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Infrastructuring AI: The stabilization of 'artificial intelligence' in and beyond national AI strategies

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Abstract

This paper explores how AI policy documents mediate the stabilization of socio-technical assemblages. It does so by developing the theory-methods package of 'discursive infrastructuring' and applying it to the U.K.'s *National AI Strategy*. By centering the conceptual slipperiness of emerging technologies such as AI, this framework sheds light on how policy documents work to stabilize emerging socio-technical assemblages comprising specific actors, ideologies, flows of capital, and relationships of power. In the context of the *National AI Strategy*, discursive infrastructuring reveals how the document stabilises: AI as an autonomous and inevitable force; a technical/social dualism which privileges the technical over the social in driving innovation; the 'heroic engineer' as an individual, masculine and rational archetype; and, the U.K. as a dominant and modernising player on AI's global stage. This assemblage does not only exist in the document's words; it is translated into practice through the funding of institutions, the centring of technical pedagogies of AI, and the opening of visa routes for 'globally mobile individuals'. The application of 'discursive infrastructuring' to the *National AI Strategy* thus elucidates the constitutive role of policy discourse in stabilising politically situated material-semiotic conceptions of AI.

Contents

1. Introduction

Since 2014, over 60 national AI strategies have been published by governments across the world (Zambrano and Sanchez-Torres, 2021). However, while the importance of artificial intelligence (AI) to issues of nationalism, modernisation, and economic progress is evident, the question of what AI *is* remains contested (Liu, 2021; Ulnicane, *et al.*, 2021). I seek to trace the relationship between the proliferation of AI strategies and the pervasive ambiguity of the term 'AI'. I do so by developing the framework of *discursive infrastructuring*, positing that the conceptual slipperiness of AI enables policy discourses to stabilise artificial intelligence as specific and geopolitically situated sociotechnical assemblages [1]. These assemblages are not universal: the polysemic nature of AI is such that different definitions of AI serve the needs of different stakeholders and draw together different actors, resources, and relationships of power. I examine one manifestation of this discourse to elucidate how the U.K.'s *National AI Strategy* 'infrastructures' a specific and politically situated conception of AI. By synthesising Foucauldian discourse analysis with Susan Leigh Star's (1999) tools for analysing infrastructure, I

develop the concept of *discursive infrastructuring* into a theory-methods package, used to reveal the ideologies, priorities, and assumptions underpinning the U.K.'s conception of AI.

Although socio-technical infrastructures are typically transparent (Star and Ruhleder, 1996) — *i.e.*, they invisibly support other tasks — "a number of significant political, ethical and social choices have without doubt been folded into [their] development" [2]. This embedding of political, ethical, and social choices cannot only be observed in places where infrastructure is physically built or used, as has typically been the STS approach to studying infrastructure (*e.g.*, Star and Ruhleder, 1996; Pipek and Wulf, 2009; Ribes and Finholt, 2009; Karasti and Blomberg, 2018; Edwards, 2019), but also through the textual, or discursive, production of infrastructure (Aspria, *et al.*, 2016). Examining the discursive strategies through which AI is infrastructured thus generates opportunities to consider how specific sociotechnical assemblages are constructed, and how they might be deconstructed and reshaped to support alternative ideological ends (Aspria, *et al.*, 2016).

This paper begins by discussing prior research relating to AI policy, explaining how the approach outlined in this paper differs from previous work on the topic (Section 2). It then develops the conceptual framework of *discursive infrastructuring* (Section 3), before demonstrating how this framework can be developed into a theory-methods package by outlining its associated methodological approach (Section 4). This approach is applied to the U.K.'s *National AI Strategy*, introduced in Section 5, and the findings of this analysis are detailed in Section 6. Finally, I explore how additional conceptual approaches, such as Geoffrey Bowker's (1994) 'infrastructural inversion', can complement this analysis (Section 7), before elaborating the contributions of this conceptual framework and suggesting further avenues of research (Section 8).

2. Background

An emerging field of AI policy studies has begun to investigate the norms, ambitions, and trends embedded in the wave of recent AI policy documents — which include national AI strategies, reports produced by consultancies and not-for-profit organisations, AI ethics pledges and statements, and recommendations for regulating AI. Given the relative novelty of documents such as national AI strategies, much of the scholarship in this domain offers a descriptive analysis aimed at mapping the terrain of AI policy. For example, Schiff, *et al.'s* (2020) analysis of 88 AI ethics documents offers preliminary findings regarding: 1) who is involved in publishing these documents (primarily government agencies, the private sector, and NGOs); 2) their stated motivations for doing so (presented through a typology of end goals, target audiences, and signalling); and 3) the potential impacts of these publications. Similarly, Dexe and Franke (2020) analyse a range of strategic AI documents published by the governments of Norway, Sweden, Finland, and Denmark to explore how AI ethics is presented as a competitive advantage; Kumar (2021) provides a comparison of how India and China positioned the role of AI in their national strategies; and Ulnicane, *et al.* (2021) examine how governance is framed across 49 recent AI strategy documents as a means to resolve public controversies around AI. Meanwhile, others have taken a normative approach, judging AI strategy documents by the extent to which they present a vision of a 'good AI society' (Cath, *et al.*, 2018) or to which they offer a feasible approach to the participatory governance of AI (Ulnicane, *et al.*, 2021).

While this scholarship offers a valuable descriptive analysis of AI policy (telling us what the documents say and/or how they differ from one another) or a normative one (providing judgement on how AI should or should not be governed), I diverge from these approaches to ontologically and politically situate AI policy discourse in AI development. In other words, I do not seek to provide a comprehensive analysis of U.K. AI policy, but instead offer a theory-methods package for investigating how AI policy documents shape and are shaped by material, semiotic, and social manifestations of AI. Doing so demonstrates why AI strategy documents matter not just for studies of AI policy, but also as part of the design, development, and deployment of technologies. This insight offers an opening for further work exploring how digital policy documents centred on other conceptually malleable emerging technologies — such as Web3 or digital twins — mediate the materialisation of their socio-technical infrastructures.

3. Conceptual framework

Artificial intelligence (AI) remains a highly contested term, whose definition plays an important role in "setting a frame for how it will be understood, measured, valued and governed" [3]. While the term was historically used to refer to the branch of computer science focused on simulating human intelligence (Minsky, 1961; O'Regan, 2013), over time it has taken on divergent meanings, with research spanning across perspectives of 'scientific AI', 'technical AI', and 'cultural AI' (Liu,

2021). In practice, AI is not a single ‘thing’, but rather a combination of labour (Gray and Suri, 2019; Roberts, 2021), material components (Ensmenger, 2021), supply chains (Widder and Wong, 2023), policies and political priorities (Galanos, 2022; Schiff, *et al.*, 2020), ideologies and industries (Whittaker, 2021), as well as the relationships between them (Mullaney, *et al.*, 2021; Crawford, 2021). Consequently, it is useful to conceptualise AI as an assemblage: an amalgamation of heterogenous components which are always in flux (Deleuze and Guattari, 1988). In the words of Deleuze and Guattari [4], AI can be seen to “act on semiotic flows, material flows, and social flows simultaneously”; it operates across multiple ontological planes.

The relationships which constitute an assemblage are not fixed; they can be replaced and displaced (Deleuze and Guattari, 1988). Consequently, understanding AI as an assemblage offers the analytical possibility of investigating the processes which construct different notions of AI, and to consider how these may be dis- and re-assembled to support alternative ideological ends. Other scholars have also found it analytically productive to conceptualise AI as an assemblage, including to circumnavigate the ‘black boxing’ of AI and discover alternative spaces for exploring how algorithmic systems operate (Tseng, 2023), or to demonstrate how the risks associated with experimental technologies such as AI are amplified when they are combined into a ‘biometric assemblage’ in ways that cannot be reduced to their constituent components (Madianou, 2019). However, simply conceptualising AI as an assemblage raises questions about how certain conceptions of AI come to eclipse others. Thus, I turn to theorisations of infrastructure to investigate how particular socio-technical assemblages become “sunk into and inside of other structures, social arrangements, and technologies” [5].

Infrastructures have long been a topic of interest for the study of technology in society, yet they remain malleably defined. On one hand, infrastructures can be understood materially: they are “*built* networks that facilitate the flow of goods, people, or ideas” [6]. However, even early work on infrastructures, such as Hughes’ (1979) classic study of the American electricity grid, illustrates how infrastructure also embodies historical political and social decisions. Thus, infrastructures need to be analysed as “concrete semiotic and aesthetic vehicles” [7]. Susan Leigh Star and her colleagues also highlight the relational dimensions of infrastructure: while a cook might consider a water system as integral infrastructure for making dinner, a plumber might understand it as a target for repair (Star, 1999; Star and Bowker, 2002; Star and Ruhleder, 1996). Denton, *et al.* (2021) employ Star’s theorisation of infrastructure to demonstrate how datasets such as ImageNet formed the background on which machine learning research and development can be realised, as well as how this background encapsulates many invisible practices, tools, and work (such as those of crowdsourced dataset labellers).

Recognising how infrastructures operate across material, semiotic, and relational dimensions demonstrates how they function as “systematic assemblage[s] of objects, codes and procedures” [8]. For example, communications infrastructures are not just collections of hardware and software components, but also spaces for the expression of intimate feelings, products of gendered and racialised labour, and lines of flight between physically grounded places (Wilson, 2016). Thus, conceptualising an infrastructure as an assemblage illuminates how it shapes materialisations of power (Wilson, 2016). However, infrastructural assemblages are not ephemeral; they are stabilised and embedded into existing structures, social arrangements, and technologies (Star and Ruhleder, 1996) — or, in Luciano Floridi’s (2016) words, digital infrastructures become the backdrop of ‘mature information societies’. Consequently, returning to Deleuze and Guattari’s (1984) conceptualisation of assemblages highlights the importance of distinguishing between molecular (unpredictable and ephemeral) and molar (organised and stable) assemblages. To identify infrastructure as a *molar* assemblage, as one which stabilises, is to identify it as an assemblage which “imposes order, reterritorializes and defines what bodies can and cannot do” [9]. Thus, an infrastructure is an assemblage which is stabilised within a particular social order.

However, the malleable definition of infrastructure remains. As a result, instead of asking *what* an infrastructure is, Star and Ruhleder (1996) ask *when* an infrastructure is. They do not define infrastructures as specific objects or systems, but instead define them by their properties (Star and Ruhleder, 1996). This temporal understanding of the term demonstrates that infrastructures are not defined by a fixed set of components, but instead by a contingent set of characteristics. In other words, when systems become embedded into other systems, or become transparent in use (*i.e.*, they invisibly support other tasks), they come to be understood as infrastructures (Star and Ruhleder, 1996). To highlight this temporal dimension of infrastructure, scholars have found it analytically productive to adopt the dynamic concept of *infrastructuring* (Karasti and Blomberg, 2018). For example, Pipek and Wulf (2009) use the term to describe the activities that go into building an infrastructure; Musiani (2022) considers how ‘infrastructuring processes’ shape institutional boundaries to reconfigure relations of digital sovereignty; and Edwards (2019) coins the term ‘infrastructuration’ to refer to how infrastructure becomes embedded into the habits and skills of individuals. However, these analyses remain focused on the built aspects of infrastructure, ultimately describing ‘infrastructuring’ with reference to the construction of *physical* technological arrangements into which social, political, and historical dimensions are embedded. I depart from this position to account for the role of policy discourses in processes of infrastructuring. In doing so, I expand prior theorisations to define infrastructuring as processes which attempt to fix a material-symbolic assemblage within a particular social order. More specifically, I examine the discursive processes of infrastructuring that attempt to stabilise AI as an assemblage comprising specific ideologies, materialities, and relationships of power.

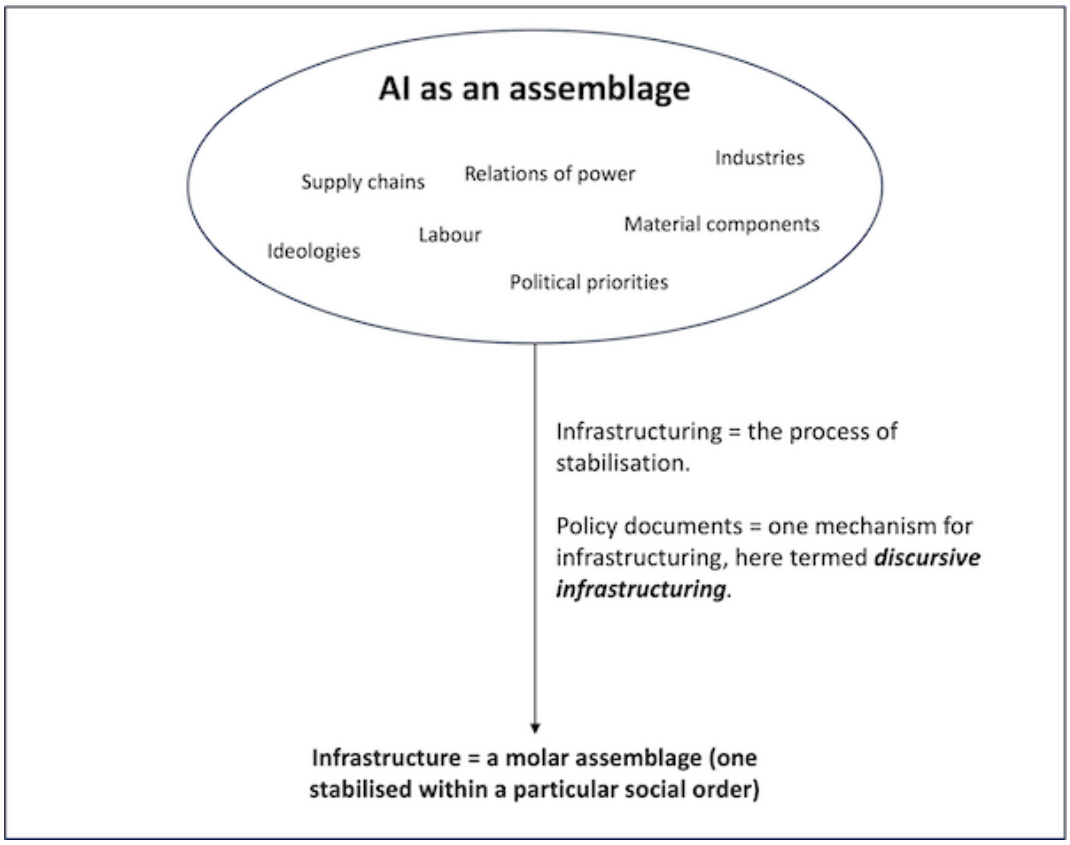

Figure 1: AI as an assemblage.

Policy documents offer an illustrative example of an infrastructuring discourse: they attempt to stabilise infrastructures by creating discursive relationships between actors, ideologies, flows of capital, and relationships of power (Goldberg, 2006). For example, strategic plans lead to legislation and shape how government agencies and non-profit organisations relate their initiatives to policy (Kissler, *et al.*, 1998), while industrial strategies explicitly attempt to "manage the pace and direction of industrial change" [10]. Within the field of artificial intelligence, where ethical norms are not yet stabilised, texts such as 'values statements' construct arenas of legitimate actors, institutions, and loci of intervention to shape the landscape of ethical technology design (Greene, *et al.*, 2019). Furthermore, the strategic aims of governments mediate the direction of AI research, since the high financial burden of training AI models drives academic researchers to position their projects in line with government ambitions (reflected in the aims of funding councils) (Galanos, 2022).

Recognising the power of AI policy documents in mediating sociotechnical development reflects Foucault's (1989, 1981) theorisation of discursive practices: discourse is not just about what is *said*, but also what saying *does*. As such, "the power in language links to, and stems from, external, material and tactical forms of power" [11]. Policy documents in particular produce truth claims beyond the pages of a text because the discursive constructions they contain are explicitly tied to governmental, financial, and regulatory powers. Acknowledging the material power of discursive practices in shaping socio-technical developments builds on existing theories of socio-technical imaginaries (Jasanoff and Kim, 2009) and promissory work (Pollock and Williams, 2010). However, instead of examining how discourse creates a performative 'expectation' or 'imaginary' which leads to the construction of a particular material reality, the concept of discursive infrastructuring foregrounds the role of discourse as a constitutive element of sociotechnical infrastructures — discourses can function as "operationalizations of sociotechnical imaginaries" [12]. Centring the processual elements of infrastructur*ing*, furthermore, offers an opportunity to elucidate the specific discursive practices which work to stabilise socio-technical assemblages. I argue that this conceptualisation is particularly useful when examining how emerging technologies (in this case, AI), which remain conceptually slippery, are stabilised (or, returning to the language of Deleuze and Guattari, are 'made molar'). Thus, *discursive infrastructuring* provides a conceptual framework to examine how policy discourses form part of, and work to stabilise, particular socio-technical assemblages.

4. Methodology

The concept of *discursive infrastructuring* offers an opportunity to shed light on the discursive tools through which AI policy documents attempt to stabilise AI as a situated socio-technical assemblage. Synthesising tools from the theoretical domains which informed this conceptual development — infrastructure studies and Foucauldian discourse analysis — thus expands this concept into a theory-methods package. I follow STS scholars in calling this a theory-methods package (*e.g.*, Clarke and Star, 2007; Fujimura, 1996) in recognition of the practical inseparability of the conceptual and the empirical (Jensen, 2014). In other words, the value of thinking about AI policy documents as an *infrastructuring discourse* is both developed through and demonstrated by analysis of these documents. Furthermore, I follow Adele Clarke and Susan Leigh Star (2008), among other feminist STS scholars, in recognising that a methodological approach is always constituted by a set of ontological and epistemological commitments.

This approach is demonstrated through its application to the U.K.'s *National AI Strategy*. Applying the theory-methods package to a single document enables the presentation of an in-depth, close reading analysis with enough supporting material from the document to demonstrate how the framework can be applied and what insights it elicits. The aim of this paper is therefore not to provide a comprehensive analysis of U.K. AI policy — although I do highlight where the document parallels or contrasts with other U.K. AI policy documents — but is instead to demonstrate why the study of AI policy is productive for those aiming to understand how emerging technologies such as AI becomes *infrastructured*. This approach parallels prior development of theory-methods packages in STS which employ single case studies to both inform and demonstrate the value of an approach (*e.g.*, Star and Griesemer, 1989; Callon, 1986; Latour, 1996) and can be further developed through additional and comparative applications to other AI policy documents.

The conceptual framework is developed into a theory-methods package by combining Foucauldian discourse analysis with Star's (1999) ethnographic method for analysing infrastructure. Foucauldian discourse analysis requires elucidating the practices which define what is true (Bacchi and Bonham, 2014). Consequently, I focus on what is named in the text (and thus what is not named or obscured), the key terms positioned as normative rather than descriptive statements, and the narrative structures elicited in the text (Gasper and Apthorpe, 1996). This approach involves engaging with the document beyond the "'things said' in terms of their content or linguistic structure" to consider the "whole package of relationships, including symbolic and material elements, that make those 'things said' legitimate and meaningful" [13]. I therefore undertake a thematic analysis of the *National AI Strategy*, but rather than looking for key themes within what the document *says*, I explore the themes in what the document *does*. I attempt to excavate the implicit visions of AI embedded within the document, and the social and historical contexts they are tied to. This paper develops previous applications of Foucauldian and Foucault-inspired discourse analysis to AI (*e.g.*, Nemorin, *et al.*, 2023; Kallioinen, 2022; Rönnblom, *et al.*, 2023), but synthesises this approach with Star's 'ethnography of infrastructure' to illustrate the role of AI policy documents in *infrastructuring* AI.

I thus add two techniques that Star (1999) offers for 'reading infrastructure' to the Foucauldian toolkit outlined prior [14]. These are: 1) identifying the 'master narratives' inscribed into infrastructures, and 2) surfacing invisible work (Star, 1999). The first technique requires attention to what is made other, the use of a global voice to represent a plurality of perspectives, and the personification of an actor or agenda (*e.g.*, 'science does ...') to position them as central to a narrative (Star, 1999). The second involves shedding light on the unnoticed or hidden 'articulation work' that enables an infrastructure to operate (Star and Strauss, 1999). However, unlike Star, I am not analysing infrastructure as a stable entity, but rather following the construction of a collective imaginary as it gets scripted into "the hard edifices of matter and practices" [15]. Thus, I analyse how the master narratives and invisible work contained within AI policy documents infrastructure a particular conception of AI.

5. The U.K. *National AI Strategy*

The U.K.'s *National AI Strategy* was released in September 2021, outlining the British government's plans and ambitions in artificial intelligence (AI) for the next 10 years (HM Government, 2021). The Department for Digital, Culture, Media & Sport (DCMS) published the 64-page document [16]. Although the *Strategy's* opening statements were presented by both the Secretary of State for DCMS and the Secretary of State for Business, Energy and Industrial Strategy, the positioning of AI within DCMS's remit signals the U.K. Government's desire for AI to contribute to both public and private sector innovation — a vision that is echoed in the strategy's aim to ensure that "AI benefits all sectors and regions" [17]. This

focus on both public and private benefits differs from other national approaches. For example, while the national AI strategies of Norway, Sweden, Denmark, and Finland are mainly written by ministries of business or economic affairs, and primarily describe the benefits of the technology in terms of economic growth (Dexe and Franke, 2020), the U.K.'s national AI strategy outlines several cross-sector purposes, most notably in healthcare and defence.

The document was released among a spate of digital policy and regulatory changes in the U.K., entangled in a 'policy web' that influenced how it was received (Goldberg, 2006). The *National AI Strategy* was published approximately one year after the U.K.'s *National Data Strategy* (U.K. Department for Digital, Culture, Media & Sport [DCMS], 2020), which introduced some of the core issues that the *National AI Strategy* proposed to address, including data skills gaps, barriers to data sharing, and boosted engagement with third sector organisations. Seven months later, in April 2021, the U.K. Government passed the *National Security and Investments Act* (U.K. Department for Business, Energy & Industrial Strategy [BEIS], 2021), setting forth AI as a critical industry to be protected through more stringent foreign investment rules. In July 2021, the U.K. Government released its policy paper, *Digital regulation: Driving growth and unlocking innovation* (U.K. Department for Digital, Culture, Media & Sport [DCMS], 2021b), which proposed to draw on the 'opportunities' afforded by the U.K.'s departure from the EU to transition towards a more deregulatory, 'pro-tech' approach to digital innovation. Finally, the *National AI Strategy* was released less than two weeks after the *Data: A new direction* consultation (U.K. Department for Digital, Culture, Media & Sport [DCMS], 2021a) which proposed reforms to the U.K. data protection framework in line with the ambitions highlighted in the July policy paper. Consequently, the *National AI Strategy* forms part of an ongoing trend in U.K. technology policy that attempts to make better use of data across public and private services, to reduce regulatory 'barriers' to innovation, and to make AI an area of national importance.

The *National AI Strategy* centres three pillars of work: 1) investing in the long-term needs of the AI ecosystem; 2) ensuring AI benefits all sectors and regions; and, 3) governing AI effectively (HM Government, 2021). Consequently, the *Strategy* has several purposes: for private industry, it offers a promise of investment and a coherent direction of technological progress; for academia and research partners, it provides focus areas for skills development and funding for research in strategic domains; for lawmakers, it indicates potential areas of future legislation; and for the civil service, it outlines a roadmap of work to deliver these projects, address current barriers including supply chain shortages, and engage in (inter)nationally-coordinated AI strategies. These ambitions exist beyond the pages of the text; an update from the U.K. Government's Office for AI (2022) reveals how the *Strategy* has been operationalised through a broad range of schemes and policies, such as: new funding for training (including UK£117m towards new Ph.D.s in AI and UK£17m towards AI and data science conversion course scholarships); the launch of an AI Standards Hub at the Alan Turing Institute; and the embedding of the *Strategy's* aims into sector-specific strategies, such as the *Defence artificial intelligence strategy* (U.K. Ministry of Defence, 2022).

I apply the framework of discursive infrastructuring to the *National AI Strategy* to examine the discursive techniques through which the document achieves its social, material, and semiotic aims. This analysis elucidates four key dimensions that the strategy works to discursively infrastructure: its definition of AI; the technical categorisation of its development and social categorisation of its governance; the central figures in AI advances; and, the role of the U.K. on AI's global stage (Table 1).

6. Findings

6.1. Defining AI

"*The act of defining an infrastructure is a categorizing moment*." [18]

Defining AI forms the lens through which the technology is understood. The *National AI Strategy* defines artificial intelligence as "machines that perform tasks normally requiring human intelligence, especially when the machines learn from data how to do those tasks" [19]. Although 'human intelligence' is not further defined in the document, the notion that a computer programme can replicate human intelligence ruptures an ontological barrier between humans and machines; it suggests there is no necessary difference between decisions made by humans and decisions made by machines. This position privileges information over the particular forms of materiality onto which it is inscribed, engendering the same trust in decisions made by computers as those made by humans (Hayles, 1999). Consequently, the *National AI Strategy's* definition of AI sets the ground on which AI can be positioned as a trustworthy and autonomous actor in the socio-political field.

This position diverges from the 2021 *National Security and Investment Act*, in which the U.K. Government defines AI as "technology enabling the programming or training of a device or software" to perceive environments, interpret data, and

make recommendations [20]. Here, AI is positioned passively: a 'text' onto which designers inscribe, or programme, particular software configurations (Woolgar, 1990). While the legal framework of the *National Security and Investments Act* requires AI to be positioned as ontologically inferior to humans, the *National AI Strategy* diverges from this position to personify AI as something which "perform[s] tasks" and "learn[s] from data" [21], centring AI as an active character in the U.K.'s technological narrative. The *Strategy* continues by suggesting that "AI has contributed to tackling COVID-19", highlighting the use of the COVID-19 Early Warning System to forecast hospital admissions and required bed capacity [22]. However, the document does not discuss the persistence of bed shortages during the pandemic (Oliver, 2021), constructing a 'functionality assumption' (Raji, *et al.*, 2022) of AI's capabilities that fails to account for the complex socio-political decision-making processes around NHS funding and management which determine whether beds are available to patients. Furthermore, adequate medical care not only requires the right bed capacity, but also medical staff to attend to them, cleaners to keep them hygienic, and medical equipment to treat patients. By personifying AI as a critical contributor in tackling COVID-19 without mentioning the other actors involved in doing so, the *National AI Strategy* both obscures the limitations of AI in addressing complex socio-political issues and renders the important articulation work of cleaning, medical, and logistics staff invisible. This results in a discursive construction which inscribes notions of indispensability into the master narrative of AI while 'invisibilising' the articulation work required to make the application of AI useful.

Finally, the discursive construction of AI as an autonomous force leads to the deterministic notion that AI *will* be implicated in all core sectors of the U.K. economy, rather than this being a result of political and commercial choices. This construction obscures how state investment, parliamentary discussions, and journalistic hype have contributed to the historical ebbs and flows of AI's popularity (Galanos, 2022). At the outset of the *National AI Strategy*, Nadine Dorries MP states that "This is the age of artificial intelligence" [23], mirroring how previous civilisations have been classified by their technological tools, such as when one speaks of the 'stone', 'iron', or 'computer' ages [24]. This rhetorical construction positions AI as a fundamental and inevitable force, discouraging questions of why AI should be the defining technology of our time, or whether our time should be defined by a technology. Such deterministic discourse cements the development of AI as an inevitability which cannot be challenged, foreclosing alternative futures (McDowall, 2012; Wyatt, 2007). It also obscures how this inevitability is manifested through political preferences — such as the decision to invest UK£3.5bn in science and technology, of which UK£1bn will be dedicated to supercomputing and AI research (U.K. Department for Science, Innovation and Technology, 2023). Thus, by defining AI through the language of autonomy, indispensability, and inevitability, the *National AI Strategy* forecloses political discourse about the desirability of AI development and stabilises its inevitability within the 'master narrative' of AI.

6.2. (Re)constructing a technical/social dualism

The notion that 'the technical' and 'the social' are two domains that can be separated has its roots in accounts of technological determinism. Technological determinism, as a modernist tendency (Latour, 1993; Suchman, 2007), promotes the idea that "technologies change, either because of a scientific advance or following a logic of their own; and then they have effects on society" [25]. This view — that technology is separate from society — both suggests that technological development happens outside of social forces, and that technology causes or determines social change (Wyatt, 2007). Although many social studies of technology have critiqued this view, particularly under the umbrella of social shaping of technology (SST) (Williams and Edge, 1996; MacKenzie and Wajcman, 1999), it has been persistent in the media (MacKenzie and Wajcman, 1999), in political discourse (Wyatt, 2007), and in the practice of engineering skills (Faulkner, 2000). A technical/social dualism, and the way it is manufactured through the language of technological determinism, is a core ideological component which the *National AI Strategy* attempts to discursively stabilise. It does so in two key ways: firstly, by separating AI development (technical) from AI governance (social), and secondly by distinguishing practitioners of AI (technical) from non-practitioners of AI (social).

As discussed in section 6.1, the *National AI Strategy* draws on the ideology of technological determinism to suggest that the direction of AI development is inevitable. As a result, AI governance and regulatory regimes are depicted as practices that need to "keep pace" with AI development rather than shape it [26]. The document not only delimits AI development from AI governance through this type of language, which discursively positions them as distinct domains, but also by spatially separating them in the document: 'Governing AI' is its own distinct section. Instead of recognising the integral role of technologists in shaping Internet governance and embedding political and ethical norms into the architectures that underpin AI models (Cath, 2021; Cath and Floridi, 2017), the document delineates governance and technology as distinct areas of practice. While the former sections speak to the skills of data scientists, computer scientists, and entrepreneurs, the latter speaks to the work of regulators and policy-makers. As a result, the work of computer and data scientists in making and shaping social decisions becomes invisible.

This rhetorical construction not only exists within the text but is constitutive of its materialisation — exemplified by the U.K. Government's choice to fund the Arts and Humanities Research Council (AHRC) 'Enabling a responsible ecosystem' programme (Luger and Vallor, 2023), rather than, for example, obliging universities to teach technical students about the social, political, and ethical consequences of their practice (not to mention the disparity between the UK£8.5m put towards

the AHRC programme and the UK£117m funding for doctoral training in AI which is largely based in centres of technical research). Schot and Rip [27] critique this "two-track regime" of governance, where technology promotion is separated from control and regulation, as it leads to the view that "promotion actors (engineers and others) need not realize that when they are engineering technology they are also engineering society". As such, this distinction — where 'technology work' is done by engineers and 'governance work' is done by lawyers and policy-makers — helps to reinforce the master narrative of technology development as an objective, neutral field of work and obscures the way that its participants engineer society.

The technical/social dualism invoked in the *Strategy's* discussions of governance privileges the technical over the social as a driver of innovation: governance and regulation is required to "keep pace with the fast-changing demands of AI" [28]. This hierarchy is mirrored in discussions of AI skills which the *National AI Strategy* described with reference to technical courses in AI, machine learning, and data science (HM Government, 2021) — and reflects the broader consensus in the field that AI expertise is a primarily technical domain (Greene, *et al.*, 2019). The classification of AI skills as a technical realm not only exists in the document but is also tied to the U.K. Government's institutional and financial powers to 'will to truth' (Foucault, 1981) this discursive construction. For example, the document pledges to build on the Government's UK£46 million Turing Fellowship investment, which is predominantly awarded to researchers in technical areas including Bayesian statistics, natural language processing, and agent-based modelling (U.K. Government, 2024). Thus, by outlining plans to fund AI education and research in the technical domain of computer science (as opposed to the social studies of AI), the *National AI Strategy* 'torques' (Bowker and Star, 2000) the AI worker to conform to its discursive construction: for one to enter the field, one must engage in a curriculum aligned to the government's classification of what AI is. As a result, the *National AI Strategy* both discursively and materially 'infrastructures' AI skills and those who perform them within the technical boundary of a technical/social dualism.

Finally, by depicting digital education as a technical domain, the *National AI Strategy* builds on a wider pattern in engineering education that not only separates the technical from the social but also privileges the former over the latter (Faulkner, 2000). Since data science skills tend to be imbued with notions of neutrality (Gitelman and Jackson, 2013), the depiction of digital education as a technical domain contributes to the narrative that the development of AI is politically neutral (Hare, 2022). This approach to technology training thus obscures the labour and environmental exploitation which underpin digital technologies, separating the digital world from the material resources which are core to its composition (Emejulu and McGregor, 2019; Ensmenger, 2021; Gray and Suri, 2019). Furthermore, although the *National AI Strategy* outlines a commitment to "back diversity in AI" — delivered through the provision of up to 1,000 scholarships for students from underrepresented groups in AI and data science [29] — it does so by promoting the representation of women, Black, and disabled students in technical courses that typically fail to explore the role of gender, race, and disability in shaping technological outcomes (Abbate, 2021; Costanza-Chock, 2020; Miltner, 2022; Sarkar, 2021). Thus, the technical/social dualism used to delineate AI from its social consequences silences alternative possibilities for deciding how AI is developed, constructing a master narrative of AI as an immaterial, technical, and apolitical domain.

Theme	Evidence	Technique
AI as an autonomous and inevitable force	AI is defined as "Machines that perform tasks normally requiring human intelligence, especially when the machines learn from data how to do those tasks"	**Master narrative**: AI is personified to make its decisions appear ontologically equivalent to those of humans.
	"AI has contributed to tackling COVID-19"	**Master narrative**: AI is personified to make it central to the narrative of the COVID-19 response. **Invisible work**: the 'articulation work' of medical and other logistical staff required to make AI useful for tackling COVID-19 is hidden from view.
	"This is the age of artificial intelligence"	**Defining what is true**: The language of technological determinism forecloses questions of whether or why AI should be the defining technology of our age. **Obscuring relations of power**: the work of funders, policymakers, researchers, and the media in promoting AI is hidden.
Technical/social dualism	"Our governance and regulatory regimes will need to keep pace with the fast-changing demands of AI"	**Master narrative**: AI is personified as an actor with 'demands'. **Defining what is true**: this normative statement about AI's inevitable pace is presented as fact. **Invisible work**: the work of computer and data scientists (as well as governance and regulatory professionals) in making and shaping social decisions is made invisible.
	"We've got to make sure we keep up with the pace of change"	**Master narrative:** A global voice is used to represent a plurality of perspectives. **Defining what is true**: 'needing to keep up' is presented as a normative obligation while the cause of the 'pace of change' is left unchallenged.
	The separation of 'Governing AI' from the sections about AI development	**Master narrative:** AI development is presented as an apolitical domain and the role of AI developers in making and shaping social decisions is 'made other'. **Obscuring relations of power**: the role of technologists in shaping internet governance and embedding political/ethical norms into the architectures that underpin AI models is hidden from view. As such, the ways that technology development has always, and continues to, entrench relations of inequality through decisions made by technology designers and developers is made invisible.
	"The government will also support people to develop skills in AI, machine learning, data science and digital through the Department for Education's Skills Bootcamps."	**Defining what is true**: the presentation of AI as a technical pedagogical domain is presented as a normative rather than descriptive statement. **Obscuring relations of power**: the presentation of AI as a technical domain obscures how AI development is imbued with social, political and ethical assumptions and implications.
	"Back diversity in AI by continuing existing interventions across top talent, PhDs, AI and Data Science Conversion Courses and Industrial Funded Masters."	**Obscuring relations of power:** the cause of underrepresentation of minoritized groups is left unchallenged, and the suggestion is that it can be fixed through technical training rather than structural interventions.
The heroic engineer	"research breakthroughs in the field of AI have been disproportionately driven by a small number of luminary talents and their trainees."	**Invisible work**: the work of large teams who have laid the ground for today's AI development is obscured. Furthermore, the work of data generators, cleaners and labellers, those who mine and assemble hardware components, security guards and workers in datacentres, etc. is hidden from view. **Obscuring historical relations of power**: the work of minorities has long been obscured in the history of computing, and this statement further entrenches the notion that work completed outside of AI labs in the Global North is not of relevance to advances in AI.
	"[Our new visa route will] make it as simple as possible for internationally mobile individuals who demonstrate high potential to come to the UK"	**Master narrative**: the mobility barriers of those who do not have the financial and social privileges to use the UK's new visa routes are made other. Instead, the 'internationally mobile individual' is made central to the master narrative of AI. **Obscuring relations of power**: This statement presents the idea of the 'internationally mobile individual' while ignoring relations of power (related to race, class, gender, citizenship, socioeconomic background, disability, etc.) that shape the possibility of being mobile.
	"High potential individuals"	**Master narrative**: the centering of the 'individual' as key to the UK's progress in AI 'makes other' the community ties that create an individual.
The UK's position on a global stage	"In the case of AI, rapid technological change seeks to rebalance the science and technology dominance of existing superpowers like the US and China"	**Master narrative**: The UK is positioned as a key player in the global 'arms race' of AI. **Master narrative:** "rapid technological change" is personified as 'seeking to rebalance' geopolitical relationships.
	"The UK is a global superpower in AI and is well placed to lead the world over the next decade"	**Defining what is true**: The UK's role as a 'global superpower in AI' is presented as a descriptive rather than a normative statement. **Master narrative**: The UK is presented as a core protagonist in the story of the field of AI. **Obscuring relations of power**: The idea that the UK will 'lead the world' depends on a modernist vision of progress to be pioneered by the UK, one which obscures the colonial histories and neocolonial realities that underpin this world.
	"Use of Overseas Development Assistance to support partnerships with developing AI nations."	**Obscuring relations of power**: The UK is imposing its technochauvinist (Broussard, 2018) vision of AI as the key to 'development', obscuring the politics of determining what 'development' is and why lower income countries remain dependent on aid from the Global North.

Table 1: Application of the framework of discursive infrastructuring to the *National AI Strategy*.

6.3. The heroic engineer

Engineers have long been characterised as individual, heroic male archetypes (Oldenziel, 1999). This practice has continued with the rise of software engineering, in which the 'ideal typical' figure is constructed as a "white, educated, middle-class man living in the Global North" [30]. However, these accounts now position the ideal typical figure within a globalised society, in which the engineer is not only atomised within a bounded geographical location but is also characterised as a node in the global network society — able to flexibly shift across national boundaries and social networks (Castells, 2010; du Gay and Morgan, 2013; Emejulu and McGregor, 2019). Consequently, the software engineer is stereotyped as individual, rational, and globally mobile.

This ideal typical figure is discursively reconstructed within the *National AI Strategy*, in which "research breakthroughs in the field of AI" are credited to be "disproportionately driven by a small number of luminary talents and their trainees" [31]. Such a position re-enacts the heavily critiqued 'great man' theory of history (Carlyle, 1841), overlooking the vast numbers of individuals whose work influenced the development of AI and computing technologies in the U.K. This includes, for example, the many women who contributed to the historic success of U.K. computing during WWII whose contributions have been silenced (Hicks, 2017). Ironically, the strategy calls for greater gender diversity while at the same time obscuring the work of women in setting the foundation for progress in artificial intelligence today — exemplifying how digital

training schemes often appropriate diversity language while leaving unexplored the structural reasons that lead to gender and racial inequality in the first place (Sarkar, 2021; Abbate, 2021; Miltner, 2022).

Centring the individual AI engineer as the pioneer of technological development makes invisible the articulation work fundamental to the development of AI, including data generation, cleaning, labelling, and moderation (Gray and Suri, 2019; Roberts, 2021). Furthermore, AI is underpinned by an entire stack of hardware and software components including servers, networks, middleware, and operating systems. These components often sit within data centres, which require material building components, security staff, and large amounts of water and electricity to power them (Ensmenger, 2021). As a result, crediting research breakthroughs in AI to 'luminary talents' marginalises the work of individuals across a plethora of roles in building AI. This discourse typically glorifies the AI work done by those in upper- or middle-class roles in the Minority World and obscures the AI work done by those in more poorly paid jobs in the Majority World (Philip, *et al.*, 2012; Nwanji, 2023; Mohamed, *et al.*, 2020). This narrative thus infrastructures a conception of AI that obscures important work, hides exploitative labour and environmental requirements, and inscribes the character of the heroic engineer as central to the master narrative of AI.

The *National AI Strategy's* discursive construction of the atomised engineer is tied to its material enactment: the *Strategy* details new visa routes for "high potential" individuals who are "internationally mobile" to enter and work in the U.K. [32]. However, being 'internationally mobile' is often contingent on one's nationality, socio-economic status, caring responsibilities, and community ties — a barrier which is only set to intensify with the U.K. Government's plans to increase visa and immigration health surcharge costs, meaning that a family of four would need to spend at least UK£33,000 in visa and health fees alone to be able to move to the U.K. (Das and Smith, 2023). Consequently, those who are legally permitted to travel into the U.K.'s infrastructure of AI are those with the financial and national privilege to travel freely, as well as those with fewer caring responsibilities.

Finally, the atomisation of the engineer as a "high potential *individual*" [33] reflects a neoliberal and Western-centric view of the individual as '*homo oeconomicus*': one who makes self-centred, rational decisions to maximise their economic position within a globalised society (Brown, 2015). However, the construction of '*homo oeconomicus*' typically obscures the myriad articulation work required to make sure one is fed, clothed, housed, and taken care of — often resulting in a glorification of masculinised work and an invisibilisation of feminised work, as well as reproducing an implicit heteronormative bias (Marçal, 2015). Thus, the *National AI Strategy* both discursively and materially reproduces the archetype of the masculine, rational and globally-mobile individual as a central figure in the 'master narrative' of AI.

6.4. Positioning the U.K. on a global stage

As AI becomes increasingly important in the geopolitical sphere, AI strategy documents play a growing role in techno-nationalist discourses (Goode, 2021). AI-centred geopolitics is a central theme within the *National AI Strategy*, in which the technology is described as offering the opportunity to "rebalance the science and technology dominance of existing superpowers like the US and China" [34]. This discursive construction situates the U.K. in the global 'race to AI', typically seen as a battle between the U.S. and China to achieve global AI dominance (Rikap and Lundvall, 2021; Zeng, *et al.*, 2022). Consequently, the *Strategy* positions AI as an 'obligatory point of passage' (Callon, 1986) for the U.K. to reach its superpower status in science and technology. This positioning reflects a long history of the presentation of computing technologies generally, and AI specifically, as core to the U.K.'s technological prowess — from the influential 1978 BBC documentary *Now the chips are down*, to David Willetts' 2013 *Eight great technologies* report, to the House of Commons Science and Technology Committee's 2016 *Robotics and artificial intelligence* paper (Galanos, 2022; Cath, *et al.*, 2018).

The centring of technology in geopolitical discourse advances the view of technology as a modernising force (Mukharji, 2012). The *National AI Strategy* outlines these connotations explicitly, describing AI as both a "modern" and a "modernising" technology (HM Government, 2021). Consequently, the suggestion that the U.K. is a "global AI superpower" that will "lead the world over the next decade" [35] not only enables the U.K. Government to position itself as a dominant actor in AI among 'superpowers' like the U.S. and China, but also to impose its view of modernity on other nations. By creating an infrastructure of AI imbued with symbolic connotations of modernity, the *National AI Strategy* reinforces a pattern of distinction between 'modern' and 'underdeveloped' nations on the basis of technological progress (Rankin, 2009). This discourse helps to justify the U.K.'s "use of Overseas Development Assistance to support partnerships with developing AI nations""[36]. Such policy positions both discursively and materially embed a neo-colonial relationship between the U.K. and developing nations, framing the U.K. as a modernising force for these countries while also imposing this construction of modernity as a condition for receiving financial aid. Thus, the *National AI Strategy* centres the role of the U.K. as a modernising player, 'leading' developing nations in achieving technological progress. As a result, the *National AI Strategy* discursively constructs a material-symbolic infrastructure that binds together AI with notions of progress and modernity while attempting to stabilise geopolitical relationships of power that centre the U.K. as a dominant force on the global stage.

7. Infrastructural inversion

This analysis deployed the theory-methods package of *discursive infrastructuring* to elucidate four key dimensions of AI that the U.K. Government's *National AI Strategy* attempts to stabilise. However, when employing this theory-methods package, one must be cautious not to overdetermine the role of AI strategy documents. Policy documents do not exist in isolation, and actors who sit outside this assemblage also interact with the construction of AI: infrastructures "wrestle with the inertia of an installed base" [37]. Thus, I widen the conceptual toolkit of *discursive infrastructuring* by employing Geoffrey Bowker's (1994) concept of 'infrastructural inversion' to explore how the actors, ideas and relationships sitting 'underneath' the *National AI Strategy* may disrupt the way it materially and semiotically infrastructures AI.

While the *National AI Strategy* focuses on the development and diffusion of AI, it makes absent the role of technology use and domestication in shaping the trajectory of technological development (Fleck, 1988; Lie and Sørensen, 1996; Stewart and Williams, 2005). This view reflects a 'linear model of innovation' which fails to account for the interplay between different stages of innovation as well as how interactions between users and suppliers shape technological change (Williams and Edge, 1996; MacKenzie and Wajcman, 1999). Consequently, actors sitting 'underneath' the *National AI Strategy* will influence how the document's material-semiotic processes of infrastructuring AI become stabilised. For example, the *National AI Strategy* was not one 'thing': it represents a roadmap of work for the U.K.'s Office for AI, a promise of investment for universities and businesses, and an opportunity for immigration for "high skilled migrant tech founders" [38]. In other words, the *National AI Strategy* is a 'boundary object' (Star and Griesemer, 1989) connecting different social worlds of actors (*e.g.* engineers, users, and policy-makers) and institutions (*e.g.*, governments, regulatory bodies, and private companies). Consequently, infrastructural work to stabilise the *National AI Strategy* will involve 'n-way' negotiations between different actors mentioned within the document, as well as those who sit 'underneath' it (Star and Griesemer, 1989). Thus, while the *National AI Strategy* attempts to impose a dominant view of what AI means and includes, it was stabilised (or, in the Deluezoguattarian terminology, 'made molar') through negotiation between different institutions, individuals, strategies, flows of capital, and types of work. These shape, interact with, and displace the U.K. Government's infrastructuring of AI.

Furthermore, the notion that AI is a 'modernising force' that the U.K. will employ to support 'developing AI nations' to achieve technological progress overlooks the agency and agendas of the actors subject to this narrative. For example, so-called developing nations such as India have mobilised the use of data-driven technologies as part of their own political agenda to counter the 'data colonisation' narrative (Prasad, 2022). Meanwhile, Steedman, *et al.* (2023) illustrate how local actors in Ghana subvert the techno-optimistic narratives of digital democratisation, problematising the notion that new technologies such as AI are a universally modernising force. As such, while the *National AI Strategy* attempts to centre the U.K. as a dominant geopolitical force on the global stage of AI, it overlooks how other actors adapt the narrative of AI as a modernising force for their own purposes.

Finally, the *National AI Strategy's* depiction of AI as a geopolitical symbol highlights the variegated and diachronic nature of infrastructure as an 'invisibilising' force. On the one hand, AI must be highly visible to demonstrate a nation's success in the field and therefore cement its position in the global arena. Within the *National AI Strategy*, the visibility of a country's success in AI becomes an 'obligatory point of passage' (Callon, 1986) for the U.K. to "rebalance the science and technology dominance of existing superpowers like the U.S. and China" and assert its position within a globalised hierarchy of political order [39]. On the other, for AI to support tasks in innovation, healthcare, climate work, or any other sector that "improve[s] everyday life" [40], it must become "transparent to use, in the sense that it does not have to be reinvented each time or assembled for each task" [41]. Therefore, while the symbolic dimensions of this AI infrastructure must be highly visible, its material dimensions must become invisible over time for it to be practical in use. Consequently, the (in)visibility of a *National AI Strategy's* infrastructure of AI is neither fixed over time nor consistent across material and symbolic dimensions. The ability of a government to 'infrastructure' its construction of AI will be mediated by the wider geopolitical arena as well as a process of infrastructuring that is variable and unstable.

8. Conclusions

In most areas, AI is perhaps not yet an infrastructure. It is in the process of being infrastructured in many different ways by many different actors. This paper introduced the concept of *discursive infrastructuring* to consider how national AI strategies both form part of and work to stabilise sociotechnical assemblages of AI comprising specific actors, ideologies,

materialities and relationships of power. In doing so, I centre the role of policy documents in the ‘infrastructuring’ of emerging socio-technical arrangements. The theory-methods package offered by this conceptual development is particularly potent for analysing emerging technologies such as AI, whose conceptual slipperiness make them ripe for competing conceptions of what they are and how they work. Thus, this framework creates space for thinking through the role of national digital strategies in shaping the material-semiotic development of emerging technologies.

This approach was applied to the U.K. Government’s *National AI Strategy* — a key document signalling the U.K. Government’s industrial, policy, regulatory, and geo-strategic position on AI (Kazim, *et al.*, 2021) — to examine how techniques of discursive infrastructuring work to stabilise: AI as an autonomous and inevitable force; a technical/social dualism which privileges the technical over the social in driving innovation; the ‘heroic engineer’ as an individual, masculine, and rational archetype; and the U.K. as a dominant and modernising player on AI’s global stage. These constructions do not simply reside in the document’s pages but are embedded in a wider assemblage of strategically aligned investments, policy programmes, and institutional relationships. Shedding light on these discursive constructions thus enables analysis of how particular socio-technical assemblages of AI might be deterritorialised and reterritorialised to support alternative ideological ends.

I expanded the toolkit of discursive infrastructuring by drawing on Bowker’s (1994) notion of ‘infrastructural inversion’ to reveal how the invisible work underpinning the *National AI Strategy* mediates the stabilisation of its socio-technical assemblage of AI. Although the discursive constructions in the *Strategy* are tied to governmental, financial, and regulatory powers, constructing truth claims beyond the pages of the text, this concept reveals the work and negotiation between different actors, ideologies, and flows of capital that they depend on. Consequently, further work should examine how the different social worlds (Clarke and Star, 2007) sitting ‘underneath’ such discourses shape how infrastructures of AI are made molar. By expanding the application of *discursive infrastructuring* to a range of AI and emerging technology policy — such as, for example, U.K. Research and Innovation’s (2022) *Transforming our world with AI* — further work can also shed light on how politically and geographically situated discourses which are in the process of ‘infrastructuring’ AI compare, compete and contend with each other in the global race for AI dominance.

About the author

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Notes

1. There is real-time overlap between the conceptual work I develop in this paper and the very recent work by Yichen Rao (2023), particularly the notion of ‘discursive infrastructure’. The paper that I present here is a development of a prior essay, presented at the 2022 *Governance by Infrastructure* workshop at the University of Lausanne under the title “Assembling AI: Discursive infrastructures and the U.K.’s *National AI Strategy*”. Although my work on ‘discursive infrastructure’ precedes the publication of Rao’s article, both papers build on an intellectual scaffolding that has started to outline how discourse can be conceptualised as infrastructure.

2. Star and Bowker, 2002, p. 5.

3. Crawford, 2021, p. 7.

4. Deleuze and Guattari, 1988, p. 23.

5. Star, 1999, p. 381.

6. Larkin, 2013, p. 329, emphasis mine.

7. Larkin, 2013, p. 329.

8. Wilson, 2016, p. 274.

9. Fox and Alldred, 2013, p. 773. Returning to the Deleuzoguattarian language, instead of conceptualising AI as a static entity, we can conceptualise it as an assemblage characterised by flows, whereby the relations that comprise assemblages can be displaced and replaced. Deleuze and Guattari's (1984) use of the term 'deterritorialization' thus refers to the freeing of social relations from an assemblage, whereas 'reterritorialization' refers to the restructuring of these relations into a different social order.

10. Green, 1981, p. 334.

11. Hook, 2001, p. 536.

12. Aspria, *et al.*, 2016, p. 81.

13. Bacchi and Bonham, 2014, p. 178.

14. Applications of these techniques are illustrated in Table 1.

15. Trauttmansdorff and Felt, 2023, p. 642.

16. Since February 2023, the Department for Digital, Culture, Media & Sport (DCMS) ceased to exist. Its functions have been divided between the newly established Department for Culture, Media and Sport, and Department for Science, Technology and Innovation (with the latter responsible for matters of AI policy).

17. HM Government, 2021, p. 40.

18. Larkin, 2013, p. 330.

19. HM Government, 2021, p. 17.

20. U.K. Department for Business, Energy & Industrial Strategy (BEIS), 2021, p. 22.

21. HM Government, 2021, p. 17.

22. HM Government, 2021, p. 43.

23. HM Government, 2021, p. 5.

24. Wyatt, 2007, p. 167.

25. MacKenzie and Wajcman, 1999, p. 3.

26. HM Government, 2021, p. 10.

27. Schot and Rip, 1997, p. 264.

28. HM Government, 2021, p. 7.

29. HM Government, 2021, pp. 8, 23.

30. Turner, 2008, in Emejulu and McGregor, 2019, p. 139.

31. HM Government, 2021, p. 25.

32. HM Government, 2021, p. 26.

33. HM Government, 2021, p. 26, emphasis mine.

34. HM Government, 2021, p. 11.

35. HM Government, 2021, p. 7.

36. HM Government, 2021, p. 38.

37. Star and Ruhleder, 1996, p. 113.

38. HM Government, 2021, p. 26.

39. HM Government, 2021, p. 11.

40. *Ibid.*

41. Star and Ruhleder, 1996, p. 113.

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