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Designs of borders: Security, critique, and the machines[†]

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Abstract

Over the past 15 years, the European Commission has poured millions of euros into Research and Development in border security. This article looks at the devices that are funded under this scheme. To this end, it applies Multiple Correspondence Analysis to a database of 41 projects funded under 7th Framework Programme. This method of data visualisation unearths the deep patterns of opposition that run across the sociotechnical universe where European borders are designed and created. We identify three rationalities of power at play: territorial surveillance aimed at detecting rare events in remote areas, policing of dense human flows by sorting out the benign from the dangerous, and finally global dataveillance of cargo on the move. Instead of trends towards either the hardening of borders or their virtualisation, we, therefore, find multiple rationalities of power simultaneously redefining the modalities of control at EU borders. A second finding shows where precisely critical actors are located in this sociotechnical universe and indicates that the structure of European R&D in border security keeps irregularised migrants off their radars. This finding calls for more caution as to the possibility to effectively put critique to work within the context of EU R&D.

Introduction

Faced with the conundrum of reconciling Brexit and the Friday agreement, Theresa May suggested in February 2019 that 'technology could play a part … for the particular circumstances of Northern Ireland'.[1] With those words, the prime minister endowed technologies with the 'myth of infallibility' that undergirds most politicians' beliefs when it comes to border security.[2] In this article, we look into these devices as they are imagined, designed, and tested. We centre on the rationalities of power that they are locked into even before they reach their market, that is, the professionals of security. Our empirical angle brings into focus practices of Research and Development (R&D) whereby small businesses, large industrial consortia, Science and Technology departments (STS), applied research centres, and other actors fashion distinct understandings of border security. The funding of R&D distributes material and symbolic assets to engineers and managers of the private industries, who get a say into what border security is, and is not.

As a matter of fact, EU research policy is one of the social universes where the logics of the European field of security have recently made headway.[3] In the early 2000s, civil servants from

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[†]The online version of this article has been updated since original publication. A notice detailing the change has been published at https://doi.org/10.1017/eis.2022.5.

[1]Theresa May, 'Theresa May makes Brexit speech in Northern Ireland', *Guardian News* (5 February 2019), available at: {https://www.youtube.com/watch?v=4n4CtAKqbhU} (19'54).

[2]Pierre Piazza, 'La biométrie: usages policiers et fantasmes technologiques', in Laurent Muchielli (ed.), *La Frénésie Sécuritaire. Retour à l'ordre et Nouveau Contrôle Social* (Paris, La Découverte, 2008).

[3]Didier Bigo, Julien Jeandesboz, Médéric Martin-Mazé, and Francesco Ragazzi, *Review of Security Measures in the 7th Research Framework Programme FP7 2007–2013,* Study No. PE 509.979 (Brussels: European Parliament – Committee on Civil Liberties,

DG Enterprise set up a high-level public-private dialogue on the security industry, which hammered out a depoliticised understanding of security. Security was presented as a neutral technique that would provide easy answers to complicated questions.[4] Such a definition concealed the political role that technologies play, especially as they interact with humans and take on agency of their own.[5] This approach nonetheless provided the backbone of the 7th Framework Research Programme (FP7), which funded 41 projects dedicated to border security between 2007 and 2013. This R&D programme epitomised 'the emergence of the civil security market as a priority in EU policymaking'.[6] Yet, we know little of the kind of border security that emerged from its many designs.

The available literature offers an alternative set of arguments when it comes to the interplay between border security and technological devices.[7] Some argue that the territorial line remains the key driver of the current hardening of borders around the globe.[8] Others insist that processes of dematerialisation are currently underway, which radically redistribute controls away from the borders.[9] This dichotomy, we argue, is largely a false alternative. As will become clear below, both arguments have equal merit in the case of the FP7. Both logics of territorialisation and deterritorialisation undergird this scheme. Crucially, however, these logics are supported by different actors, who enter into relations through different projects and design different devices. Divergent transformations unfold at the same time. We therefore need to investigate the heterogenous process at play here. Such heterogeneity begs a different set of questions than an either/or alternative. We need to ask which actors contribute to assembling which rationality of border control through which devices. More specifically, we want to find out which projects integrate the critical analysis that social scientists and activists voice regarding the 'effects of innovations and commercialization' of border devices?[10] Finally, we are keen on gauging the possibility of 'critique' through 'companionship' in EU-funded security R&D?[11]

Answering those questions requires a significant expansion of the theoretical and methodological perspectives that inform Security Studies.[12] That is why we resort to a method of data

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2014); Didier Bigo and Julien Jeandesboz, *Review of Security Measures in the 6th Research Framework Programme and the Preparatory Action for Security Research*, Briefing Note No. PE 393.289 (Brussels: European Parliament – Committee on Civil Liberties, 2008); Julien Jeandesboz and Francesco Ragazzi, *Review of Security Measures in the Research Framework Programme*, Study No. PE 432.740 (Brussels: European Parliament – Committee on Civil Liberties, 2010).

[4]Médéric Martin-Mazé, 'The power elite of security research in Europe: From competitiveness and external stability to dataveillance and societal security', *International Journal of Migration and Border Studies*, 6:1/2 (2020), pp. 52–73.

[5]Marijn Hoijtink and Matthias Leese, *Technology and Agency in International Relations* (London: Routledge, 2019).

[6]Marijn Hoijtink, 'Capitalizing on emergence: The "new" civil security market in Europe', *Security Dialogue*, 45:5 (2014), p. 458.

[7]See also Anthony Amicelle, Claudia Aradau, and Julien Jeandesboz, 'Questioning security devices: Performativity, resistance, politics', *Security Dialogue*, 46:4 (2015), pp. 293–306; Mike Bourne, Heather L. Johnson, and Debbie Lisle, 'Laboratizing the border: The production, translation and anticipation of security technologies', *Security Dialogue*, 46:4 (2015), pp. 307–25.

[8]See, for instance, Stéphane Rosière and Reece Jones, 'Teichopolitics: Re-considering globalisation through the role of walls and fences', *Geopolitics*, 17:1 (2012), pp. 217–34; or Wendy Brown, *Walled States, Waning Sovereignty* (2nd edn, New York: MIT Press, 2017).

[9]Philippe Bonditti, 'From territorial space to networks: A Foucaldian approach to the implementation of biometry', *Alternatives: Global, Local, Political*, 29 (2004), pp. 465–82; Didier Bigo, 'Freedom and speed in enlarged borderzones', in Vicky Squire (ed.), *The Contested Politics of Mobility* (New York: Routledge, 2011), pp. 31–50; Andrea Rea, 'The network-border: The articulation of mobility and immobilisation', in Laure-Anne Bernes, Hassan Bousetta, and Caroline Zickgraf (eds), *Migration in the Western Mediterranean: Space, Mobility and Borders* (London: Rouledge, 2017), pp. 32–51.

[10]Ibid., p. 472.

[11]John L. Austin, Rocco Bellanova, and Mareile Kaufmann, 'Doing and mediating critique: An invitation to practice companionship', *Security Dialogue*, 50:1 (2019), pp. 3–19; Matthias Leese, Kristoffer Lidén, and Blagovesta Nikolova, 'Putting critique to work: Ethics in EU security research', *Security Dialogue*, 50:1 (2018), pp. 59–76.

[12]Claudia Aradau, Marijn Hoijtink, and Matthias Leese, 'Technology, agency, critique: An interview with Claudia Aradau', in Marijn Hoijtink and Matthias Leese (eds), *Technology and Agency in International Relations* (London: Routledge, 2019), p. 192.

visualisation called Multiple Correspondence Analysis (MCA). Popularised by Pierre Bourdieu from the mid-1970s on, this method is considered standard practice in social sciences, even though it is seldom used in Security Studies.[13] MCA brings out the structures of a statistical population described by a large set of qualitative variables.[14] In our case, we designed 56 variables in order to characterise 41 projects of border security funded under the FP7 programme. Our endgame is to better understand the type of border security that emerges from the relations between actors, devices, and rationalities unfolding across those projects.

Our argument falls in six parts. The first section engages the connection between practices and devices in the context of border security. It highlights the heuristic purchase that a transversal perspective on European R&D in border security can yield. The second section presents our method of data visualisation. MCA processes a multiplicity of relations: the actors involved in EU border security research, the laboratories where devices are designed so as to connect to security practices, and the rationalities of power that are embedded in those devices. After laying out our dataset in section 3, we move on to analysing our findings. Section 4 visualises an emerging social structure where two cleavages are at play. Firstly, territorial control of space is opposed to differential control of flows. Secondly, facilitation of non-human flows contrasts with surveillance and control of human movement. In section 5, we move on from rationalities of power to the actors who are involved in designing devices. This move enables us, in our sixth and last section, to locate social scientists and activists in this sociotechnical universe. In the concluding remarks, we bring those results to bear on the current post-critical enthusiasm about the possibility of critique in security research programmes subsidised by the EU Commission.

Practices, devices, and rationalities of border security

This section engages with recent scholarship on practices and devices of security. It delineates the theoretical quadrilateral wherein our argument is nested. The first vertex corresponds to Didier Bigo's inquiry into the three universes of border control in Europe. The second vertex coincides with Mike Bourne, Heather L. Johnson, and Debbie Lisle's investigation into one security laboratory. The third one matches Theodore Baird's rendering of border industry in Europe. The fourth and last one symbolises the post-critical appraisal of the possibility of critique in EU security R&D.

Bigo identifies three universes that shape control practices at the external border of the EU.[15] The first one pertains to the universe of the military. Those actors operate within a territorial rationality of power, whereby 'the metaphor of solid walls is epitomized by an electronic system of surveillance (EUROSUR) and its local translation traces an imaginary line dividing the Mediterranean Sea between North and South'.[16] The second universe is populated by policemen who manage flows of people. They set up a series of filters in order to sort out licit life and things, from illicit ones. The rationality of a liquid running through a system of locks contrasts with that

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[13]See also Pierre Bourdieu, *La Distinction: Critique sociale du jugement* (Paris: Éditions de Minuit, 1979). For a historical perspective of MCA in Social Sciences, see Philippe Bonnet, 'Pour une histoire sociale de l'analyse des données', in Frédéric Lebaron and Brigitte Le Roux (eds), *La Méthodologie de Pierre Bourdieu en action: Espace culturel, espace social et analyse des données* (Paris, Dunod, 2015), pp. 21–42.

[14]Brigitte Le Roux and Henry Rouanet, *Multiple Correspondence Analysis* (Los Angeles, SAGE, 2010); Frédéric Lebaron, 'How Bourdieu quantified Bourdieu: The geometric modelling of data', in K. Robson and C. Sanders (eds), *Quantifying Theory: Pierre Bourdieu* (Dordrecht, Springer, 2009), pp. 11–29; Frédéric Lebaron, 'L'analyse géométrique des données dans un programme de recherche sociologique: Le cas de la sociologie de Pierre Bourdieu', *La revue Modulad*, 42 (2010), pp. 102–09.

[15]Didier Bigo, 'The (in)securitization practices of the three universes of EU border control: Military/Navy – border guards/police – database analysts', *Security Dialogue*, 45:3 (2014), p. 210.

[16]Ibid., p. 212.

of the solid line, even when this line cuts through maritime space.[17] Finally, Bigo delineates a third universe featuring a deterritorialised rationality of power where borders are neither solid nor liquid: they exist in a gaseous state. IT specialists set up and maintain a digital environment where the circulation of data outpaces that of the bodies and things to which they relate.[18] When bodies and things cross a port of entry, they are translated into a set of data to which inductive techniques of profiling can apply with a view to thwart abnormal or undesirable events even before they happen.[19]

Bigo's analysis delivers rich heuristic pay-offs insofar as it foregrounds the multiple rationalities of power wherein borders are located. It falls short, however, of investigating the 'political economy of security' whereby devices are put in production.[20] Bigo's focus lies with the dispositions of policemen, officers, and IT specialists. Those combine to the agency of security devices in yielding distinct bordering effects. If, however, 'security devices are the non-linear result of struggles, controversies and translations between various actors, heterogeneous conceptions, and myriad interests, goals and values',[21] then the conceptions, interests and values of actors who design those devices matter as well as those who operate them. The focus of the investigation must therefore shift from the fields of consumption to the fields of production of those bordering devices.

Bourne, Johnson, and Lisle's article helps move the argument in this direction.[22] They bring a single FP7 project under close ethnographic examination: HANDHOLD. HANDHOLD aims to fashion a portable, multi-sensor device, easily deployable at the border. The authors investigate the laboratory where engineers, managers and scientists imagine how the border will operate through the mutual enrolment of devices and end users. HANDHOLD is thus designed to enable border guards to rapidly detect and stop the transnational flows of dangerous things, ranging from soft drugs to radioactive material. This device fits neatly in the liquid rationality identified by Bigo.

This laboratory study provides a first element of answer to our overall question about the relations between devices, practices, and rationalities of the border. But it only focuses on one project out of the dozens that the EU Commission has funded over the past 15 years. As a consequence, the conclusions seem difficult to generalise. The liquid rationality has indeed boarded this one device, but what about the others? In the authors' words, what other 'assumptions and imaginations about bordering practice' become black-boxed in devices designed in the laboratories of the forty remaining projects?[23] Are border guards and sniffer dogs the only 'phantom end users' who are 'powerful in shaping the actual form, design and components of the device itself'?[24] Are there other phantoms, in other labs, shaping other devices? To start answering these questions, one needs to move on from the in-depth but narrow view provided by laboratory studies to a broader perspective that encompasses multiple projects at the same time and, crucially, pays attention to their distinctive properties.

[17]Ibid., pp. 214–16; Btihaj Ajana, 'Biometric citizenship', *Citizenship Studies*, 16:7 (2012), pp. 851–70; Matthias Leese, 'Blurring the dimensions of privacy? Law enforcement and trusted traveler programs', *Computer Law & Security Review*, 29 (2013), pp. 480–90.

[18]Didier Bigo, 'The transnational field of computerised exchange of information in police matters and its European guilds', in Mikael Rask Madsen and Niilo Kauppi (eds), *Transnational Power Elites: The New Professionals of Governance, Law and Security* (London: Routledge, 2013); Didier Bigo, 'International political sociology: Internal security as transnational power', in Raphael Bossong and Mark Rhinard (eds), *Theorizing Internal Security in the European Union* (Oxford: Oxford University Press, 2016).

[19]Bigo, 'The (in)securitization practices of the three universes of EU border control', pp. 217–20; See also Matthias Leese, 'The new profiling: Algorithms, black boxes, and the failure of anti-discriminatory safeguards in the European Union', *Security Dialogue*, 45:5 (2014), pp. 494–511.

[20]Amicelle, Aradau, and Jeandesboz, 'Questioning security devices', p. 300.

[21]Ibid., p. 297.

[22]Bourne, Johnson, and Lisle, 'Laboratizing the border'.

[23]Ibid., p. 309.

[24]Ibid., p. 320.

At first glance, such a vantage point is what Baird achieves by bringing the 'relational structure' of the border security industry into focus. Baird conceptualises the border industry as a set of 'dynamic relations among diverse actors'.[25] His investigation proceeds on two empirical levels. His analysis of patterns of co-participation in FP7 projects shows that private firms and applied research organisations are 'the most central actors of the network', whereas academia and government play a secondary role.[26] On the other hand, he highlights the rationality of power that surfaces from 'actor-event network' and 'actor-discourse network'.[27] In this regard, 'private firms, state actors, and EU agencies' share a common priority on surveillance and control, rather than rights and free movement.

Baird takes us some way into the broader landscape of bordering devices that the security industry puts together. His methodology, however, falls somewhat short of a genuine relational approach. Network analysis processes social contacts that actually occurred, such as co-participation in conference panels of FP7 projects. But, even if interactions may sometimes actualise structural relations, the later remain irreducible to the former. In other words, even in the absence of direct contacts, structures bear on practices.[28] By focusing on co-participation at fairs and conferences, Baird loses tracks on the properties of actors, their dispositions and trajectories, their outlook and professional training. This appears detrimental because, as Claudia Aradau, Anthony Amicelle, and Julien Jeandesboz argue, security practices occur at the intersection between actors' social dispositions, the sociotechnical characteristics of devices and the broader social context where both are embedded.[29]

Thus, while retaining Baird's broader outlook, it is necessary to 'think about the production of technologies in relation to the use of technologies'.[30] This is all the more challenging that multiple actors are involved in these projects, including social scientists and NGO activists. In this regard, exponents of the postcritical turn argue that EU security R&D is a fertile terrain for critique. The role that social scientists play either as ethical advisers or as direct participants enables them to put critique to work.[31] We would certainly agree that these actors are sometimes able to graft their outlook onto some projects' explicit objectives. For this critical hijacking to happen, however, the very involvement of critically minded actors, be they academics, activists or others, represents an insufficient but necessary condition. The key question, therefore, deals with the participation of critical actors in R&D projects. How does the structure of participations in R&D projects shape the scope of critique? Do critical actors participate in some projects and not others? In this sense, what are the conditions of possibility of *doing* and *mediating* critique within the broader sociotechnical universe of EU border security?

Thus, to unpack the relations between practices and devices that undergird EU R&D in border security, one needs to cater to the multiple rationalities of power at play when multiple actors design the devices that will eventually materialise EU borders. Such a perspective is needed to embrace the wider social space where border laboratories are located. Indeed, what happens within those laboratories owes, for a great part, to the positional properties that attach to their relative position and to one another.[32] To understand this positional complexity, we visualise

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[25]Theodore Baird, 'Who speaks for the European border security industry? A network analysis', *European Security*, 26:1 (2017), p. 39.

[26]Theodore Baird, 'Surveillance design communities in Europe: A network analysis', *Surveillance & Society*, 14 (2016), pp. 43–4.

[27]Baird, 'Who speaks for the European border security industry?'.

[28]Pierre Bourdieu, *Sur l'Etat: cours au collège de France, 1989–1992* (Paris: Seuil, Raison d'Agir, 2011), pp. 178–80.

[29]Amicelle, Aradau, and Jeandesboz, 'Questioning security devices', p. 302.

[30]Aradau, Hoijtink, and Matthias Leese 'Technology, agency, critique', p. 201.

[31]Austin, Bellanova, and Kaufmann, 'Doing and mediating critique'; Leese, Lidén, and Nikolova, 'Putting critique to work'; Sam Weiss Evans, Matthias Leese, and Dagmar Rychnovská, 'Science, technology, security: Towards critical collaboration', *Social Studies of Science* (2020).

[32]Pierre Bourdieu, *Science de la science et réflexivité: cours du collège de France, 2000–2001* (Paris: Seuil, Raison d'Agir, 2001), pp. 67–8.

data pertaining to 41 R&D projects in border security funded by the EU between 2007 and 2013. The next section explains the principles that are involved in our method of data visualisation, that is, Multiple Correspondence Analysis (MCA).

Visualising a socio-bureaucratic texture of R&D projects

MCA belongs to Geometric Data Analysis and applies to qualitative data. This method of data visualisation enables the inductive exploration of large sets of complex data by the means of their visual representation. In other words, it synthesises large amounts of information that the human brain is ill-equipped to process on its own. MCA identifies the variables that capture with the utmost accuracy the specificity of each individual. It then combines those important variables into meta-variables. MCA yields a specific indicator, called 'contribution' that measures how variables weigh on the construction of those meta-variables.

Meta-variables may be represented as axes of bidimensional planes, where statistical individuals (be they 'biological' individuals, institutions or, in our case, projects) are represented by points. That is why meta-variables are also called 'dimensions' or 'axes'. The sampled population is therefore visualised under the shape of a cloud of points in a bidimensional plane. It is worth stressing that this cloud of points is but a bidimensional approximation of the multidimensional cloud of points to which the statistical population would correspond if it were described by every variables of the matrix, as opposed to only the metavariables yielded by the MCA. In such an abstract cloud, there would be as many dimensions as there are variables in the matrix.

In this regard, MCA proceeds quite similarly to painters or photographs when they reduce a three-dimensional reality to a two-dimensional one – except that in the case of MCA, there are often dozens of variables in the statistical matrix and, therefore, dozens of dimensions in the abstract cloud. To borrow a metaphor from Julien Duval, none of us would spontaneously represent a camel with a front view. In such a perspective, one would barely distinguish the camel from a horse. The front view would not translate the defining feature of the camel. That is why we often go for the side view. This perspective captures the distinctive characteristics of the animal, most importantly the two humps on its back. What MCA does is simply to identify the bidimensional view that renders best the defining properties of the population under study.[33]

In this bidimensional representation, individuals that have similar characteristics with regards to the most important variables are close to one another. Conversely, dissimilar individuals are represented by points that are further away from one another. In a nutshell, similarity translates into closeness, and dissimilarity into remoteness. By extension, individuals that are located near the origin of the graph display modal properties, whereas those near the extremities have rare characteristics. Both the dimensions and the distribution of individuals in the bi-dimensional plane provide powerful props for the analysis of social spaces.[34] Dimensions give insight into the structures of opposition that underpin the social setting under examination. Distribution provides information as to which projects share the same properties, and which differ.

Thus, MCA is well designed to answer our questions about which rationality boards which devices. It caters well to the multiplicity of actors, rationalities, and devices at play and offers the possibility to map their distribution accurately. Most importantly, and contrary to interaction-based mapping such as network analysis, it focuses not on direct contacts but on the properties of the population under study.

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[33]Julien Duval, 'Multiple correspondence analysis', *Politika*, available at: {https://www.politika.io/en/notice/multiple-correspondence-analysis} accessed 3 September 2020).

[34]Pierre Bourdieu, *Questions de sociologie* (Paris: Les Editions de Minuit, 1984), p. 113.

In this regard, we looked at the 41 projects in border security that the European Commission has funded between 2007 and 2013. Firstly, we studied websites, promotional material, final reports, and results in briefs to collect information about actors, devices, and funding. In rare cases where those were unavailable, we resorted to short summaries of proposed action, fully aware of the gap between those descriptions and what projects eventually implement. Such gaps explain why we focused on FP7 rather than the most recent H2020. Indeed, projects funded under this subsequent scheme were still ongoing at the time of data generation.

Secondly, we defined 56 qualitative variables, containing a set of categories that are designed to describe each project. Simply put, variables are the questions that we want to ask to the projects, and categories are the answers. The dataset evolved continuously during the extraction of information, so as to build categories and variables that are as reliable and robust as possible. As we added material, we increased and specified further variables and categories – that is, we added columns to the matrix, and possible answers to each column. Furthermore, in order to ensure consistency across the coding, we systematically backtracked and inspected variables horizontally – that is, we made sure that similar empirical asperities received the same code along the lines of the matrix.

Figures 1 and 2 feature the distribution of the 41 projects in the bi-dimensional plane yielded by the MCA. At first glance, one locates four different clusters. The bottom-right quadrant contains a highly concentrated group, including the project HANDHOLD that Bourne et al. studied. This cluster stands in opposition alongside the axis 1[35] to the cluster located in the bottom-left dial, where one finds for instance the project AMASS. AMASS stands for Autonomous Maritime Surveillance System. It tests a network of automated detection buoys in wide maritime areas. Although the rationale changed along the way to include the goal of rescuing people in distress, the project was, at the beginning, aimed solely at intercepting embarkations of migrants before they reach European waters.

Around the origin of the graph, one finds a third cluster whose lowest project is TASS. TASS corresponds to Total Airport Security System. It aims to integrate different surveillance devices into one single solution that would centralise the management of passenger flows in an airport. TASS is opposed alongside the axis 2[36] to the project CASSANDRA and to the fourth cluster whose highest point the later represents. CASSANDRA stands for Common Assessment and Analysis of Risk in Global Supply Chains. In order to combine efficiency and security in the logistics of containers, it increases supply chain visibility, again by integrating pre-existing devices into one single solution.

Against this charcoal-painted background, we aim to know more not only about the bordering rationalities that are embedded in those projects and in the devices that they design, but also about the logic of oppositions according to which they are located along the two axes of the plane. Before we interpret the axes and the shape of the cloud, we need to explain how the variables (questions) and categories (answers) of our coding matrix were designed.

A dataset of projects on border security

This section lays out our dataset. It is designed to connect two explorations: that of the bordering devices that the European Commission fosters through the 41 FP7 projects, and that of the actors who participate in the R&D projects. Therefore, our coding matrix contains two classes of variables: one describes the type of border security that informs each project and the other one

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[35]Axis 1 captures 14.3 per cent of the total variance of the population.
[36]Axis 2 captures 11.1 per cent of the total variance.
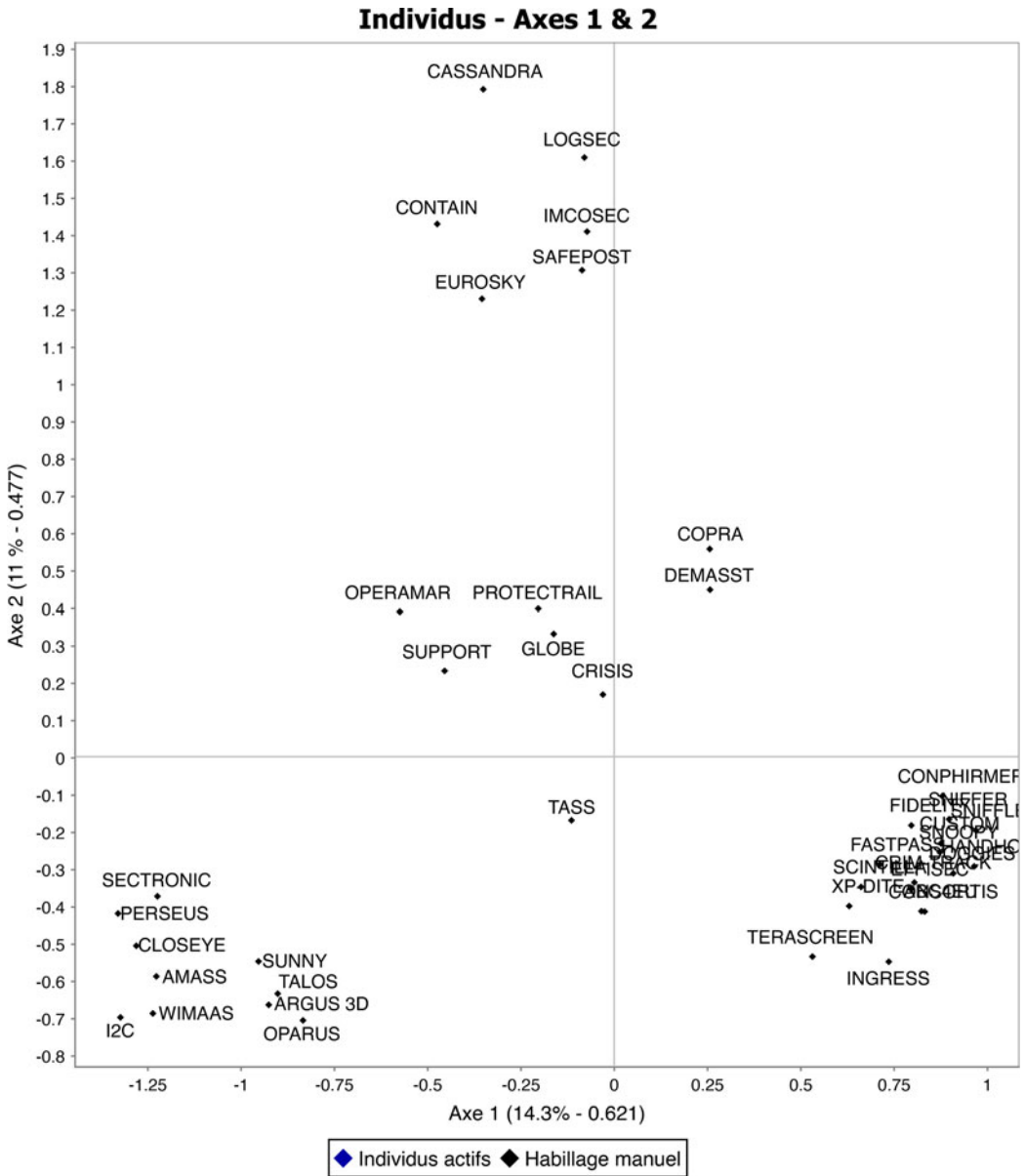
Individus - Axes 1 & 2

Figure 1. Distribution of the 41 projects.[37]

pertains to the actors who participate in the projects.[38] In this section, we focus on the first class of variables, which contains four different rubrics.

The first rubric focuses on projects' **logical frame**. It sketches how each project problematises border security. The first variable corresponds to the general objective that projects pursue. They can *aim* to 'accelerate licit humans', 'detect illicit humans', 'non-humans' or both, 'facilitate trade',
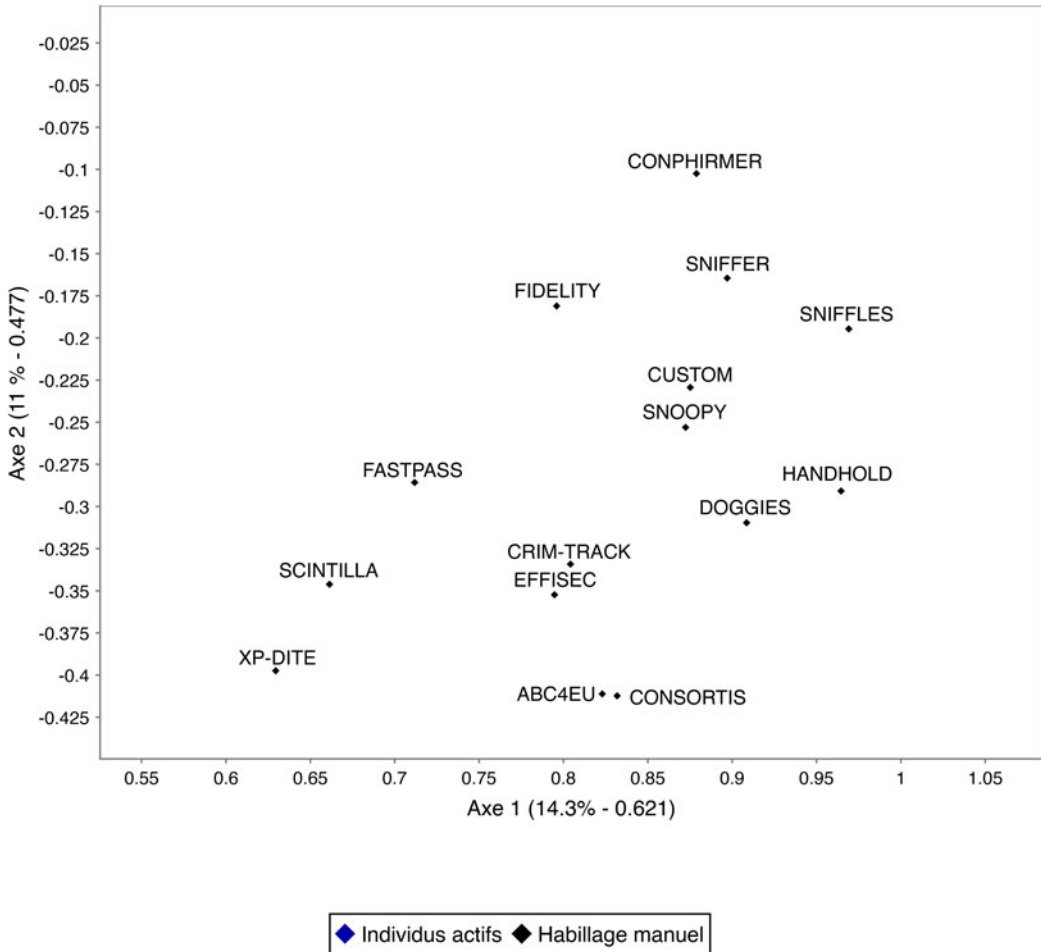
Individus - Axes 1 & 2

Figure 2. Zoom on the bottom-right dial.

'secure transports' infrastructures, 'detect vehicles' and, finally, 'intercept' them. Then comes the variable *means*, which advances a systemic analysis of how projects achieve those objectives. Projects may operate for instance via authentication between the microchip and biometric data, or by putting together portable sensors. The variable *policy* highlights projects' broader context in EU policies. The modality 'CUSTOMS+' aggregates initiatives connected to the e-management of trade, the World Customs Organizations and DG TAXUD. 'FONTEX+' describes policies of external border control that are linked to the agency, the external border fund and systems border surveillance such as EUROSUR, MARSUR, and CISE.

Finally, 'E-BORDERS+' contains policies linked to the constitution of large databases such as the Smart Border package, the Enter/Exit System, the Registered Traveller Programme, the agency EU-LISA, the Visa Information System, the Schengen Information System, and the Passenger Name Record. Finally, the variable *output*, classifies the results of each project which are for instance devices such as 'prototypes' or simple 'recommendations'.

The next rubric depicts the **bordering** rationality of power that both projects and their devices operate. The variable *target* describes that which devices are supposed to apply to. They may sort

out bodies and their data-doubles,[39] bodies, and their personal 'belongings', look for 'vehicles', 'planes', 'small boats', 'cargo' in general, 'bodies' in general, or even data *tout court*. This variable overlaps with the one describing the *milieu* wherein the device is supposed to be inserted. The *type* of border refers to where technologies are to be deployed: 'blue', 'green', and 'air border', or border crossing points ('BCP'). We indicate 'immaterial border' whenever control does not happen at the geographical border, but before or after it.

We furthermore observed that each device behaves differently in relation to space. We have constructed four categories of *spatialisation* to highlight those differences, namely 'point', 'network', 'zone', and 'global'. This variable shows that 'borders' are not necessarily physical. It echoes David Newmann's remarks when he calls 'traditionalists' those 'border scholars' who understand 'borders' as 'physical lines of separation between the States and countries of the international system'.[40] In this perspective, it is worth stressing that few devices work so as to straightforwardly establish lines of control. Those that come closest to this spatialisation actually work as zonal technologies rather than purely linear ones. These four variables show that the geometric figure of the line is conspicuously absent from this coding, while this imaginary remains often associated with borders. It therefore seems hard to imagine how EU R&D in border security would have laid the groundwork for the reintroduction of physical borders after the so-called 'Migration Crisis'.[41]

The third rubric of variables is designed to explore the type of **control** that is assembled. The variable 'threats' registers the discourses of insecuritisation that are encapsulated under the heading 'context' of final reports. In this case, our categories aggregate different types of threats. For instance, the category 'crime' aggregates cross-border, organised and serious crimes, as well as money laundering and cargo theft. The category 'crime+' corresponds to discourses where crime is linked to other threats. It should be noted that our coding accentuates rare threats. For instance, we code a material under 'crime+' where crime and immigration both appear because immigration appears more often. This choice allows us to capture slight discursive differences in terms of threat construction.

The next variable corresponds to *rationalities of control*. 'Differential control of flows' applies whenever a device accelerates licit flows while simultaneously decelerating illicit ones. 'Territorial control of space' describes devices that aim to expand surveillance capacities over a portion of geographical domain so as to authorise or deny access. 'Area of security' combines those two rationalities and intensifies them at a specific location, such as harbour or airports. The next rubric of variables typifies the *modality of control* and warrants further inspection into how devices relate to data. This is what the variable *datafication* provides for in distributing projects in categories such as 'digital translocal' whenever data is extracted locally to be processed elsewhere, 'database' whenever a local device connects to a large database (VIS, SIS, etc.), or 'interoperable systems' whenever two different data systems connect to one another. The type of control incorporated in those devices rarely if ever operates without human intervention. It enrols, in specific ways, human operators for whom they work – or conversely.

Our last rubric deciphers these human/non-human relations. Firstly, humans are often made to see things that would otherwise remain unseen. We therefore built a variable *visualisation* with four categories: 'none', 'scan&vids' when simple feeds are provided to human operators, 'situational picture' when visualisation yields actionable maps, and finally 'data-visualisation' in general. This variable echoes the work of many scholars who show how bordering devices, and the

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[39]According to Linnet Taylor Linnet and Fran Meissner, 'data-doubles' are turning the 'complex' humans' identities into a simple standardised identity and 'not possible to reverse-engineer or change it'. In Taylor and Meissner, 'A crisis of opportunity: Market-making, big data, and the consolidation of migration as risk', *Antipode*, 52:1 (2019), p. 282.

[40]David Newmann, 'Borders and bordering: Towards an interdisciplinary dialogue', *European Journal of Social Theory*, 9:2 (2006), p. 172.

[41]Georg Löfflmann and Nick Vaughan-Williams, 'Vernacular imaginaries of European border security among citizens: From walls to information management', *European Journal of International Security*, 3 (2018), p. 388.

wider sociotechnical networks to which they connect, are geared towards visualising flows, space, or events.[42] Thus, this variable participates in shifting the debate away from a previous understanding of the relations between visibility and border politics that stressed its spectacular character.[43]

All of these automate the detection of anomalies in one way or another[44] – yet another variable in our coding matrix called *detection*. Once anomalies are detected, some interventions are required from decision-making operators. The variable *decision* plots the kind of support that devices provide to them. The category 'go/no-go' refers to a binary green/red light system. Some devices are more complex and draw the attention of the operator to an abnormal situation by triggering early 'warnings'. Others provide Key Performance Indicators ('KPI') as a way to keep tabs on unfolding situations. Others still go even further and suggest a series of 'countermeasures' to the human operators.

Last but not least, some project exhibits mild attempts at balancing control with what might be regarded as more human considerations. We captured these attempts under the variable *ethics*. Some mention the upholding of human rights, others the protection of privacy, others still the necessary acceptability of technologies of control. Some even combine concerns about privacy and acceptability. Finally, in some cases, projects limit themselves to not inflicting any physical injury to those who might become their targets.

Altogether, this first class of variables describes which power rationalities 'board' which bordering devices. That is why we speak of 'onboard rationalities' in the next section. It should be noted that those variables are set as active in the MCA. This means that the MCA computes them to calculate the dimensions that define the bidimensional plane. In what follows, we turn to the interpretation of those dimensions.

Onboard rationalities of control: Territories, passengers, and containers

The crux of the matter is now to interpret the two dimensions that create the plane onto which projects and their characteristics are projected in Figures 1 and 2. To carry out this task, this section relies on a set of graphs where categories are located at the barycentre of the cloud of individuals that they describe, and conversely. This enables us to seamlessly go back and forth between projects and their defining properties.

Furthermore, the size of the markers is proportional to the contribution of their categories to the axes. Simply put, the larger the marker, the more relevant the category. Thus, the most important properties, those that contribute in the most potent way to shaping the dimensions, are readily accessible for interpretation. For reasons of graphic legibility, categories whose contribution falls below average do not feature in the graphs. By the same token, we provide two representations for the interpretation of axis 1. Figure 3 features the categories of the first two rubrics that contribute most to the first axis. Figure 4 does the same for the last two rubrics.

In the bottom-left dial, projects such AMASS are located in the broader policy context of FRONTEX+ and geared towards the control of irregularised migrants. They operate mostly at sea, on the blue border, as well as in remote land areas and apply a zonal type of surveillance. They network sensors so as to feed a constant stream of data to Command-and-Control Centres, where early warnings are automatically triggered, inviting (or rather demanding) that

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[42]Martina Tazzioli and William Walters, 'The sight of migration: Governmentality, visibility and Europe's contested borders', *Global Society*, 30:3 (2016), pp. 445–64.

[43]Louise Amoore and Alexandra Hall, 'Border theatre: On the arts of security and resistance', *Cultural Geographies*, 17:3 (2010), pp. 299–319; Peter Andrea, *Border Games: Policing the U.S.-Mexico Divide* (2nd edn, Ithaca, NY: Cornell University Press, 2009).

[44]Aradau and Blanke show how 'Anomalies have become particularly desirable for security professionals in their promise to capture the "unknown unknowns"'. Claudia Aradau and Tobias Blanke, 'Governing others: Anomaly and the algorithmic subject of security', *European Journal of International Security*, 3:1 (2017), p. 20.
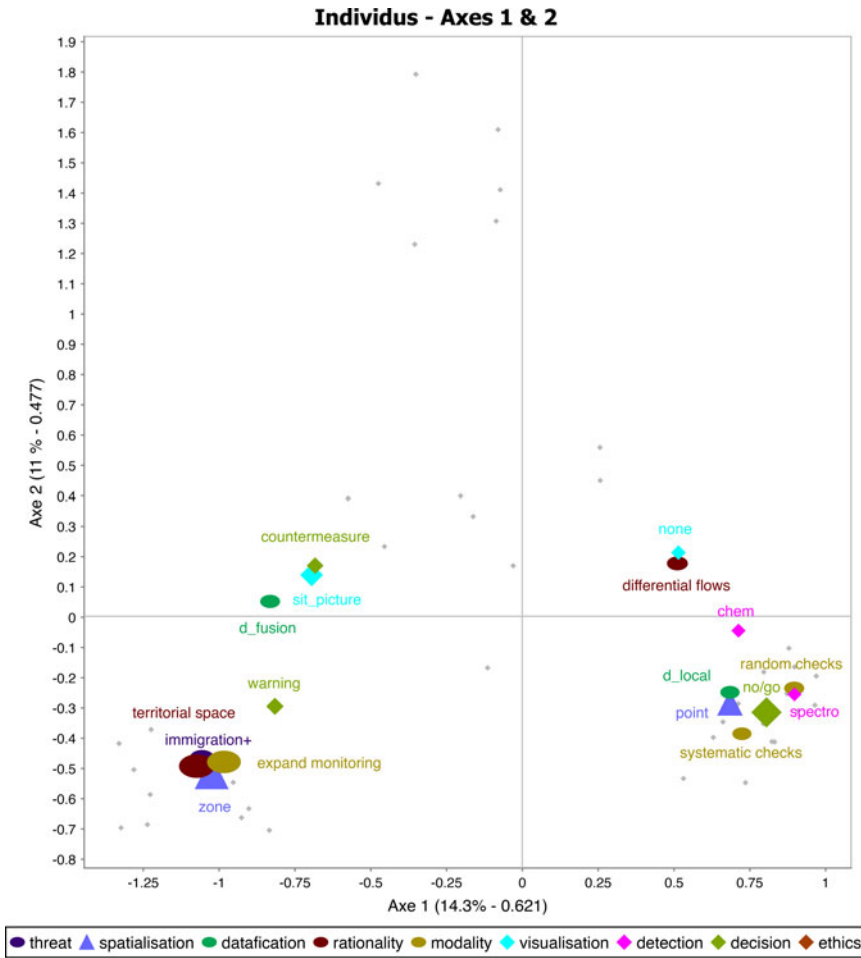
Figure 3. Axis 1: logframe and border.

human operators take a closer look at abnormal situations – often to dispatch teams of intervention or more targeted surveillance devices. Indeed, as is made clear by the positioning of more analytical categories such as 'expanding monitoring' and 'territorial space', the bottom-left dial of the graph corresponds to projects that work within a **rationality of territorial control of space**, bolstered by technologies of surveillance and aimed at detecting rare events in remote areas. We therefore name this pole of the graph **territorial surveillance**.

In the bottom-right dial, one finds categories and projects that are rigorously opposed to those of the bottom-left. Projects such as DOGGIES, SNIFFLES, and SNIFFER assemble prototypes that replace the chemical capacities of sniffer dogs in detecting unwanted things or humans. As such they are very similar to the project HANDHOLD that Bourne et al. have taken as the focal point of their laboratory study.[45] It is one heuristic upside of our approach to show that, far from being isolated, HANDHOLD is only one member of a pack of chemically engineered sniffer dogs geared towards the detection of molecules emanating from drugs, explosives or even, in some cases, the human body. Also, in this cluster, one finds projects such as XP-DITE, FASPASS and ABC4EU that design new border crossing points in order to make

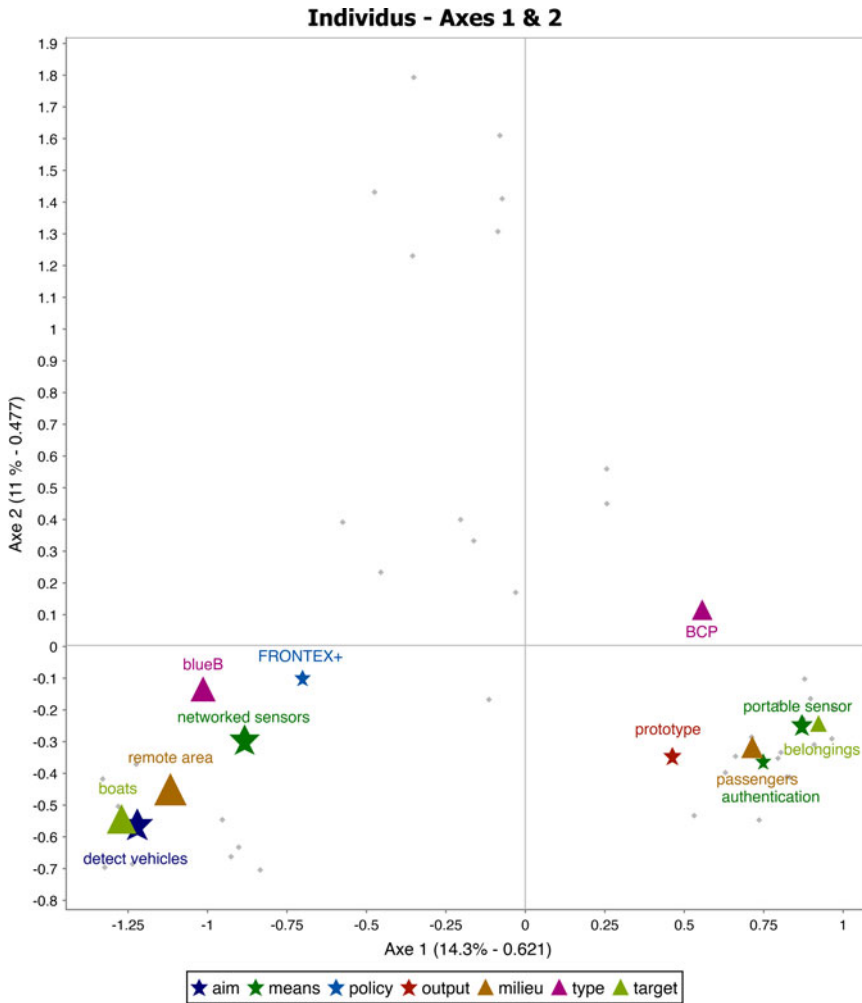[45]Bourne, Johnson, and Lisle, 'Laboratizing the border'.

Figure 4. Axis 1: control and interface.

ID checks smoother, faster and more comfortable for licit passengers, while intercepting illicit ones.

Both portals and chemical sniffer dogs boast high throughput capacity in order to insert smoothly within dense flows of passengers and goods. They may apply checks either randomly or systematically and are usually deployed at points of control. Those devices tend to produce data that is exploited locally but may also be checked against large databases in order to authenticate passengers against their data-doubles. According to Huub Dijstelbloem and Dennis Broeders, these data-double create three categories of 'bodies': the 'privileged (trusted travellers)', 'unwanted (blacklisted terrorists, criminals and increasingly those who have trespassed against immigration law); and those who are suspect and require further scrutiny'.[46] Decisions suggested to human operators are then often a simple go/no-go alternative. In a nutshell, the bottom-right dial is organised by a **rationality of differential control** that is aimed at policing flows by accelerating licit ones and decelerating illicit ones.

[46]Huub Dijstelbloem and Dennis Broeders, 'Border surveillance, mobility management and the shaping of non-publics in Europe', *European Journal of Social Theory*, 18:1 (2015), p. 28.
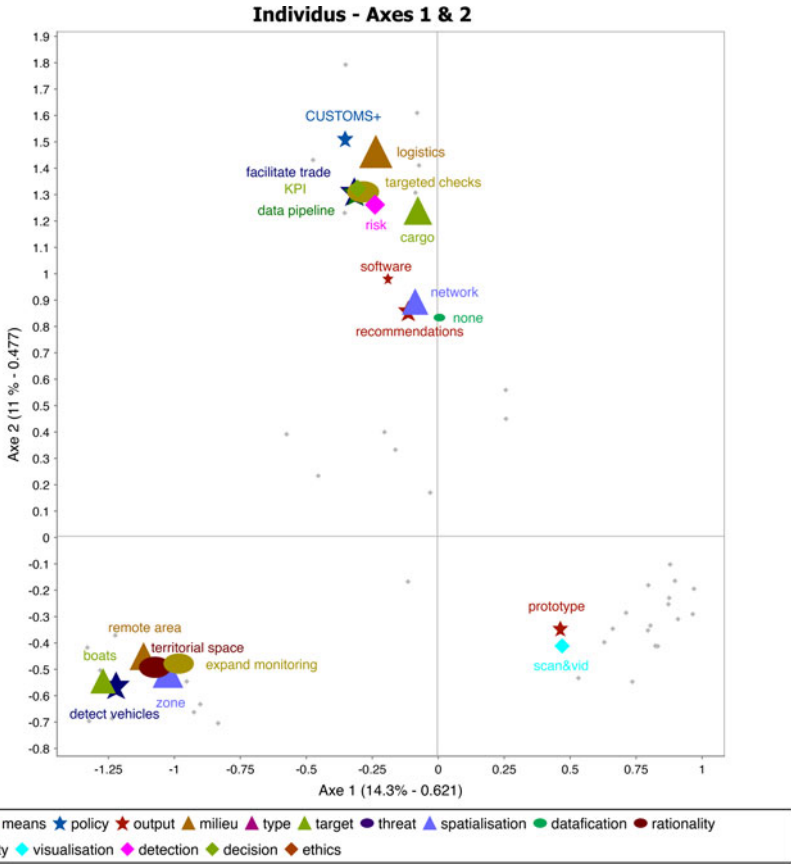
Figure 5. Axis 2.

Thus, axis 1 polarises a cleavage between territorial control of space aimed at detecting abnormal events that occur against low background noise on the one hand, and differential control operating in dense flows on the other. In the later modality, 'control is short term and of rapid rates of turnover, but also continuous and without limit' – to borrow a phrase from Deleuze.[47] Oddly enough, however, the category 'differential flows' does not stand near the extreme of axis 1, but is much more central than its counterpart 'territorial rationality'. To understand this apparent contradiction, one must move on to deciphering axis 2. Figure 5 features the categories contributing most to the formation of this axis.

Interestingly, territorial surveillance also polarises this axis. This time, however, it is opposed to a cluster located in the upper and central part of the graph. These projects tend to be located in the policy context of customs (CUSTOMS+) and aim to facilitate trade. They develop devices that insert in the flows of containers sustaining the global supply chains upon which international trade hinges. The devices that are developed in this region of the graph are often designed to target cargo in transit by laying down a data pipeline in order to speed up pre-clearance procedures for customs administration. Such risk analysis supposedly allows the bulk of containers to move around unimpeded. Whenever checks do actually apply, some devices are designed to scan the cargo from the outside without opening the containers. CASSANDRA, CONTAIN, and other projects in this cluster have to do with the globalisation of things rather than the circulation of people. The second

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[47]Gilles Deleuze, 'Postscript on the societies of control', *October*, 59 (winter 1992), p. 6.

dimension of the space therefore highlights an opposition between bordering devices aimed at humans, in the lower part, and bordering devices aimed at non-humans in the upper part.

As a result of this first step of our analysis, a triangle-shaped sociotechnical universe comes into focus. This topography is reminiscent of the three rationalities of power that Bigo identified.[48] One observes a sharp differentiation between: (1) the devices that materialise the border as a **liquid** by aiming to filter legitimate travellers in dense flows (in the bottom-right dial); (2) devices that materialise the border as a **solid** and expand surveillance into remote areas in order to detect rare events (in the bottom-left dial); and (3) devices that materialise the border as a **gas** by facilitating trade (in the upper part). So far, we lay exposed to the charge of having quantitatively demonstrated a trivial finding that more qualitative methods have already established. We contend, however, that such is not the case, as will become clear in the remainder of this article. We now move on from the analysis of the rationalities of border that are materially encapsulated in those devices to an examination of the actors who contribute to their design.

Consumers and producers of bordering devices

Our final aim is indeed not only to bring out the different rationalities of power that undergird bordering devices, but also to shed light on their designers. In this regard, our investigation takes into account the full dimensionality of 'sociomaterial configurations' whereby 'imaginaries and materialities' are joined together, in Lucy Suchman's words.[49] Our second class of variables thus describes 'the designer's point of view on the user', and vice versa.[50] It registers how both engineers and end users contribute to designing the materiality of borders within FP7 projects. These variables are set as illustrative, which means that the MCA does not compute them to calculate the metavariables. They are merely projected onto the bidimensional plane as it is defined by active variables. This move is instrumental in unleashing the full potential of our method. It reveals which actors stand behind which kind of bordering rationality. Figure 6 showcases the participation of the industries of defence and security. This rubric contains 4 variables: *defence industry, security industry, security consultancy,* and *cyber-security*. They receive each three modalities – as is the case for all of the other variables in this class: 'participates', 'does not participate', and 'coordinates'.

The distribution of those illustrative variables reveals a first opposition between security firms, which specialise in commercialising technologies of detection and authentication, and the defence industry that sells heavier equipment of monitoring such as drones. The defence industry almost monopolises participation in projects assembling a territorial surveillance of remote areas, while the security industry is involved in sorting out flows of passengers. One observes, however, that defence consortia are also present in this region of the graph, which testifies to their efforts in diversifying their activities. Furthermore, a second faultline comes into focus, which opposes industrial actors in the bottom part of the graph to firms producing immaterial goods in the upper part. They both are equally involved in the bottom-right dial, as well as companies selling solutions of computer security.

Our next exploration focuses not on the producers but on the consumers of those bordering devices, that is, professionals and institutions of security. Those are often, but not always, involved in FP7 projects. Figure 7 showcases the pattern of their participation. It reveals a trenchant distinction between three actors. The military are almost exclusively involved in projects pertaining to the territorial surveillance of remote areas. The police participate in projects that focus on filtering out human flows. For these two actors, the involvement is almost exclusive.

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[48]Bigo, 'The (in)securitization practices of the three universes of EU border control'.

[49]Lucy Suchman, 'Configuration', in Celia Luri and Nina Wakeford (eds), *Inventive Methods: The Happening of the Social* (London: Routledge, 2012), p. 48.
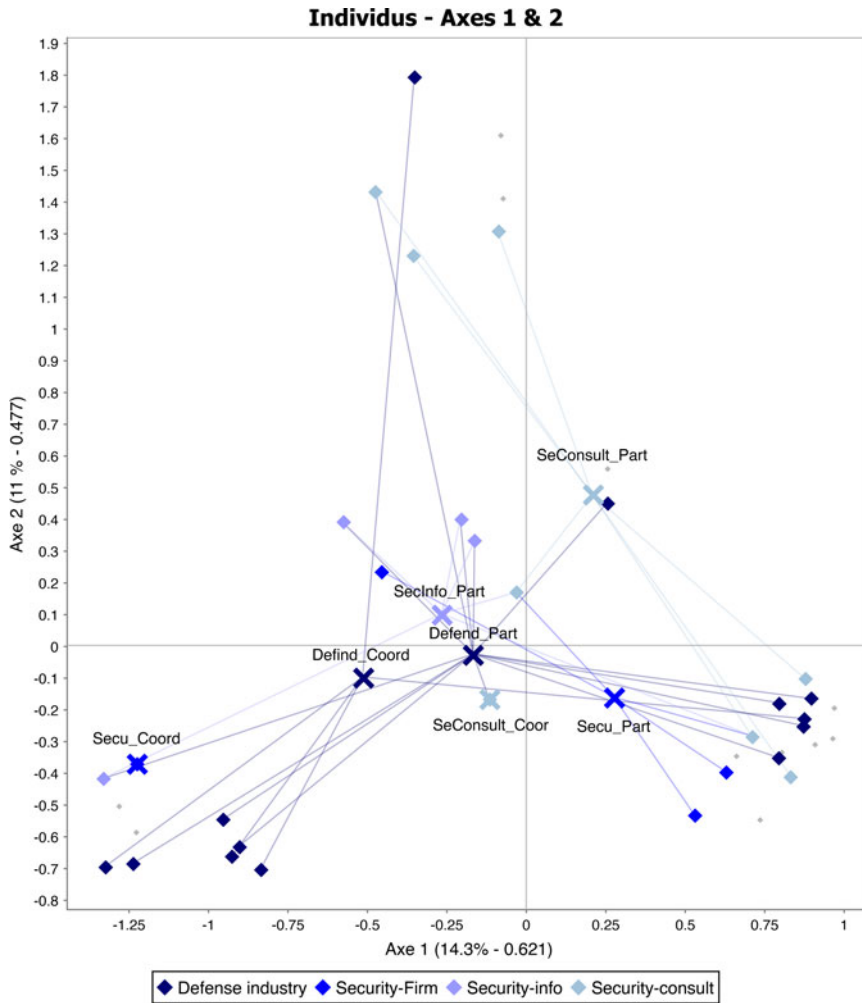
[50]Ibid., p. 56.

Figure 6. Producers.

We detect only one foray of the military into the bottom-right dial, and conversely. The positioning of customs administrations is more interesting in this regard. They are evenly involved in projects dealing with the policing of flows of passengers, in the bottom-right dial, and projects focused on trade facilitation in the upper region of the graph.

The comparison between Figures 6 and 7 brings to light a neat homology of position between producers and consumers of security devices.[51] The defence industry is located in the same region as the military. The same goes for security firms and the police, as well as customs and business intelligence. These patterns of participation qualify the widely shared belief in technological determinism that feeds both expert and scientific discourse on the dedifferentiation between the military and the police.[52] One of the analytical purchases of our approach is to cater to a

[51]Bourdieu, *La Distinction*, p. 257.

[52]Didier Bigo, 'When two become one: Internal and external securitizations in Europe', in Morten Kelstrup and Michael C. Williams (eds), *International Relations Theory and the Politics of European Integration, Power, Security and Community* (London: Routledge, 2000), pp. 171–205; Derek Lutterbeck, 'Between police and military: The new security agenda and the rise of gendarmeries', *Cooperation and Conflict*, 39:1 (2004), pp. 45–68. On the US case, see Frederik Rosén,
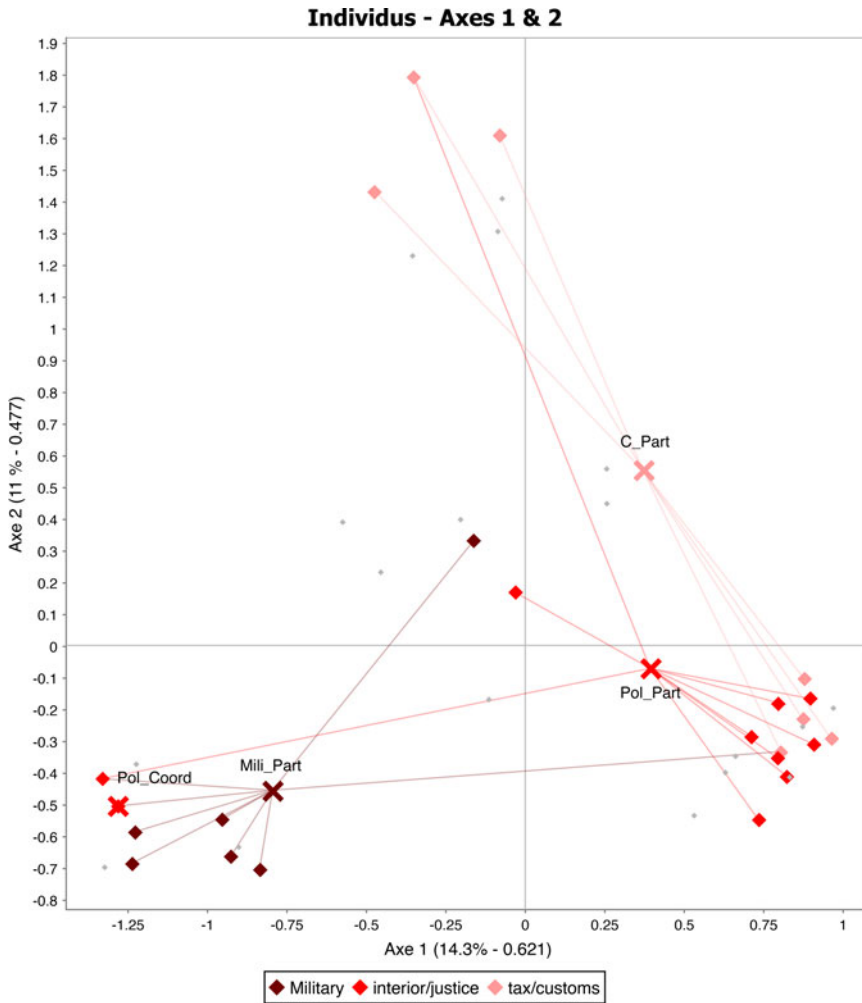
Figure 7. Consumers.

reality that is more complex than a simple 'militarisation' of border security. In this regard, our finding shores up the following observation by Claudia Aradau and Tobias Blanke. 'Militarisation of borders … is not universal or even dominant, but it comes into tension with practices and discourses that focus on managing populations and "filtering" at the border or on using data analytics to govern at a distance both spatially and temporally.'[53]

Figures 6 and 7 not only highlight the position of police and military stakeholders but also stress how each relate to distinct private partners. Instead of a single process of privatisation, one finds at least two different circuits whereby private and public actors forge competitive alliances to define what border security is and how it should materialise. This stands in sharp contrast to Baird's otherwise insightful inquiry that we discussed in the above. According to him, public institutions of security are homogenously marginal in the network that the private industry

weaves. In fact, they are neither marginal nor homogeneous. Any interaction-based method such as network analysis is bound to remain oblivious to this differentiation because it cannot process attributional data. Only a relational method processing categorical information can render such differences. Moreover, Baird minimises the role of border guards, police, and the military. Those actors do 'not occupy central positions' in what he calls 'surveillance design communities'.[54] His interactional approach shows that private actors dominate the network of FP7 projects on security but fails to capture the small but meaningful distinctions among these actors, and how they relate differently to public institutions that are also different. By contrast, our approach brings another hierarchy to the fore. When they design the very devices whose multi-functionality supposedly erases the difference between the military and the police, both the military and the police stay in their corner. The core differences between these actors remain strong and meaningful. This finding echoes Bruno Martins and Christian Küsters's study dealing with EU public research funding on drones.[55] We too identify a diverse and competitive public/private partnership in the context of EU border security (police, military, customs, etc.).

Our findings also bring into focus the role that customs play in this game. This, in turn, shapes a somewhat different understanding of bordering rationalities to that put forth by Bigo. According to our finding, it is the not the managers of large EU IT-systems of security such as EU-LISA who assemble the gaseous image of the border, but customs officials working closely with small firms of cyber-security. Quite paradoxically, although they eventually flocked the policy forums that set the rationale for the security scheme of the FP7,[56] those former actors remain rather discreet at the level of project implementation. It may be for the the the very reason that they do not apply to people that projects of trade facilitation go much further and faster in designing surveillance devices that make intensive use of inductive data-processing. In other words, the differentiation between the global dataveillance of supply chain on the one hand, policing of flows and territorial control on the other, is much more prevalent in the sociotechnical pluriverse of the European border than what Bigo found by talking solely to end users.

With some important exceptions,[57] the role of customs professionals and projects of trade facilitation remains in the blind spot of much of the current research on border security in Europe. Crucially, this includes critical approaches because of their overwhelming focus on issues pertaining to the free movement of people. Our last section turns to the issue of critique, R&D and border security in more details.

Critique and research: Academics and activists in the machine

This section harks back to the possibility of critique in the context of EU security R&D that the first section touched upon. To this end, it locates SHS scholars and activists in the sociotechnical universe wherein bordering devices are designed with the financial support of the European Commission. We focus on members of non-governmental organisations and SHS scholars (Figures 8 and 9) because they provide a good proxy for critically minded actors. Even though they do not hold a monopoly over critical capacity, such actors are often invited to participate in these projects for the critical voices that they may bring to the table.

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[54]Baird, 'Surveillance design communities in Europe', p. 43.

[55]Bruno Oliveira Martins and Christian Küsters, 'Hidden security: EU public research funds and the development of European drones', *Journal of Common Market Studies*, 57:2 (2019), pp. 278–97.

[56]Médéric Martin-Mazé, 'The power elite of security research in Europe'.

[57]Brenda Chalfin, 'Customs regimes and the materiality of global mobility: Governing the port of Rotterdam', *American Behavioral Scientist*, 50:12 (2007), pp. 1610–30; B. Chalfin, *Neoliberal Frontiers: An Ethnography of Sovereignty in West Africa* (Chicago: Chicago University Press, 2010); Karine Côté-Boucher, 'Border preclearance and the securing of economic life in North America', *Neoliberalism and Everyday Life* (Kingston, ON: McGill-Queen's Press-MQUP, 2010), pp. 37–67; K. Côté-Boucher, 'The paradox of discretion: Customs and the changing occupational identity of Canadian border officers', *British Journal of Criminology*, 56:1 (2016), pp. 49–67.
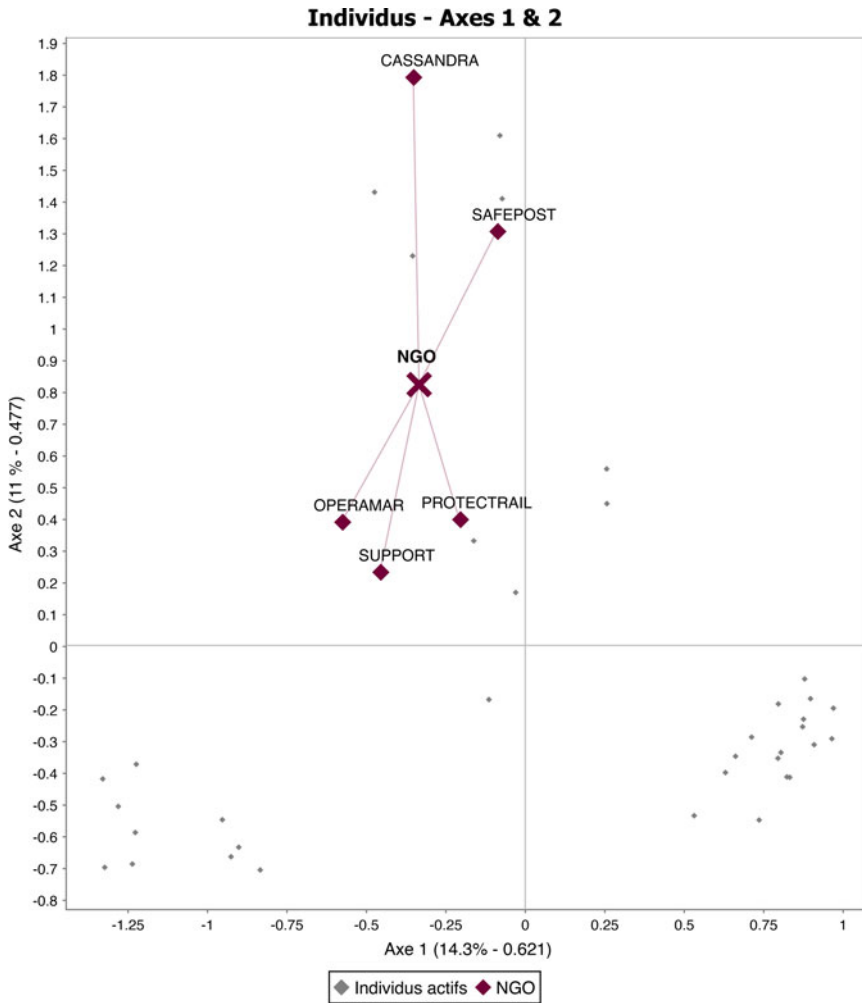
Figure 8. NGOs' participation.

At first glance, one observes that SHS scholars participate to merely 7 projects and NGOs to 5 out of 41 – which is quite low. Secondly, academics are drawn towards the pole of 'differential control'. Members of NGOs, for their part, are involved, somewhat surprisingly, in projects pertaining to the dataveillance of cargo. Both are kept almost completely at bay from the pole of 'territorial surveillance' on the left-hand dial. This bears some significance for the meaning of security research in general, and for the role that social scientists play within that kind of research in particular.

If, indeed, 'critique is put to work' through those projects, as Mathias Leese, Kristofen Liden, and Blagovesta Nikolova somewhat optimistically contend,[58] the perimeter of this critique seems limited to that which regards the speed of cargo transfer, and the comfort of licit passengers at crowded airports. Critical academics in particular are enrolled in a relation of 'companionship' where, so to speak, they speed and smoothen the movement of tourists and businessmen through border control points (Figure 9). Increasing the speed at which the later works, so as to improve

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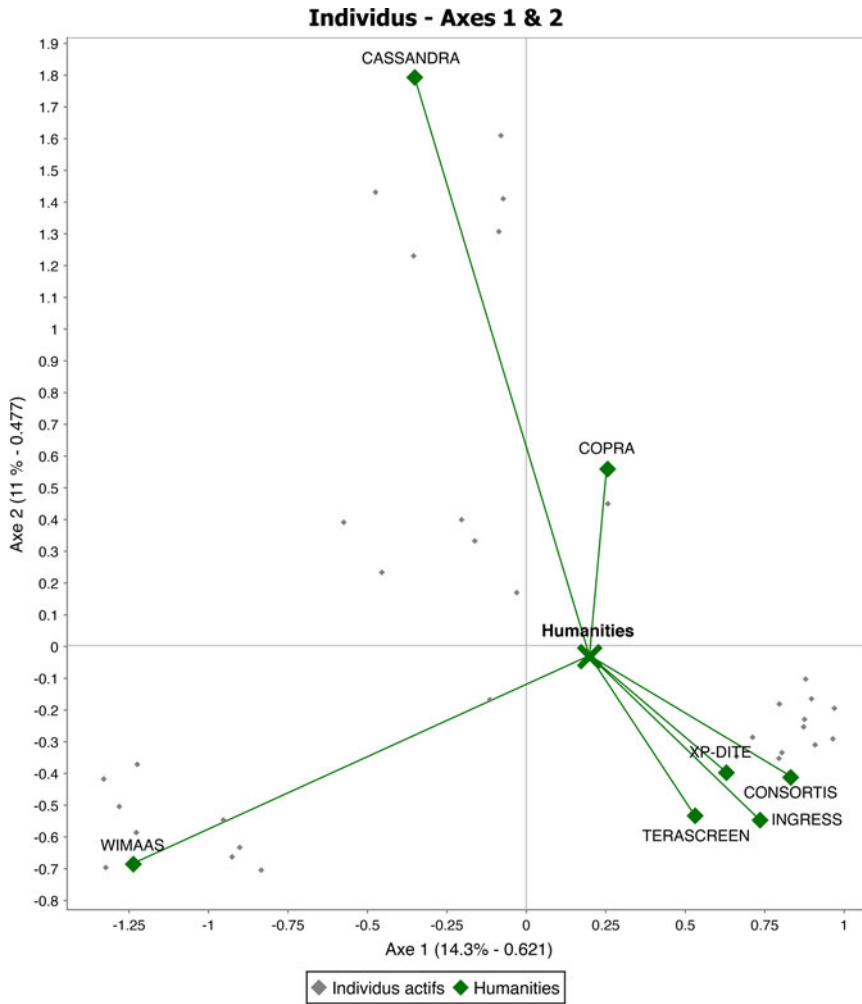[58]Leese, Lidén, and Nikolova, 'Putting critique to work'.

Figure 9. Social scientists' participation.

the experience of human beings who travel legitimately seems a task of ever-greater importance. But Daniele Lorenzini and Martina Tazzioli insist, rightly in our view, that other investigations are of critical significance: those carefully tracing the link between migrant death at EU borders back to the 'EU politics migration containment' as well as the 'rise of racism and xenophobia in Europe'.[59] In this regard, Didier Bigo is on point when he asks whether 'comfort is even becoming the semantic equivalent of fundamental rights and freedom in the mind of many travellers, and speed and absence of blockade are seen as the proof of a free world in advertisements of travel agencies and in the mind of the travellers'.[60]

The powerful but anonymous logic of European R&D in border security that this article documents, contributes to the 'political program of liberalism on a worldwide scale (which) is dedicated to freedom of movement. But it is not applied in a homogenous manner. The freedom of capital, goods, and services is a source of profitability; the freedom of human movement not

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[59]Daniele Lorenzini and Martina Tazzioli, 'Critique without ontology: Genealogy, collective subjects and the deadlocks of evidence', *Radical Philosophy* (2020), pp. 27–8.
[60]Didier Bigo, 'Freedom and speed in enlarged borderzones', in Squire (ed.), *The Contested Politics of Mobility*, p. 43.

necessarily so. Those who are profitable and economically solvent are to be separated from those who are not, but this must be done without checking everybody.'[61] To be clear, such structural effects need not be deliberate or imply calculated intent on the part of actors who would hatch subtle plans behind closed doors.[62] Still, the implication seems clear: structural effects cut both ways when it comes to the possibility of critique in European border security. We observe that both activists and social scientists cannot engage meaningfully with what happens to those who, precisely, are excluded from the legitimate channels of movement, because they do not participate in the projects that pertain to these actors. Those who have no choice but to travel under dangerous conditions are the target of a devices of coercion and interception that are developed under the radar of critical academics and activists simply because the latter are not involved in the consortium that win those tenders. To investigate the practical logics that drive not only the formation of these consortia but also compares their rate of success is certainly a worthy endeavour. However, it lies beyond the scope of this article. Notwithstanding, this particular finding remains robust: the structural conditions under which critique is made to work within EU-funded security research are such that critical scholars cannot but turn a blind eye on irregularised migrants and asylum seekers. Instead, they end up holding the hands of tourists and businessmen as the happy few clear controls at border points.

Conclusion

Expansion, both functional and transnational, represents a key driver in the genesis of the field of European security.[63] European R&D policy is but one of the latest universes where the practical logic of security professionals has made headway. Between 2007 and 2013, the European Commission funded 41 R&D projects in border security. For the most part, those activities aimed to design devices that would materialise borders in specific ways. In this article, we ask which rationalities of power board those devices, and which actors participate in the boarding process. To answer these questions, we build a relational approach that makes use of data visualisation. Our methodological perspective brings out two faultlines that run across the sociotechnical universe of border in Europe. The first one opposes 'territorial control of space' and 'differential control of flows', the second one contrasts the 'surveillance of humans' to that of 'non-humans'.

Our investigation does not stop at rationalities of power, however. It also brings under examination the actors who are in the business of designing those bordering devices. Against pervasive claims about a technologically driven dedifferentiation upon which the FP7 was itself predicated, our findings document a persistent difference between the military and the police. It should be noted that this differentiation holds true both at the level of producers and at the level of consumers. One is confronted not to one process of privatisation, but rather to multiple public-private circuits that lay competitive claims as to what borders ought to look like in practice and in matter. What is even more significant, however, is the position of academic researchers and activists in this sociotechnical universe of bordering devices. Those actors almost exclusively work so as to make differential control faster and, when applied to legitimate travellers, more comfortable. But they are kept away from engaging with the situation of undocumented migrants and asylumseekers. The structures of EC-funded R&D severe this crucial relation of companionship between fragile actors and critical voices.

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[61]Didier Bigo, 'Detention of foreigners, states of exception, and the social practices of control of the Banopticon', in Prem Kumar Rajaramand and Carl Grundy-Warr (eds), *Borderscapes Hidden Geographies and Politics at Territory's Edge* (Minneapolis: University of Minnesota Press, 2007), p. 30.

[62]Médéric Martin-Mazé, 'Unpacking interests in normative power Europe', *Journal of Common Market Studies*, 53:6 (2015), pp. 1285–300.

[63]Didier Bigo, *Polices en réseaux: l'expérience européenne* (Paris: Presses de Sciences Po, 1996), pp. 329–31.

This article makes three contributions. Firstly, it moves beyond the current wave of inquiries into the agency of sociotechnical border arrangement. Most studies have so far focused mainly on how technologies play out at the border, remodelling the ways borders function, reconfiguring how border guards work, and reframing encounters with migrants. Against this backdrop, the present investigation explores what happens upstream. It sheds light on the conditions under which those devices are designed in the context of EU-funded programmes of Research & Developments. In so doing, our analysis shares the concern of Bourne et al., who carefully unpack the labour going on in border laboratories.[64] Yet, it foregrounds a more transversal approach that zooms out and encompasses multiple laboratories. In order to clear any misunderstanding as to the scope of our findings, it is worth stressing a clear limitation of our investigation. Of the 41 projects that we studied at the level of their design and R&D, we did not follow them all the way through industrial production and operational deployment. In other words, the important question of which devices actually find their way to the market lies beyond the range of the present article. Further empirical research on the materialisation of these projects, particularly in relation to the contracts awarded by the European agencies of Frontex or eu-LISA, seems of crucial significance.[65]

Secondly, we identify which actors design which border devices into which laboratories, by visualising a space of border R&D projects with the help of Multiple Correspondence Analysis. For it stays clear of any 'interactional fallacy',[66] MCA performs well in rendering the structures of opposition that underpin the current 'border struggles' where managers, researchers, and lobbyists of the security industry are increasingly involved.[67] This second, more methodological contribution offers a deeper perspective than network analysis and wider angle than ethnographic studies of business fairs into the industry of border security.[68]

Thirdly, and finally, our findings qualify the optimism of the post-critical programme in terms of the possibility of critique. To the extent that the present research has been supported by one FP7 project (SOURCE), we would certainly agree that such grants offer some leeway to academics and activists, critically minded or otherwise. However, a necessary albeit insufficient condition for critique is the involvement of such actors. In this regard, our findings document the uneven participation of social scientists and NGO members in the border security scheme of the FP7. If we agree that critique should not be reduced to 'judging the positive or negative state of the worlds we inhabit',[69] we still have to question the socio-material conditions under which scholarly informed critique can be enforced in the context of border security. Our mapping shows how the practical logic of EU R&D in border security removes not only scholars but also activists from projects where the crudest forms of coercion are designed to target the most fragile human beings on the move. Instead, this very same practical logic channels critical voices towards situations where the only available companions happen to be privileged travellers, whose comfort and speeds are to be increased.

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[64] Bourne, Johnson, and Lisle, 'Laboratizing the border'.

[65] On Frontex, see Bruno Oliveira Martins and Maria Gabrielsen Jumbert, 'EU border technologies and the co-production of security "problems" and "solutions"', *Journal of Ethnic and Migration Studies* (2020), pp. 1–18; and Matthias Leese's work on the 'European standardization' of technical solutions for border security. Matthias Leese, 'Standardizing security: The business case politics of borders', *Mobilities*, 13:2 (2018), pp. 261–75. On Eu-Lisa, see eu-LISA, *Interoperability*, available at: {https://www.eulisa.europa.eu/Activities/Interoperability} accessed 3 February 2021.

[66] Mustafa Emirbayer and Victoria Johnson, 'Bourdieu and organizational analysis', *Theory and Society,* 37:1 (2008), pp. 1–44.

[67] Médéric Martin-Mazé, 'Returning struggles to the practice turn: How were Bourdieu and Boltanski lost in (some) translations and what to do about it?', *International Political Sociology*, 11:2 (2017), pp. 203–20; Sandro Mezzadra and Bret Neilson, *Border as Method or the Multiplication of Labor* (Durham, NC and London: Duke University Press, 2013), pp. 264–370.

[68] Baird, 'Surveillance design communities in Europe'; Baird, 'Who speaks for the European border security industry?'.

[69] Austin, Bellanova, and Kaufmann, 'Doing and mediating critique', p. 15.

The extent to which this logic continues to shape H2020 lies beyond the scope of this article. However, it is worth noting with Bruno Martins and Maria Jumbert how in this case as in the case of FP7, 'the technological expertise lies with private industries, and not within scientific communities exclusively' and how 'expert knowledge-based policymaking has systematically increased in the EU and became mainstream in virtually all the domains of the security agenda, understood here in its widest sense'.[70] Thus, we are left wondering to which extent the post-critical programme runs the risk of easing the cooptation of critique by prevalent forms of power if it keeps turning a blind eye on the structural dimension of security practices to replace it with a narrower focus on situations.

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[70]Martins and Jumbert, 'EU Border technologies and the co-production of security "problems" and "solutions"', p. 13.

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