Borders, Migration, and Technology in the Age of Security: Intervening with STS

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Abstract: In recent years, a broad and multidisciplinary literature has emerged at the intersection of critical border and migration studies, critical security studies, and science and technologies studies (STS). This literature has produced a rich conceptual repertoire for the analysis of digital technologies and infrastructures of border control and mobility governance. This scenario conceptually maps some of the core strands in this debate, which portray borders as complex and multi-located arrangements that create spaces of control and circulation, notions and images of "trusted" and/or "risky" travelers, and a globalized hierarchy of mobility rights. Furthermore, the scenario reflects on some major research avenues for STS to intervene in this debate and expose how border regimes are today imagined, designed, maintained, and critiqued.

Keywords: border studies; migration studies; security studies; border multiple; data infrastructures.

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1. Introduction

Borders have long been subject to theoretical and empirical scrutiny. However, geography and political science scholars, sociologists, anthropologists, or philosophers have been unwilling to provide a satisfying answer to the question: What is a border? Balibar has offered a straightforward reason for this:

> Basically, because we cannot attribute to the border an essence which would be valid in all places and at all times, for all physical scales and time

> periods, and which would be included in the same way in all individual and collective experience. (2002, 75)

The Roman *limes* had little to do with today's sophisticated, militarized, high-tech borders that have emerged primarily in the Global North. Dijstelbloem observes that although the term "expresses delimitation and demarcation, it remains a concept with few limits" (2021, 1). The point is that borders are transforming entities in both their material and symbolic aspects: "[f]or most part of human history, the border was a peripheral thing, [… a] forgotten, far-flung place. Today, it is the center of the political world" (Longo 2017, xii).

This scenario acknowledges – much like the broad spectrum of scholarship at the intersection of critical border and migration studies – the analytical productivity of Balibar's observations that the border today seems to be *overdetermined, polysemic, heterogeneous,* and *ubiquitous* (2002, 97-85). I will not revisit these claims but summarize some dominant conceptual elements that have emerged from the contemporary analyses of (digital) border regimes and their operations and revolve around the idea of the *border multiple* and the *securitization of mobile bodies* – as outlined in the first part of this scenario. The second part reflects on three analytical angles through which STS may intervene here: enactment, infrastructure, imaginaries. This scenario thus aims to provide an orientation to scholars which, in whatever different ways, wish to postulate a more symmetrical understanding of human agency and material structure and explore borders as the socio-material entanglements of people, policies, movements, practices, technologies and artifacts.

2. Unpacking the Border Multiple

Today's borders are dislocated. Border crossing points, such as the airport in Vienna, may have very different appearances but are nonetheless intimately connected with the militarized maritime frontiers of the EU, and the seemingly unbounded, natural sea stands out as a *border zone* conditioned to kill (Heller and Pezzani 2017). Exploring borders as multiple and polymorphous can be a starting point for grasping broader political and social transformations and revealing power dynamics and mechanisms. "Borderings," a term used in plural by Saskia Sassen, "cut across traditional borders and become evident both globally and inside national territory" (2015, 23), revealing the shifts in state sovereignty and territoriality in globalization processes. Likewise, border studies have proposed exploring the heterogeneous sites, at which borders become manifest as institutions of categorization and in- or exclusion as well as in "formal, practical, and popular performances of sovereignty" (Johnson et al. 2011, 66). It has become a common denominator to perceive borders

as *multiplicities* that require a range of concepts to grasp their social, cultural, political, symbolic, and material facets and functions (Paasi 1998; Rumford 2006; Walters 2006). Rumford suggests "seeing like a border" by embarking on a multiperspectival study that takes into account "those at, on, or shaping the border" and calls for acknowledging "the constitutive nature of borders in social and political life" (2012, 897). In other words, the border can be something like an *epistemic prism* for analyzing power transformations and dynamics:

> It is above all a question of politics, about the kinds of social worlds and subjectivities produced at the border and the ways that thought and knowledge can intervene in these processes of production. (Mezzadra and Neilson 2013, 17)

2.1 The Biopolitical Turn

The specific character of borders and their modes of governance in the world have fundamentally changed over time. The multidisciplinary field of border studies grew rapidly in the early nineties after the demise of one of the most notorious border architectures in history – the iron curtain. It found its agenda in, and against, popularized ideas such as a *borderless world* and *deterritorialization*. The *Ashgate Research Companion to Border Studies* introduces the field by noting that after the fall of the Berlin Wall, "[i]n summary, borders are still ubiquitous, are manifested in diverse ways, and have various functions and roles" (Wastl-Walter 2011, 2). A variety of terms – *borderscapes*, *borderlands*, and *border regimes* – have sought to grasp the diverse and various manifestations, shifts, and roles of borders. As Hess and Kasparek argue, border studies:

> emphasize the transformation of the border from a demarcation line surrounding national territory to an ubiquitous, techno-social, deterritorialised apparatus or regime producing geographical stretched borderscapes. (2017, 57)

Such notions challenge the linear and fixed imaginations of borders, instead turning our attention to their multi-location. The idea of borderlands, for instance, points to the phenomena of whole countries or regions becoming zones of transition and no longer having territorial fixity (Balibar 2009; Rumford 2006; Squire 2011). Even more widely in use is the concept of borderscapes, which has been mobilized as an epistemic viewpoint for exploring the border's distinct spatial, temporal, and political dimensions to uncover the hidden geographies and distributions of categories of belonging (Dell'Agnese and Szary 2015; Rajaram and Grundy-Warr 2007). Borders, as Longo aptly notes, "cannot merely be 'tall,' they must also be 'wide' and 'layered'" (2017, 56).

A key component in summarizing some of these transformations of borders is the *biopolitical turn*. It articulates the "multiplicity and multiplication of biopolitical technologies" for the management of mobility and migration (Aradau and Tazzioli 2020, 201). The biopolitical term invokes, perhaps most clearly, the shift in the state's primary concern with *territory* to that of *population*. Foucault (2009) depicted this shift initially by developing his concept of security, tracing biopolitics as a form of governance back to the development of towns in the eighteenth century when the problem of regulating and surveilling populations was first encountered. The objective of governance changed from being concerned with territorial domination to the challenge of managing the influx and circulation of populations: governance became a matter of:

> organizing circulation, eliminating its dangerous elements, making a division between good and bad circulation, and maximizing the good circulation by diminishing the bad. (2009, 18)

Employed to analyze the institution of the border, these insights help to scrutinize the distinct techniques and mechanisms of borders, which aim to include and exclude an "indefinite series of mobile elements" that originate *outside* the field of surveillance: "carts, travelers, thieves, disease, tourists, migrants, criminals" (Feldman 2011, 381). While still predominantly focused on the Global North, the literature's verdict is that the principle of *biopolitics* seems to have supplemented (but not replaced) the principle of *geopolitics*: borders have operated through spatially dispersed and temporally varied tactics of control, semantics, policies, laws, and technical architectures (see Olwig et al. 2019; Schwertl 2018; van Baar 2017; Tazzioli 2020). Consequentially, Walters (2002) conceived the notion of the *biopolitical border* and acknowledged what he calls a process of biopoliticization:

> the political concerns, events, and means by which the border will become a privileged instrument in the systematic regulation of national and transnational populations – their movement, health, and security. (2002, 571)

2.2 Digital Transformations

Unsurprisingly, it has been suggested that the rise of large-scale IT systems and digital technologies has enabled, facilitated, or intensified this biopolitical turn. Borders, as Dijstelbloem observes,

> have a particular relationship with technology. […] Technologies inform – and limit – how societies are governed and can be imagined to be governed. (2021, 9)

The interdisciplinary scholarship has gone to great lengths to unpack the distinct actors, discourses, facets, and functions that carry out today's digitally mediated border controls. Databases intensify what Bonditti (2004) calls the *traceability*. The growing production, collection, and storage of data seek to capture and trace the movement and trajectories of populations, enabling a new form of *digital hyper-documentation* by which "each piece of data is linked to other data, and ultimately to a risk profile" (Salter 2006a, 47). Longo likewise observes a "renewed commitment to us[ing] and deploy[ing] technology at the border" (2017, 56) and ties the emergence and proliferation of databases targeting mobility closely to the performance of biopower. The governmental desire for traceability is thus particularly articulated by the new means of biometric identification, the digitization of asylum and visa procedures, the creation of traveler watch lists or blacklists, and other related mechanisms that track mobilities. Such practices of digital bordering illustrate the shift away from the territorial model of the sovereign border to an increasingly supranational character of mobility control.

The increase in the literature on border and migration control through digital means is also responsible for the proliferation of terms that seem to describe similar, but not identical, phenomena. Scholars have described *digital borders* (e.g., Broeders 2007; Trauttmansdorff 2017; Glouftsios 2019), *technological borders* (Dijstelbloem and Meijer 2011), and *socio-digital borders* (König 2016). Another influential term is Amoore's *biometric border* (Amoore 2006; Muller 2011), defined as the:

> portable border par excellence, carried by mobile bodies […] as it is deployed to divide bodies at international boundaries, airports, railway stations, on subways or city streets, in the office or the neighbourhood. (Amoore 2006, 338)

Amoore underscored the diffuse character of biometric control in the contemporary regimes of mobility management, in which facial images, iris scans, and fingerprints seek to establish the migrant's *embodied identity* (van der Ploeg 2000). In less specific ways, the notions of *mobile borders* (Szary and Giraut 2015) and Côté-Boucher's (2008) *diffuse border* also imply delocalized and spatially diffused characteristics of borders and their biometric reinforcement. Scholars have deployed the idea of the "virtual border" (Zureik and Salter 2006) or the related concept of "bioinformatic border security" (Vukov and Sheller 2013) that mark the shift in borders away from physical or territorial boundaries. Pötzsch's (2015) idea of *iBorder* likewise seeks to signal the exercise of informational power that digital technologies seemingly enable, as does Rygiel's (2011) politics of *e-borders*. Finally, we add the term *liquid borders* (Moraña 2021) to this growing list of signifiers, which, importantly, also acknowledges the

element of *porousness* that haunts every border, no matter how technologized and secured it appears.

It is important to note that these labels are not merely academic concepts; some have also been actively introduced or used by politicians, officials, or industrial actors who strongly promote the development of digital bordering practices. In this regard, the *smart border* stands out as a term that has shaped the discourse and practice of border and migration management policy. Smart borders have thus come under special academic scrutiny (Amoore, Marmura and Salter 2008; Leese 2016; Sontowski 2018; Sparke 2006). This euphemistic and homonymous terminology should not be seen as an accidental outcome but one that has strategically served industry actors, officials, and experts in fostering and legitimizing the underlying visions and meanings of (digital) border security. It does not necessarily mean to refute these notions or to offer a new term. Instead, we should be cautious of some of the unintended effects of many of these notions, i.e., the artificial dichotomy that is invoked between the digital and the physical, the seamless virtual and the robust material. Such dichotomies prevent us from examining the distinct ways and forms in which technologies, devices, artifacts, and the so-called virtual spaces are continuously shaped by social, cultural, economic, and political worlds and always enacted through actors, discourse, and materials. As Ruppert, Law, and Savage note, social scientists should account for the ways in which "digital devices themselves are materially implicated in the production and performance of contemporary sociality" (2013, 22). As much as the biopolitical turn shifts the analytical gaze away from the border as a demarcating line, it becomes necessary to be attuned to the multiple enactments of borders and border security which may take place prior to or after their deployment at the state's territorial boundary (Bourne, Johnson and Lisle 2015; Martin-Mazé and Perret 2021) – i.e., the spaces in which digital borders become not only imagined, designed, and assembled but also monitored, maintained, and repaired. This viewpoint proposes exploring border control and security through deliberate ethnographic fieldwork that can investigate the stickiness of lasting imaginations and narratives as well as the material practices of creating and maintaining borders. As a large body of work has devoted itself to the biopolitical character, its functions, and mechanisms of digitally mediated borders, contributions have thus started to analyze both the imaginative and infrastructural work that is carried out to design and enact digital borders.

3. Digital Border Surveillance and the Securitization of the Mobile Body

3.1 Securitization and Externalization

In the tradition of critical security studies, technologies and databases have been prominently described as being part of the intensifying process of securitizing migration – an umbrella concept that traces, in manifold ways, how mobility and immigration have come to be constructed as a problem of security, especially in the aftermath of the 9/11 terror attacks (Bigo 2002; Amoore 2006; Bello 2022; Huysmans 2000; van Munster 2009). Broadly, (digital) technology is explained here as a core driver in creating the conditions for mass surveillance and perpetuating the logic of risk in contemporary capitalist societies. It has tied border protection and migration management permanently to the question of global (in)security: security professionals, politicians, and bureaucrats envision their security policies and strategies on a global scale while embedding them deeply within the fabric of their national societies (Popescu 2011, 92). The multiplication of borders – away from the physical border, beyond and within territorial boundaries – strongly relates to checks, surveillance, and controls that occur *prior* to the traveler's arrival. This is often referred to as the *externalization* of border security, which has been extensively discussed in the face of the European Union's externalization strategies (e.g., Guiraudon and Lahav 2000; Lavenex 2006; Zaiotti 2016). Externalization is closely associated with what Zolberg once called *remote control* – the "projection of the country of destination's borders into the world at large" (2006, 223-24). For instance, analyses have examined what EU states euphemistically call the "forward-looking" visa policies which have fundamentally transformed the visa regime into a transnational model of governance through information networks (Salter 2006b; Salter and Mutlu 2013). The digitization of bordering practices has considerably refined this work of remote control (through the storage and processing of data doubles) and sought to restrict movement at a distance, subjecting mobile individuals to enrolment procedures long before they embark on their journey. Broeders and Hampshire summarize this claiming "[t]he governance of border traffic in the digital age is evolving into a multi-sited system of remote control" (2013, 1207).

Most of these contributions confirm a more general observation – namely, that border control faces the fundamental problem of guaranteeing security and enforcing control, on the one hand, and facilitating mobility and global flows on the other. This paradox articulates the general contradiction between securitization and (neo)liberal globalization (Amoore 2006), or what Popescu calls "globalization's security dilemma" (2011, 100). But scholars tend to ignore the fact that officials, policymakers, or bureaucrats can be perfectly aware of these issues. They inform

the imaginative and narrative repertoires that justify the investments in deploying digital borders and thereby reproducing technological solutionism – the belief that border security is a problem or dilemma that may be reconciled through digital technologies and growing databases. The category of the *mobile body* is an essential part of this solution – it must be captured and identified to assess its potential risk, ideally before it reaches the border, and it must be sorted accordingly so as not to disrupt the flow of legitimate traffic (Follis 2017; Suchman, Follis and Weber 2017). Contemporary processes of securitization and surveillance at the border have thus sought to proliferate and diversify *traveler categories*, which are granted different rights and ease of mobility and border crossing. The way in which we experience movement today follows the principle of what Adey (2006) aptly summarizes as *divided we move*.

3.2 Mobile Bodies: Identification, Translation, Informatization

Border (in)security has also been explored through the lens of the (surveillant) assemblage (see Allen and Vollmer 2018; Dijstelbloem and Broeders 2015; Sohn 2016; Tsianos and Kuster 2016) – described as the way in which societies are governed through the production of data doubles, which circulate through different centers of calculation with increasing speed and across networked space. In the context of EU databases, Kuster and Tsianos (2016) provide an exemplary approach in their study on the Eurodac system, mobilizing Latour's idea of *immutable mobiles* to show how migrants are forced to register their fingerprints to produce data doubles that are both immutable and hypermobile across virtual networks. In their own words, it is an attempt "to liquefy and freeze mutable, alterable, fluctuating, and varying corporealities" (2016, 59). The *human body* is especially highlighted in the conceptualization of digital bordering in terms of surveillant assemblages: the body is perceived as the primary object of biopoliticization. Popescu has noted that it is, in fact, the body itself that makes an "ideal border": "always at hand, ready to be performed whenever circumstances require" (2011, 103). Likewise, Amoore's notion of the biometric border centers on the body as the locus of the modern state's exercise of biopower: "the body itself is inscribed with, and demarcates, a continual crossing of multiple encoded borders – social, legal, gendered, racialized and so on" (2006, 337). Less evident and often neglected in this scholarship are the very complex and far-from-evident processes, policies, and practices through which the border can become inscribed onto the body. If the multi-located realm of border control is now relocated in the mobile bodies of travelers, what exactly are the arduous and costly forms of labor and resources that are required by a vast array of actors and institutions? Additionally, we find less contributions that study how these ideas, which underpin various policies and governmental strategies, are repeatedly impeded by people on the

move. There are constant frictions, failure, and resistance to the processes of convergence between the body and the border, which characterize the diverse patterns of mobility.

One might take into account, like Annalisa Pelizza (2021), the complex *procedures of translation*. Studying travelers, migrants, or refugees' encounters with borders, as Pelizza argues, requires a translational approach in order to consider the multiple and heterogeneous actors involved in bordering as a performative production of identity. Two related concepts can here discuss the central position of the body-as-border in more complex ways*: informatization of the body* and *embodied identity.* Drawing on the case of the biometric identification, Irma van der Ploeg has argued that biometric identification informatizes the body, i.e., it collects not only information *about* the body but screens the *body-as-information* (van der Ploeg 2000, 2005; Pollozek and Passoth 2019). She claims that the practices of identification do not determine preexisting identities but establish what she calls machine-readable *embodied identity*. This production of illegalized bodies has far-reaching consequences for what we understand as bodily integrity: it radically erases "the space between the person and the identifier" (van der Ploeg 2000, 301). It is the space that defines not only the distribution of power between the state (authorities) and mobile individuals but also the degree to which gendered and racialized bodily differences are enacted and potentially intensified (Kloppenburg and van der Ploeg 2020; M'charek, Schramm, and Skinner 2014). The production of identity at the border, with its inextricable connection to the human body, proves that bodies have become organized and deployed as *evidence* to recognize, categorize, classify, and manage human life itself: bodies are treated as "the origin of evidence and the target of evidence-based interventions" (Maguire, Rao, and Nils 2018, 4; see also Leese, Noori, and Scheel 2022). There is a further need to explore the developments of such regimes of evidence and how they are re-imagined and reperformed in the technopolitics of border regimes – continuing to enter the policies and practices of digital bordering.

4. Advancing STS at the Border

The conceptual strands outlined above portray borders as complex and multi-located arrangements that create spaces of control and circulation, notions and images of "trusted" and "risky" travelers, and a globalized hierarchy of mobility rights. Borders and their infrastructures have become expressions of the increasing (in)securitization and surveillance of mobility, which have targeted and digitized mobile bodies for the purposes of social categorization and sorting. I will now describe three important STS perspectives that build on and expand these insights, primarily by postulating a more symmetrical understanding of human agen-

cy and material structure as well as a situated understanding of migration and border control, which aim to expose the complex socio-material entanglements of people, policies, practices, technologies and artifacts.

4.1 Enacting Migration and (Non-)Knowledge

A perennial concern in STS is the relationship between knowledge and order. Knowledge-making practices – from designing policies and conducting experiments to collecting and visualizing data – are essential for articulating and framing order; knowledge and order reinforce each other's existence (Jasanoff 2004). In line with this principled understanding, Scheel, Ruppert, and Ustek-Spilda (2019) introduced their special issue, "Enacting Migration Through Data Practices," in which they call for studying the onto-politics of data practices – i.e., the performative and political implications of border regimes' data practices that make migration knowable and governable (see also Leese, Noori and Scheel 2022). They postulate that migration must be *enacted*:

> as a single, coherent, measurable reality that can be ordered according to certain policy objectives through data practices. (Scheel, Ruppert and Ustek-Spilda 2019, 585)

The same can be said about surveillance infrastructures – radars, drones, vessels, satellites – as they render visible (or invisible) specific forms and patterns of movement. In particular, scholars emphasize the practices and technologies of *(in)visibilization* that produce knowledge about certain people and their movements, as Tazzioli and Walters argue:

> [M]igration visibility works not only as a means of surveillance and control but more importantly as a way of producing knowledge *on* migration and migrants. (2016, 454)

However, it is also the production of ignorance and nonknowledge – from omission, mistakes, or deliberate deflection – that shape discourses and practices in the governance of mobility (Aradau and Perret 2022; Ustek-Spilda 2020). In other words, knowledge and data do not simply *represent*; "[d]ata enacts that which it represents" (Ruppert, Isin and Bigo 2017, 1), which is a *performative* process that intervenes in the politics of bordering. At the same time, the techniques of data extraction and collection at the border, and the knowledge they produce, are controversial and contested procedures – they are inherently technopolitical (see Pezzani and Heller 2019; Plájás, M'charek and van Baar 2019; van Reekum 2019).

Thus far, most studies have focused how technologies of datafication have been shaped and used by various border constellations, scrutinizing (non)knowledge production at the border. However, knowledge and representation also take place *before* the border. Recent research has been

conducted on the technoscientific/industrial sites in which (future) borders are designed, conceptually emerging from the discussions, visions, and negotiations between various actors such as technicians, engineers, scientists, corporate industry representatives, and security professionals (Baird 2018; Binder 2020; Lemberg-Pedersen 2013; Martin-Mazé and Perret 2021; Schwertl 2018; Valdivia et al. 2022). The new border databases created in the EU, for example, have emerged under conditions that were shaped by funding programs and research and development programs, stakeholder and industry conferences, or in scientific laboratories. Bourne, Johnson, and Lisle provide a meticulous account of how laboratory practices stabilize the (future) border, supported by the promises, norms, and values of a variety of actors, i.e.,

> in the mediations of scientists, end-users, materials, international standards and policies, laboratory practices, immaterial imaginations, and phantasmic figures as they circulate and combine with wider forces of political economy. (2015, 309)

This emphasis on the performative processes of (non)knowledge-making addresses an important critique of the securitization and surveillance literature, which too often have invoked a rather instrumental understanding of technologies in bordering processes. They had often been described as part of a broader rationale (of security or surveillance) that forms a somewhat somber background for political goals and public policy. The performative turn, so to say, allows to see how knowledge-making is instead subjected to the multiple interests and actors in border regimes, as well as the confusion, contestation, failures, and the (un)intended consequences of their design.

4.2 Infrastructuring Borders and Migration

One of the most intriguing STS-informed strands in the border and migration literature conceptually focuses on *infrastructuring*. Anthropologists such as Lin, Lindquist, Xiang, and Yeoh have proposed to analyze migration through the lens of infrastructure, allowing them to:

> [shift] away from the people who move […] towards those human *and* nonhuman actors that move migrants within specific infrastructural frames. (Lin et al. 2017, 169; see also Xiang and Lindquist 2014).

STS scholars likewise mobilize this concept to study how infrastructure mediates and engenders the work that:

> configure[s] actors, elements and their relations, organize[s] access, incorporate[s] political agendas, and treat[s] some issues as irrelevant. (Pollozek and Passoth 2019, 619)

This line of research recommends considering the subtle modes, techniques, or strategies for moving people as *infrastructuring* (i.e., as a verb). The conceptual shift seeks to grasp the manifold and dynamic constellations of the involved actors, practices, artifacts, technologies, but also the narratives through which people become digitized, filed, and processed – in short, it highlights the materiality of migration governance as a meticulous organization of mobility across space and time.

Infrastructures embody the entanglements that connect the digital and the physical; they shape new relationships between authorities and technology, mobility and control, and states and people. Bellanova and Glouftsios, for instance, have illustrated how EU databases "bring together hardware, software and users" and advance what they call "the flickering foundations of the Schengen Area as a controlled space" (2022a, 170). *As infrastructures*, databases serve as powerful enablers of networked control, but they are also highly fragile as their ever-growing capacity for knowledge circulation is constantly undermined by technical failures and breakdowns (Bellanova and de Goede 2022; Glouftsios 2021). Such understandings prevent us from seeing border control as enforcing the ever-present and all-seeing panoptic gaze on mobility. Digital borders are not the durable, robust artifacts and instruments they are often portrayed to be. Instead, the lens of infrastructure renders the border a provisional, incomplete patchwork (Tazzioli and Walters 2016; Dijstelbloem 2017). They require an enormous amount of harmonization and standardization – a constant concern for the actors involved in the governance of migration and part of the painstaking labor that must go into assembling, maintaining, and extending the spaces of security (Leese 2018; Walters 2011).

Infrastructures have thus significantly expanded the repertoire to problematize border and migration control. Their operations require continuous work – from the imagining and symbolically representing epistemic and material orders, to their meticulous design and the maintenance labor that goes into upholding their underlying networks (Lausberg and Pelizza 2021). It directs our attention to a variety of bordering work that is "dependent upon relatively regulated sequences of interpretation and movement" (De Goede 2018, 27; see also van Reekum 2019). Furthermore, infrastructures of border control host multiple encounters between technologies and the movements of people, who subvert, sabotage, escape, or appropriate them. For STS scholars, infrastructuring borders and migration emerges as essential but contingent practices of how mobile populations are inscribed into IT systems or converted into "legible" identities (Pelizza 2020; Van Rossem and Pelizza 2022). These processes become inevitably tied to the construction of the state or transnational institutions (Amelung et al. 2020; Dijstelbloem 2021; Pelizza 2020). The infrastructure's capacity to *process alterity*, in Pelizza's words, emerges as an integral part of institutional orders, underpinning the rationales and practices of categories of belonging and social sorting.

4.3 Imagining Future Borders, Imagining Alternative Futures

Most contributions in this line of research analytically focus on the techno-material aspects of infrastructuring. At times, this comes at the expense of the collective meanings, promises, and visions that any material infrastructure acquires and embodies to exert its power of b/ordering. The distinct imaginative capacities, the ability to craft visions of the future, the mobilization of visionary powers – in short, the collective forms of sociotechnical imagination have often been omitted from existing accounts but are key to understanding the formation of borders and their infrastructures. Borders must be imagined and represented upstream by policy experts, border guards, and other epistemic communities, e.g., at policy gatherings, roundtables, conferences or other spaces where actors meet and engage in the laborious work of envisioning, performing, and justifying digital borders and their solutionist promises. Such spaces enable us to scrutinize also how expertise and expert authority are forged and infused into policymaking processes in the border regime (Martins and Jumbert 2020; Trauttmansdorff 2022). Scholars have thus begun to unearth the collective visions and their relationships with processes of (digital) infrastructuring, i.e., how infrastructures embody specific political visions (Aradau 2010; Leese 2022) or what anxieties and fears inform their design and formatting (Bellanova and Glouftsios 2022b).

STS-informed works may further explore the collectively imagined *futures* that guide individuals and societies in organizing their regimes of border security and migration control. Futures drive social groups and communities toward specific designs and applications of technologies, the definition and production of calculable risks, discourses of fear and threat, protection and exclusion. Industry roundtables, policy meetings, and international security conferences are examples of the powerful tools of political communication and imagination by state authorities. They create the epistemological conditions in which the local and complex realities of migration can be largely ignored, instead focusing on what is framed as techno-scientifically achievable in the future. The future acts here as an "epistemic orientation" and a "moral imperative, a will to anticipate" (Adams, Murphy and Clarke 2009, 254) – directing and shaping knowledges toward speculative forecast and prediction, mobilizing the present as a space of opportunity. Futures are thus seldomly couched only in progressivist terms but routinely invoked with ideas of "crisis" and "emergency." They naturalize and affirm the challenges to social/political order while calling for technological fix. Such framings appear frequently alongside technoscientific futures and, as in the case of the EU, have also repeatedly justified the continuous buildup and implementation of large-scale IT systems for border control (Trauttmansdorff and Felt 2021; Jeandesboz and Pallister-Wilkins 2016; Stierl et al. 2016).

Focusing on the imaginability of future borders thus perceives transformations in border and migration control regimes as always changing and prospective processes. It inevitably reflects on the technopolitical orders of societies and their boundary-making practices. But it also raises the question about alternative futures and alternative migration infrastructures (see Mora-Gámez 2020) that seek to counter the inequalities and violence of contemporary borders. Scholars have repeatedly critiqued some of the prevalent imaginations and justifications of "smart" and "deep" borders (Amoore 2021) – technoscientific visions that propagate the seamless inclusion of travelers in the profitable circuits of mobility but rely on the arbitrary detainment and brutal banishment of human beings. They have also critiqued the political imperative to expand IT systems and the fervent solutionist belief in the unfettered power of data, on which today's mobilities hierarchies and inequalities rest upon. It remains an open task however to reimagine and design futures that not only reject the violent responses to the realities of migration, but also to nurture a politics of responsibility and rights – a politics that involves actors in genuine deliberation about how to create accountability for the injustices and violence that occur at today's borders and works towards a genuine form of mobility justice.

5. Conclusions

The scenario has offered a specific reading of some important conceptual threads in the analyses of (digital) border regimes, departing from the observation about the border multiple. Its aim was to carve out the complementarity of critical border and migration studies and STS but also to suggest some possible analytical vantage points that can be further leveraged, i.e., by investigating how border/migration knowledges are enacted, conceptualizing borders as infrastructure(s), or exploring imaginaries of (future) border and migration control. All these perspectives understand borders as formed in complex and laborious ways; as repeatedly crossed and resisted against; as complex, sociotechnical patchworks of different forms of movements, technologies, desires, and practices. STS-informed studies therefore treat borders as processes of assemblage and translation. Such conceptualizations will always question and transgress what state officials, policymakers, or private companies in border regimes represent as stable, clear-cut, seamless, or fixed entities. STS perspectives can contribute not only to depict borders as fuzzy, fluid, and ambiguous but also challenge what borders must delimit and demarcate as institutionalized within regimes of control and power: the idea of stable referents such as the nation-state, a single geography, a homogenous people, or collective security.

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