such as birthplace or nationality. The person who changes their usual residence between the two time periods could be a national of one of the two countries, of both of them or of a third country. Their definition of migration also does not relate to motives or determinants of migration. Implicitly, to

them, migration is international migration as mentioned in the title of their paper.

Bogdan State et al. draw on data from the online platform LinkedIn to study the migration of professionals to the US. Instead of defining migration, they define a "migration event":

> We define a migration event by querying the location of each individual at the beginning of every calendar year. If the individual's estimated place of residence is in a different country, compared to the beginning of the previous year, we assume that a migration event has occurred during the past calendar year. (State et al. 2014, 540)

More precisely, they "measured migrations by examining country-level locations associated with positions held by individuals across their careers, as listed in their LinkedIn profiles" (State et al. 2014, 540). Those migrations had to last for at least one calendar year and must have taken place between 1990 and 2012. In short, a migration event is defined as a change of employment listed in a user's LinkedIn profile that is related to a changed country of residence and lasts for at least one year. Again, from this view, migration is not defined by nationality or birthplace and it is implicitly understood as international migration. Also, this definition does not focus on movement but on migration as the result of an already completed process of mobility. The criterion of length of stay of at least one year coincides with the definition of migration proposed by the European Migration Network.[4]

Interestingly, most big-data-based research papers do not define migration but migrant. Those definitions are more diverse than the definitions of migration but are also heavily data driven. Three main types of definitions can be distinguished: (1) a specific amount of time spent in at least two countries, (2) self-reported multiple places of residence, (3) self-reported and inferred residence in a country different from the original country of residence.[5]

The first type of definition considers a migrant a person who spends a specific amount of time in one country and another specific amount of time in another country. In their paper on studying international mobility through IP-address-based geo-located logins into Yahoo accounts, Bogdan State et al. define a migrant as "an individual who spends at least 90 days in exactly two countries during the observed timespan of one year" (State et al. 2013, 3). Length of stay and the stay in

at least two countries are also the main aspects of the definition in a paper on the use of IP-address-based geo-located logins into Skype accounts to explain international migration. Riivo Kikas et al. define Skype users as migrants "if they have been in one country for at least five consecutive months and in another country for at least five consecutive months. Setting these time limits prevents counting longer holidays or business visits as migration events" (Kikas et al. 2015, 18). Similarly, in their study on international and internal migration patterns inferred from geo-located Twitter tweets, Zagheni et al. define migrants as "those users that are identified as people who moved to a different country for at least one of the 4-month periods that we considered" (Zagheni et al. 2014, 4).

In their often-cited definition for collecting data on migration, the United Nations Department of Economic and Social Affairs (UN DESA) defines an "*international migrant*" as "*any person who changes his or her country of usual residence*" (UN DESA 1998, 9).[6] UN DESA also provides definitions for "long-term migrant"[7] and "short-term migrant".[8] The big-data-driven migrant definitions cited above indirectly relate to the definition of short-term migrant as the minimal length of stay is set at 90 days (approx. 3 months). However, except for the first study, they do not set a maximal length of stay, thus examining both what UN DESA defines as short-term and long-term migration. Unlike the European Migration Network, which defines a migrant as "a person who is outside the territory of the State of which they are nationals or citizens and who has resided in a foreign country for more than one year irrespective of the causes, voluntary or involuntary, and the means, regular or irregular, used to migrate" (European Migration Network 2021), this first type of big-data-driven definition does not refer to categories such as nationality, citizenship, motivations or means of migration.

Interestingly, Rein Ahas et al. also base their definition of "transnationals" on length of stay and stay in at least two countries. However, in their paper on tracking transnationalism with mobile telephone data, they add a third parameter: the number of trips. Drawing on domestic and roaming call detail record (CDR) data of the two largest mobile communications operators in Estonia for the year 2015, they consider people as transnationals "if they spend more than 25% of their time (at least 92 days), but not more than 75% of their time (up to 273 days) in a foreign country" and "if they have taken at least five trips to a foreign country, but not more than 52 trips (once a week)" (Ahas et al. 2017, 8). In summary, this first type of definition of migrants (and transnationals) resembles

the above-presented definitions of migration by its reference to length of stay and stay in at least two countries as well as in its non-reference to categories such as country of birth, country of origin, nationality or citizenship.

The second type of definition relates to multiple places of residence reported by users. In their paper, Johnnatan Messias et al. draw on data from Google+ profiles to study migration clusters—the relocation of a person between three countries. Users of Google+ accounts can list in their profiles all the places in the world where they have lived. These "Places where I lived" are automatically geo-coded by Google+. Unlike in the first type of definition, where migration is inferred from a change in geo-coded logins of users, here the definition of migrant builds on multiple former places of residence self-reported by the users: "As our study is about international migration, we only considered the subset of users who have lived ('places lived') in at least two distinct countries. We refer to this group of users as *migrants*" (Messias et al. 2016, 423, emphasis in original). This means that people are considered as migrants if they have ever lived in more than one country. Even if they have returned to their country of origin after a short period of time abroad, they are still considered to be migrants. Thus, everyone who has studied abroad for a semester or worked for a year in a foreign country and returned is considered a migrant for the rest of their lives. This understanding of migrant stands in stark contrast to the use of the term in public discourse or national statistical offices. Here "migrants" are only those who have arrived from abroad—and sometimes even their children are marked by the German statistical category "migration background" (Will 2019)—but not those who have returned from abroad. This second type of definition resembles the first type in lacking any reference to categories such as country of origin or nationality, but it differs from the first type in also lacking any reference to the length of stay.

The third type of migrant definition is based on a mixture of user-reported and inferred information on the users' residence outside their "original country of residence". Drawing on data from Facebook's advertising platform, Antoine Dubois et al. explore "migrant assimilation through Facebook interests". Using Facebook's Marketing API, companies and researchers can obtain estimates of the number of users "who belong to a certain demographic group and show certain *interests*" (Dubois et al. 2018, 53, emphasis in original). As Facebook does not provide the category "migrants", the authors use Facebook's category

"expats" instead: "We use the Facebook advertising platform terminology, which does not refer to *migrants* but to expats, though we use migrant and expat interchangeably" (Dubois et al. 2018, 53, footnote 7). Facebook defines expats as "people whose original country of residence is different from the current country".[9] Facebook does not provide information on how users are categorised as "expats". However, Zagheni et al. infer from research produced by Facebook staff that the "current city" and "hometown" provided by users in their Facebook profiles as well as the structure of the users' network of Facebook friends must be "among the key components of the estimation process" (Zagheni et al. 2017, 724).[10] In their paper on the quantification of human mobility patterns using Facebook Network data, Spyratos et al. indicate that the Facebook-based definition of migrants does not refer "to a user's citizenship, country of birth, or legal status" (Spyratos et al. 2019, 5). However, unlike the first and second type, this third type of definition refers to an "original country of residence" and a "hometown", thus using categories that are close to country of origin or country of birth. As in the second type, there is no reference to the length of stay.

As shown above, big-data-based research papers enact migration and migrants in multiple ways. The two presented definitions of migration are not so diverse, as both build on two main criteria: change of usual residence to another country and length of stay. However, they differ in the defined length of stay. Both definitions do not relate to categories such as country of origin or nationality. The definitions of migrants presented in the research papers are manifold. While the first type of definition builds on length of stay and stay in at least two countries, similar to the criteria for the definitions of migration, the second and third types of definition do not refer to length of stay. Instead, according to the second type of definition, people are considered to be migrants if they have ever lived in more than one country. Only the third type of definition builds on the idea of a given country of origin or birth that differs from the current place of residence.

From the perspective of a "reflexive turn" (Nieswand and Drotbohm 2014; Dahinden 2016; Amelina 2021) in migration studies, the big-data-driven enactments of migration and migrant hold both potentials and risks. On the one hand, they invite reflection upon the strong associations between migration, nationality and origin in "conventional" migration research and help to rethink migration beyond these categories—as (a result of) movement in space. On the other hand, these big-data-driven

enactments reproduce methodological nationalism, as the nation-state—here usually called "country"—is still (implicitly) used as the key reference point to define migration and migrant. Also, the second and third type of migrant definition discussed above hold the risk that categories such as "Places where I lived" or "expats" defined by private companies and attributed by their algorithms greatly influence migration researchers' understanding of migration.

Work of Coordination: Enacting Migration as a Singular Object by Reference to Migration Narratives

How is it possible that the presented research papers treat migration and migrants as singular objects given the diverse ways in which they define them? How is the singularity of migration and migrants as an object achieved within and across the research papers? Following Annemarie Mol, I highlight the "work of coordination" that is undertaken in the research papers and argue that migration and migrants "hang together" by reference to three mainstream migration narratives—demography, integration and humanitarianism—which all frame migration as something that needs to be governed and that can be governed better through better data.

Eight out of the 17 research papers frame migration as a demographic phenomenon (Zagheni and Weber 2012; State et al. 2013, 2014; Zagheni et al. 2014; Kikas et al. 2015; Messias et al. 2016; Zagheni et al. 2017; Dubois et al. 2018). In this view, migration is understood as a factor that changes the size and composition of a population and that can be influenced to a certain extent through political interventions. In this vein, Zagheni and Weber see international migration as an "important driver of demographic growth in many countries" (Zagheni and Weber 2012, 1), State et al. consider high-skilled migration as an "important demographic phenomenon with relevant consequences, for instance in terms of human capital formation, a central issue in the study of economic development" (State et al. 2014, 537), and Dubois et al. perceive immigration as a "stopgap measure to address population aging, which would otherwise strain the economy and public finances" (Dubois et al. 2018, 51). Moreover, some authors see their papers as a direct contribution to demographic research, for example, Zagheni et al. when they write "[I]n this article, we contribute to the development of tools and methods

that leverage new data sources for demographic research" (Zagheni et al., 2017, 721; see also Zagheni et al. 2014, 1; Messias et al. 2016, 427).

Three research papers relate to a second migration narrative that is built around the assumed need to integrate migrants into receiving societies (Dubois et al. 2018; Stewart et al. 2019; Marquez et al. 2019). Interestingly, two of the papers do not focus on integration into the labour market or the education system but on "cultural assimilation" in terms of "interests" expressed on Facebook (Dubois et al. 2018, 52; Stewart et al. 2019, 3258). Thus, integration is imagined as a unidirectional process of adaptation by migrants and their descendants to the population of the receiving country. In their study on the segregation between Syrian refugees and the native population in Turkey, which is based on call detail records and Twitter, Neal Marquez et al. show a significant positive relationship between positive sentiments towards refugees in Turkey expressed on Twitter and the probability of refugees contacting non-refugees via mobile phone (Marquez et al. 2019, 276). This implies that the receiving society plays its part in the integration process. However, the main responsibility for integration seems to lie with the migrants as it is their calls to non-refugees that are counted as a proxy for integrative behaviour—and not the calls of non-refugees to refugees. Thus, in all three papers, integration is primarily imagined as a one-way street.

The third migration narrative concerns humanitarian assistance to people fleeing from natural disasters, or economic, political or medical crises (Bengtsson et al. 2011; Lu et al. 2012; Blanford et al. 2015; Böhme et al. 2020; Palotti et al. 2020). The central assumption is that better data on the number, spatial distribution and routes of fleeing populations allows for improved humanitarian assistance. In their paper on the spatial distribution and socio-economic status of Venezuelan "refugees and migrants" in different receiving countries, which is based on data from the Facebook advertising platform, Joao Palotti et al. write: "Estimating the absolute number and the spatial distribution of Venezuelan refugees and migrants are (sic) a top priority in order to quantify the magnitude of the crisis and to plan an appropriate humanitarian response" (Palotti et al. 2020, 6). Linus Bengtsson et al., whose study tracks the movement of people after the earthquake in Haiti in 2010 via call detail records, also argue that the provision of close to real-time data "on postdisaster population distributions can potentially enable improved distribution of water, food, shelter, and sanitation" (Bengtsson et al. 2011, 7; see also Lu et al. 2012, 11580). Additionally, referring to the cholera outbreak

in Haiti a few months after the earthquake, they show that call detail record data can also be used to "potentially inform outbreak preparedness and response for infectious diseases" (Bengtsson et al. 2011, 7). Justine Blanford et al. also point out the potential of geo-located Twitter tweets for understanding epidemic dynamics and enhancing disease surveillance (Blanford et al. 2015, 11). Even Marcus Böhme et al. see in their study on the prediction of international migration via online search keywords an approach that could "be used for policy applications in the case of humanitarian crises in order to deliver real-time monitoring of migration intentions ahead of their realization to organize humanitarian responses" (Böhme et al. 2020, 19).

All three migration narratives frame migration as something that needs to be governed and that can be governed better through better data. From a demographic perspective, better data on migration allow for better demographic forecasts and more appropriate population-related policies; from an integrationist perspective, better data on migration allow for better integration policies and from a humanitarian perspective, better data on migration allow for better planning and implementation of humanitarian assistance. Several authors consider their own research as "input for policy-making" and envisage a "systematic use of non-traditional data for policy support and migration governance" (Spyratos et al. 2019, 19).

Finally, I argue in the sense of the "performativity of methods" that the multiple big-data-driven definitions of migration and migrants discussed above enact realities beyond a governmental discourse on migration—for example, a gradual shift from state/nation/origin-centred migration thinking to mobility-centred migration thinking. For (self-)reflexive migration studies, it might be worth exploring these enactments more closely to discover alternative ways of rethinking migration. However, contrary to a pure "performativity of methods" standpoint, I also argue that the authors of the big-data-based research papers—perhaps to gain credibility and prestige as a new sub-field of migration studies—aim at contributing to the well-established research fields of demography, integration or humanitarianism and thereby inscribe into migration narratives that stand in stark contrast to these alternative enactments of migration. In this process, the research papers—some more implicitly and others very explicitly—adopt the assumption that migration needs to be managed or governed and that this can be improved through better data. Finally, this common assumption is what makes the multiple big-data-driven versions of migration and migrants "hang together".

Conclusion

In a pre-recorded online panel discussion titled "Data for what? A conversation with policymakers and practitioners on the use of evidence and data on forced displacement" that was part of the virtual United Nations World Data Forum 2020, Björn Gillsäter, head of the recently founded World Bank—UNHCR Joint Data Center on Forced Displacement, said in his introduction: "I think one of the things that unites those of us who are watching this video is that we believe in what gets measured gets done or at least what gets measured gets managed".[11] Just like the big-data-based research papers analysed in this chapter, this statement builds on the assumption that migration is an object of government, and that it needs to be managed. To make this assumption more explicit, we could reformulate it as: What needs to be governed gets measured to be governed better.

Drawing on 17 big-data-based research papers, I showed in this chapter that the emerging sub-discipline of big-data-based migration research enacts migration and migrants in multiple ways. While some papers focus on change of residence and length of stay, others define migrants by self-reported multiple former places of residence or by a mixture of self-reported and inferred residence in a country different from a supposed original country of residence. Interestingly, nationality, citizenship or country of birth hardly play a role in these enactments, which is what makes them—to a certain extent—differ from realities enacted by social science migration researchers or by actors involved in migration governance. However, following Annemarie Mol, I have argued that this multiplicity of migration is held together by reference to three migration narratives—demography, integration and humanitarianism—which all frame migration as something that needs to be governed and that can be governed better through better data. As the research papers aim at contributing to these research fields, they inscribe themselves into these migration narratives and thereby adopt the assumption of migration as an object of government. The will or necessity of data scientists and computational social scientists to relate to dominant migration narratives—perhaps to gain credibility and prestige as a new sub-field of migration studies—seems to be stronger than the "performativity of methods" that creates new migration realities. However, I would argue that—from a (self-) reflexive migration studies perspective—exactly these big-data-driven alternative enactments of migration might be worth

exploring in more detail as they promise to offer new ways of rethinking migration beyond governmental discourse. Finally, we could ask in the sense of "ontological politics" (Mol 1999, 2002; Law and Urry 2004, 396f.): If methods help to make realities, which migration realities might big-data-based migration research want to enact in the future?

Notes

1. See, for example, the initiative "Migration 4.0" organised during Germany's presidency of the Council of the European Union which covered control (e.g. forecasting tools, facial and voice recognition), humanitarianism (virtual psycho-social counselling), integration (new digital communication channels with migrants) and objectivity (better evidence through data collaboratives; study of public attitudes on migration) (German Federal Ministry of the Interior, Building and Community 2020).
2. The International Organization for Migration defines migration as "[t]he movement of persons away from their place of usual residence, either across an international border or within a State" (International Organization for Migration, n.d.).
3. For the UK's Office of National Statistics see Anderson and Blinder (2019).
4. The European Migration Network is a network of "migration and asylum experts" initiated by the European Commission's Directorate-General Migration and Home Affairs. In the network's glossary, migration in "the global context" is defined as the "movement of a person either across an international border (international migration), or within a state (internal migration) for more than one year irrespective of the causes, voluntary or involuntary, and the means, regular or irregular, used to migrate" (European Migration Network, n.d.).
5. It would need further research based on a larger selection of research papers to investigate how migration/migrant definitions and the choice of big data sources have changed over the last ten years and how this might have been related to changes in migration narratives.
6. The IOM defines a migrant as "a person who moves away from his or her place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons" (International Organization for Migration, n.d.).
7. "A person who moves to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence" (UN DESA 1998, 10).

8. "A person who moves to a country other than that of his or her usual residence for a period of at least 3 months but less than a year (12 months) except in cases where the movement to that country is for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage" (UN DESA 1998, 10).
9. Facebook Adverts Manager's documentation cited by Zagheni et al. (2017, 723).
10. In October 2018, Facebook's advertising platform changed its classification from "expats of country X" to "lived in country X" whereby users who have "lived in country X" are defined as "people who used to live in country X and now live abroad". The classification was changed back to "expats" in late 2018, while its definition remained the same (Spyratos et al. 2019, 4; Palotti et al. 2020, 10f.).
11. This video was available at the United Nations World Data Forum 2020 which took place from 19 to 21 October 2020 as a virtual event due to the corona pandemic. The quote can be found at time code 0:35 (*Data for What? A Conversation with Policymakers and Practitioners on the Use of Evidence and Data on Forced Displacement*, n.d.).

Bibliography

Agamben, Giorgio. 2008. *Was ist ein Dispositiv?* Zürich and Berlin: Diaphanes.

Ahas, Rein, Siiri Silm, and Margus Tiru. 2017. "Tracking Trans-Nationalism with Mobile Telephone Data." In *Estonian Human Development Report 2016/2017. Estonia at the Age of Migration*, edited by Tiit Tammaru, Raul Eamets, and Kristina Kallas. Foundation Estonian Cooperation Assembly. https://2017.inimareng.ee/en/open-to-the-world/tracking-trans-nationalism-with-mobile-telephone-data/.

Amelina, Anna. 2021. "After the Reflexive Turn in Migration Studies: Towards the Doing Migration Approach." *Population, Space and Place* 27 (1). https://doi.org/10.1002/psp.2368.

Anderson, Bridget, and Scott Blinder. 2019. "Who Counts as a Migrant? Definitions and Their Consequences." *Migration Observatory Briefing, COMPAS, University of Oxford* (blog). July 2019. https://migrationobservatory.ox.ac.uk/resources/briefings/who-counts-as-a-migrant-definitions-and-their-consequences/.

Bartels, Inken. 2018. "Practices and Power of Knowledge Dissemination. International Organizations in the Externalization of Migration Management in Morocco and Tunisia." *Journal for Critical Migration and Border Regime Studies* 4 (1): 47–66.

Bengtsson, Linus, Xin Lu, Anna Thorson, Richard Garfield, and Johan von Schreeb. 2011. "Improved Response to Disasters and Outbreaks by Tracking Population Movements with Mobile Phone Network Data: A Post-Earthquake Geospatial Study in Haiti." Edited by Peter W. Gething. *PLoS Medicine* 8 (8): e1001083. https://doi.org/10.1371/journal.pmed.1001083.

Blanford, Justine I., Zhuojie Huang, Alexander Savelyev, and Alan M. MacEachren. 2015. "Geo-Located Tweets. Enhancing Mobility Maps and Capturing Cross-Border Movement." Edited by Renaud Lambiotte. *PLOS ONE* 10 (6): e0129202. https://doi.org/10.1371/journal.pone.0129202.

Böhme, Marcus H., André Gröger, and Tobias Stöhr. 2020. "Searching for a Better Life: Predicting International Migration with Online Search Keywords." *Journal of Development Economics* 142 (January): 102347. https://doi.org/10.1016/j.jdeveco.2019.04.002.

Boswell, Christina. 2009. *The Political Uses of Expert Knowledge: Immigration Policy and Social Research*. Cambridge and New York: Cambridge University Press.

Boswell, Christina, Andrew Geddes, and Peter Scholten. 2011. "The Role of Narratives in Migration Policy-Making: A Research Framework." *The British Journal of Politics and International Relations* 13 (1): 1–11. https://doi.org/10.1111/j.1467-856X.2010.00435.x.

Braun, Katherine, Fabian Georgi, Robert Matthies, Simona Pagano, Mathias Rodatz, and Maria Schwertl. 2018. "Umkämpfte Wissensproduktionen der Migration: Editorial." *Movements. Journal for Critical Migration and Border Regime Studies* 4 (1): 9–27.

Casas-Cortes, Maribel, and Sebastian Cobarrubias. 2018. "It Is Obvious from the Map! Disobeying the Production of Illegality beyond Borderlines." *Journal for Critical Migration and Border Regime Studies* 4 (1): 29–44.

Dahinden, Janine. 2016. "A Plea for the 'De-Migranticization' of Research on Migration and Integration." *Ethnic and Racial Studies* 39 (13): 2207–2225. https://doi.org/10.1080/01419870.2015.1124129.

Data for What? A Conversation with Policymakers and Practitioners on the Use of Evidence and Data on Forced Displacement. n.d. Accessed November 27, 2020. https://www.jointdatacenter.org/data-for-what-a-conversation-with-policymakers-and-practitioners-on-the-use-of-evidence-and-data-on-forced-displacement/.

Dubois, Antoine, Emilio Zagheni, Kiran Garimella, and Ingmar Weber. 2018. "Studying Migrant Assimilation Through Facebook Interests." In *Social Informatics*, edited by Steffen Staab, Olessia Koltsova, and Dmitry I. Ignatov, 11186: 51–60. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-01159-8_5.

European Migration Network. 2021. "Migrant." Glossary. Accessed March 15, 2021. https://ec.europa.eu/home-affairs/what-we-do/networks/european_migration_network/glossary_search/migration_en.

European Migration Network. n.d. "Migration." Glossary. Accessed March 15, 2021. https://ec.europa.eu/home-affairs/what-we-do/networks/european_migration_network/glossary_search/migration_en.

Foucault, Michel. 1980. "The Confession of the Flesh [1977]." In *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977*, edited by Colin Gordon. Brighton, Sussex: Harvester Press.

Geddes, Andrew. 2015. "Temporary and Circular Migration in the Construction of European Migration Governance." *Cambridge Review of International Affairs* 28 (4): 571–588. https://doi.org/10.1080/09557571.2015.1018135.

German Federal Ministry of the Interior, Building and Community. 2020. *Virtual Meeting "Migration 4.0." Related to the German Presidency 2020*. https://migrationnetwork.un.org/migration-digitalization.

Hatton, Joshua. 2018. "MARS Attacks! A Cautionary Tale from the UK on the Relation between Migration and Refugee Studies (MARS) and Migration Control." *Journal for Critical Migration and Border Regime Studies* 4 (1): 103–132.

Ho, Justin Chun-Ting. 2020. "How Biased Is the Sample? Reverse Engineering the Ranking Algorithm of Facebook's Graph Application Programming Interface." *Big Data & Society* 7 (1): 205395172090587. https://doi.org/10.1177/2053951720905874.

Hughes, Christina, Emilio Zagheni, Guy J. Abel, Arkadiusz Wi'sniowski, Alessandro Sorichetta, Ingmar Weber, Andrew J. Tatem, et al. 2016. *Inferring Migrations, Traditional Methods and New Approaches Based on Mobile Phone, Social Media, and Other Big Data: Feasibility Study on Inferring (Labour) Mobility and Migration in the European Union from Big Data and Social Media Data*. Luxembourg: Publications Office.

International Organization for Migration. n.d. "Migrant." Key Migration Terms. Accessed March 15, 2021a. https://www.iom.int/key-migration-terms#Migrant.

International Organization for Migration. n.d. "Migration." Key Migration Terms. Accessed March 15, 2021b. https://www.iom.int/key-migration-terms#Migration.

Kikas, Riivo, Marlon Dumas, and Ando Saabas. 2015. "Explaining International Migration in the Skype Network: The Role of Social Network Features." In *Proceedings of the 1st ACM Workshop on Social Media World Sensors—SIdEWayS '15*, 17–22. Guzelyurt, Northern Cyprus: ACM Press.

Knowledge Centre on Migration and Demography, and Global Migration Data Analysis Centre. 2018. "Big Data for Migration Alliance Launch Event." June 25, 2018. https://knowledge4policy.ec.europa.eu/migration-demography/big-data-alternative-data-sources-migration_en#launch.

Law, John. 2004. *After Method: Mess in Social Science Research*. International Library of Sociology. London and New York: Routledge.

Law, John. 2008. "On Sociology and STS." *The Sociological Review* 56 (4): 623–649. https://doi.org/10.1111/j.1467-954X.2008.00808.x.

Law, John. 2012. "Collateral Realities." In *The Politics of Knowledge*, edited by Patrick Baert and Fernando Domínguez Rubio, 156–178. London and New York: Routledge.

Law, John, and John Urry. 2004. "Enacting the Social." *Economy and Society* 33 (3): 390–410. https://doi.org/10.1080/0308514042000225716.

Lu, X., L. Bengtsson, and P. Holme. 2012. "Predictability of Population Displacement after the 2010 Haiti Earthquake." *Proceedings of the National Academy of Sciences* 109 (29): 11576–11581. https://doi.org/10.1073/pnas.1203882109.

Marquez, Neal, Kiran Garimella, Ott Toomet, Ingmar G. Weber, and Emilio Zagheni. 2019. "Segregation and Sentiment: Estimating Refugee Segregation and Its Effects Using Digital Trace Data." In *Guide to Mobile Data Analytics in Refugee Scenarios*, edited by Albert Ali Salah, Alex Pentland, Bruno Lepri, and Emmanuel Letouzé, 265–282. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-12554-7_14.

Messias, Johnnatan, Fabricio Benevenuto, Ingmar G. Weber, and Emilio Zagheni. 2016. "From Migration Corridors to Clusters: The Value of Google+ Data for Migration Studies." In *Proceedings of the 2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining: ASONAM 2016: San Francisco, CA, USA, August 18–21, 2016*, edited by Institute of Electrical and Electronics Engineers.

Mol, Annemarie. 1999. "Ontological Politics. A Word and Some Questions." Edited by John Law and John Hassard. *The Sociological Review. Sepcial Issue: Actor Network Theory and After* 47 (S1): 74–89.

Mol, Annemarie. 2002. *The Body Multiple: Ontology in Medical Practice*. Science and Cultural Theory. Durham: Duke University Press.

Nash, Sarah Louise. 2018. "Knowing Human Mobility in the Context of Climate Change. The Self-Perpetuating Circle of Research, Policy, and Knowledge Production." *Journal for Critical Migration and Border Regime Studies* 4 (1): 67–82.

Nieswand, Boris, and Heike Drotbohm. 2014. "Einleitung: Die Reflexive Wende in der Migrationsforschung." In *Kultur, Gesellschaft, Migration: Die Reflexive*

Wende in der Migrationsforschung, edited by Boris Nieswand and Heike Drotbohm, 1–37. Studien zur Migrations- und Integrationspolitik. Wiesbaden: Springer VS.

Palotti, Joao, Natalia Adler, Alfredo Morales-Guzman, Jeffrey Villaveces, Vedran Sekara, Manuel Garcia Herranz, Musa Al-Asad, and Ingmar Weber. 2020. "Monitoring of the Venezuelan Exodus through Facebook's Advertising Platform." Edited by Federico Botta. *PLOS ONE* 15 (2): e0229175. https://doi.org/10.1371/journal.pone.0229175.

Plájás, Ildikó Z., Amade M'charek, and Huub van Baar. 2019. "Knowing 'the Roma': Visual Technologies of Sorting Populations and the Policing of Mobility in Europe." *Environment and Planning D: Society and Space* 37 (4): 589–605. https://doi.org/10.1177/0263775819837291.

Pollozek, Silvan, and Jan Hendrik Passoth. 2019. "Infrastructuring European Migration and Border Control: The Logistics of Registration and Identification at Moria Hotspot." *Environment and Planning D: Society and Space* 37 (4): 606–624. https://doi.org/10.1177/0263775819835819.

Raffnsøe, Sverre. 2008. "Qu'est-Ce Qu'un Dispositif? L'analytique Sociale de Michel Foucault." *Symposium. Canadian Journal of Continental Philosophy/Revue Canadienne de Philosophie Continentale* 12 (1): 44–66.

Rango, Marzia, and Michele Vespe. 2018. "Big Data and Alternative Data Sources on Migration: From Case-Studies to Policy Support. Summary Report. European Commission—Joint Research Centre (JRC), Ispra, Italy, 30 November 2017." https://bluehub.jrc.ec.europa.eu/bigdata4migration/workshop-outcome.

van Reekum, Rogier. 2019. "Patrols, Records and Pictures: Demonstrations of Europe in the Midst of Migration's Crisis." *Environment and Planning D: Society and Space* 37 (4): 625–643. https://doi.org/10.1177/0263775818792269.

Ruppert, Evelyn, and Stephan Scheel. 2019. "The Politics of Method: Taming the New, Making Data Official." *International Political Sociology* 13 (3): 233–252. https://doi.org/10.1093/ips/olz009.

Scheel, Stephan, Evelyn Ruppert, and Funda Ustek-Spilda. 2019. "Enacting Migration through Data Practices." *Environment and Planning D: Society and Space* 37 (4): 579–588. https://doi.org/10.1177/0263775819865791.

Scheel, Stephan, and Funda Ustek-Spilda. 2019. "The Politics of Expertise and Ignorance in the Field of Migration Management." *Environment and Planning D: Society and Space* 37 (4): 663–681. https://doi.org/10.1177/0263775819843677.

Schultz, Susanne. 2019. "Demographic Futurity: How Statistical Assumption Politics Shape Immigration Policy Rationales in Germany." *Environment and Planning D: Society and Space* 37 (4): 644–662. https://doi.org/10.1177/0263775818772580.

Sîrbu, Alina, Gennady Andrienko, Natalia Andrienko, Chiara Boldrini, Marco Conti, Fosca Giannotti, Riccardo Guidotti, et al. 2020. "Human Migration: The Big Data Perspective." *International Journal of Data Science and Analytics*, March. https://doi.org/10.1007/s41060-020-00213-5.

Spyratos, Spyridon, Michele Vespe, Fabrizio Natale, Ingmar Weber, Emilio Zagheni, and Marzia Rango. 2018. *Migration Data Using Social Media: A European Perspective*. Luxembourg: Publications Office of the European Union.

Spyratos, Spyridon, Michele Vespe, Fabrizio Natale, Ingmar Weber, Emilio Zagheni, and Marzia Rango. 2019. "Quantifying International Human Mobility Patterns Using Facebook Network Data." Edited by Itzhak Benenson. *PLOS ONE* 14 (10): e0224134. https://doi.org/10.1371/journal.pone.0224134.

State, Bogdan, Mario Rodriguez, Dirk Helbing, and Emilio Zagheni. 2014. "Migration of Professionals to the U.S. Evidence from LinkedIn Data." In *SocInfo 2014*, edited by Luca Maria Aiello and Daniel McFarland, 531–543. Lecture Notes in Computer Science 8851. Springer International Publishing.

State, Bogdan, Ingmar Weber, and Emilio Zagheni. 2013. "Studying Inter-National Mobility through IP Geolocation." In *Proceedings of the Sixth ACM International Conference on Web Search and Data Mining, WSDM 2013, February 04–08, 2013, Rome, Italy*, edited by ACM International Conference on Web Search and Data Mining. New York: ACM.

Stewart, Ian, René D. Flores, Timothy Riffe, Ingmar Weber, and Emilio Zagheni. 2019. "Rock, Rap, or Reggaeton? Assessing Mexican Immigrants' Cultural Assimilation Using Facebook Data." In *The World Wide Web Conference—WWW '19*, 3258–3264. San Francisco, CA, USA: ACM Press.

Stielike, Laura. 2017. *Entwicklung Durch Migration? Eine Postkoloniale Dispositivanalyse am Beispiel Kamerun-Deutschland*. Kultur und soziale Praxis. Bielefeld: Transcript.

Taylor, Linnet. 2016. "No Place to Hide? The Ethics and Analytics of Tracking Mobility Using Mobile Phone Data." *Environment and Planning D: Society and Space* 34 (2): 319–336. https://doi.org/10.1177/0263775815608851.

Taylor, Linnet, and Lina Dencik. 2020. "Constructing Commercial Data Ethics." *Technology and Regulation*, 1–10. https://doi.org/10.26116/TECHREG.2020.001.

Taylor, Linnet, and Fran Meissner. 2020. "A Crisis of Opportunity: Market-Making, Big Data, and the Consolidation of Migration as Risk." *Antipode* 52 (1): 270–90. https://doi.org/10.1111/anti.12583.

UN DESA. 1998. "Recommendations on Statistics of International Migration, Revision 1." https://unstats.un.org/unsd/publication/SeriesM/SeriesM_58rev1e.pdf.

UN Global Pulse, and UNHCR Innovation Service. 2017. "Social Media and Forced Displacement: Big Data Analytics & Machine-Learning." https://www.unhcr.org/innovation/wp-content/uploads/2017/09/FINAL-White-Paper.pdf.

UN Statistics Division. 2017. "Improving Migration Data in the Context of the 2030 Agenda." https://unstats.un.org/unsd/demographic-social/meetings/2017/new-york--egm-migration-data/Background%20paper.pdf.

United Nations. 2018. "Global Compact for Safe, Orderly and Regular Migration. Resolution Adopted by the General Assembly on 19 December 2018."

United Nations Expert Group Meeting. 2017. "Improving Migration Data in the Context of the 2030 Agenda. Recommendations, New York Headquarters, 20–22 June 2017." https://migrationdataportal.org/sdgs#0.

Will, Anne-Kathrin. 2019. "The German Statistical Category 'Migration Background': Historical Roots, Revisions and Shortcomings." *Ethnicities* 19 (3): 535–557. https://doi.org/10.1177/1468796819833437.

Yeung, Karen, and Martin Lodge, eds. 2019. *Algorithmic Regulation*. 1st ed. Oxford University Press. https://doi.org/10.1093/oso/9780198838494.001.0001.

Zagheni, Emilio, Venkata Rama Kiran Garimella, Ingmar Weber, and Bogdan State. 2014. "Inferring International and Internal Migration Patterns from Twitter Data." In *WWW '14 Companion: Proceedings of the 23rd International Conference on World Wide Web: April 7–11, 2014, Seoul, Korea*, edited by Chin-Wan Chung, International WWW Conference, Association for Computing Machinery, Hypermedia and Web Special Interest Group on Hypertext, and International World Wide Web Conference Committee.

Zagheni, Emilio, and Ingmar Weber. 2012. "You Are Where You E-Mail: Using E-Mail Data to Estimate International Migration Rates." In *WebSci'12: Proceedings of the 3rd Annual ACM Web Science Conference, 2012 : Evanston, IL, USA*, edited by Web Science 2012, Brian Uzzi, Michael Macy, Noshir Contractor, and ACM Digital Library.

Zagheni, Emilio, Ingmar Weber, and Krishna Gummadi. 2017. "Leveraging Facebook's Advertising Platform to Monitor Stocks of Migrants." *Population and Development Review* 43 (4): 721–34. https://doi.org/10.1111/padr.12102.