

RESEARCH ARTICLE

Infrastructure and the integral state: Internal Relations, processes of state formation, and Gramscian state theory

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Abstract

Infrastructures are central to processes of state formation. The revival of materialism in International Relations has made an important contribution to our understanding of states through careful analysis of the politics of infrastructure and state building. Yet, to date, engagement with the state-theoretical tradition associated with the work of Antonio Gramsci, Nicos Poulantzas, and Bob Jessop has been absent. Through comparison with the external-relational ontology of Bruno Latour and actor-network theory (ANT), this article argues that state theory and its internal-relational ontology avoids reifying the state while providing an analysis of infrastructure and state formation sensitive to the historical reproduction of social orders over time. Developing Gramsci's concept of the 'integral state', it emphasises the necessary interpenetration between civil society, the state apparatus, and the creation of infrastructure. These conceptual arguments are illustrated through an analysis of the United States' development of nuclear infrastructures during the early Cold War period, in the internal relations between infrastructure and the integral state are explored through Civil Defense Education programmes. Clarifying the internal relations of past, present, and potential future forms of socio-technical order is an important task for rethinking the politics of technological design in International Relations.

Keywords: civil defence education; infrastructure; national security; nuclear weapons; state theory; United States

A range of scholarship focusing on infrastructural politics and state formation has thrown fresh light onto core issues in International Relations (IR), primarily through an engagement with theoretical perspectives developed in Science and Technology Studies (STS). Studies of the infrastructural politics of state failure, the role of infrastructure in state building and peace processes, the relationship between infrastructure and global finance, and the global governance of large technical systems illuminate the material foundation of state-ness and, in turn, those of global political order.¹ Drawing on actor-network theory (ANT), new materialism, and related assemblage

¹Peer Schouten, 'The materiality of state failure: Social contract theory, infrastructure and governmental power in Congo', *Millennium: Journal of International Studies*, 41:3 (2013), pp. 553–74; Jan Bachmann and Peer Schouten, 'Concrete approaches to peace: Infrastructure as peacebuilding', *International Affairs*, 94:2 (2018), pp. 381–98; Jutta Bakonyi, 'Modular sovereignty and infrastructural power: The elusive materiality of international statebuilding', *Security Dialogue*, 53:3 (2022), pp. 256–78; Nick Bernards and Malcolm Campbell-Verduyn, 'Understanding technological change in global finance through infrastructures', *Review of International Political Economy*, 26:5 (2019), pp. 773–89; Maximilian Mayer and Michele Acuto, 'The global governance of large technical systems', *Millennium: Journal of International Studies*, 43:2 (2015), pp. 660–83. The literature on critical infrastructures in security studies is related to yet distinct from that on state formation, with a primary focus on how infrastructures become objects of protection. See, e.g., Claudia Aradau, 'Security that matters: Critical infrastructure and objects of protection', *Security Dialogue*, 41:5 (2010), pp. 491–514.

approaches, work on the politics of infrastructure have undoubtedly broken new ground in IR and enriched materialist perspectives on global politics. This work has focused on explaining the state as an effect produced by human and non-humans, pulling them together into shared ways of being in the world.²

Concepts of the state in IR have often provided a series of ‘quasi-transcendental’ attributes held to define ‘the state’, with these criteria defining state strength or weakness.³ Such approaches to the state lend themselves to reification, whereby the state takes on a solidity as a permanent object of human political organisation. By contrast, the overarching project of assemblage approaches to the state is to undermine this solidity while providing a critique of liberal state theories of state formation.⁴ Its political import is to emphasise the fragility of state power and thereby highlight the potential to create democratic human–non-human state assemblages.⁵ Infrastructures, the physical networks that circulate people, commodities, and ideas, ‘literally provide the undergirding of modern societies.’⁶ In considering the politics of infrastructure, this literature highlights an arena of political struggle traditionally excluded from IR’s purview.

Bruno Latour’s actor-network theory has been at the forefront of this reconstructed understanding of state formation; careful theoretical engagement with ANT is the starting point for any contemporary discussion of state formation and infrastructure. For ANT, the state exists as a product of networks relations between humans and non-humans. Its studies of state formation outline how states come into being – how the state, as an effect, is made by corporations, civil society movements, electricity networks, and so on. ANT stresses the contingency of the networks that make the state. While actants may come together to form the French state, the American state, or the Afghan state, they also may not, as in ANT there is no necessary relationship between actants. An ontology of ‘external relations’, in which all relations between actants in a network are incidental, allows ANT to pursue a relentless anti-structuralism that places agency at the forefront of its analytical and political programme.

ANT thus challenges traditional approaches to state formation to integrate the politics of infrastructure into their theoretical frameworks. This article accepts this challenge from the perspective of Gramscian state theory, associated with the work of Antonio Gramsci, Nico Poulantzas, and Bob Jessop. Gramscian state theory conceptualises the state as an institutional ensemble.⁷ It has carefully elaborated the complex dynamics of state power and the intersection between repressive institutions of the state and its ideological institutions, such as those concerned with

²Jan-Hendrik Passoth and Nicholas J. Rowland, ‘Modeling the state: An actor-network approach’, in Jan Peter Voß and Richard Freeman (eds), *Knowing Governance: The Epistemic Construction of Political Order* (Basingstoke: Palgrave, 2016), pp. 37–61; Jan-Hendrik Passoth and Nicholas J. Rowland, ‘Actor-network state: Integrating actor-network theory and state theory’, *International Sociology*, 25:6 (2010), pp. 818–41; Schouten, ‘The materiality of state failure’, p. 561. Timothy Mitchell, ‘The limits of the state: Beyond statist approaches and their critics’, *American Political Science Review*, 85:1 (1991), pp. 77–96, is a forerunner of this work.

³Jens Bartelson, *The Critique of the State* (Cambridge: Cambridge University Press, 2001), pp. 126, 156–69. Cf., e.g., David A. Lake, ‘The state and international relations’, in Duncan Snidal and Christian Reus-Smit (eds), *The Oxford Handbook of International Relations* (Oxford: Oxford University Press, 2008), pp. 49–51.

⁴Schouten, ‘The materiality of state failure’; Bruno Latour, *Politics of Nature: How to Bring the Sciences into Democracy* (Cambridge, MA: Harvard University Press, 2004), pp. 206–7.

⁵Latour, *Politics of Nature*.

⁶Brian Larkin, ‘The politics and poetics of infrastructure’, *Annual Review of Anthropology*, 42 (2013), p. 327. The term ‘infrastructure’ is often employed metaphorically in social theory, in contradistinction to the emphasis on its physicality in the materialist turn, as employed here.

⁷Antonio Gramsci, *Selections from the Prison Notebooks* (London: Lawrence & Wishart, 1971); Nico Poulantzas, *State, Power, Socialism* (London: New Left Books, 1978); Bob Jessop, *The Capitalist State: Marxist Theories and Methods* (Oxford: Blackwell, 1982); Bob Jessop, *State Power* (Cambridge: Polity, 2008); Stanley Aronowitz and Peter Bratsis (eds), *Paradigm Lost: State Theory Reconsidered* (Minneapolis: University of Minnesota Press, 2002); Peter Thomas, *The Gramscian Moment: Philosophy, Hegemony and Marxism* (Chicago: Haymarket, 2009); Priya Chacko and Kanishka Jayasuriya, ‘A capitalising foreign policy: Regulatory geographies and transnationalised state projects’, *European Journal of International Relations*, 24:1 (2018), pp. 82–105; Andreas Bieler and Adam David Morton, *Global Capitalism, Global War, Global Crisis* (Cambridge: Cambridge University Press, 2018).

education and culture. Gramsci's concept of the 'integral state' broadens our view of state form to analyse the internal relations between the state apparatus and civil society. Its internal-relational ontology focuses on the *necessary* relationship between different entities of social formations in the process of historical development. This includes the relations between, for instance, the past and future forms of the state. However, to date Gramscian state theory in IR has not analysed the internal relations between the production of the state and the production of its infrastructures.⁸ Studying how physical infrastructures – the 'undergirding' of societies – materialise dominant political and cultural values is necessary if Gramscian scholarship is to remain relevant in charting signally important sites of domination and contestation within and between political communities.⁹ An internal-relational ontology with its emphasis on study of social wholes and *including* their material institutions is well suited to this task.¹⁰

At the same time, Gramscian state theory provides a useful corrective to two limitations of ANT. First, ANT's ontology treats the state as separate from society, as one actor among a field of other actors; this naturalises an historically rooted transformation in political order – the differentiation of public and private spheres – and inadvertently suggests the state sits above or separate from society, as in liberal theories of the state.¹¹ Second, the coupling of an external-relational ontology to an occasionalist view of causation conceives of actants as lacking temporally enduring properties. ANT thereby struggles to conceive the temporalities of infrastructural state formation. The distinction between ANT's external-relational ontology and a Gramscian philosophy of internal relations is sharpest at this latter point. It defines the historical sensibilities of each approach and their ability to explain patterned forms of socio-technical reproduction – including the reproduction of relations of dominations and inequality.

This argument will proceed as follows. First, it will briefly outline the new political sociology of state formation which has emerged through interdisciplinary engagement with materialist social theory. Focusing on ANT, it will describe how this literature has extended our understanding of the state through its focus on the infrastructural bases of political order. Second, it will explain how Latour's external-relational ontology treats relations between actors as contingent, rather than necessary, in the production of a given 'matter of concern'. Third, the paper will outline Gramscian state theory, with a particular focus on Gramsci's concept of the integral state and its ontology of internal relations. This section will clarify Gramsci's ontological and methodological approach to dissecting the necessary relations between civil society, the state apparatus, and its infrastructure. It will emphasise state formation as a historical process, with the 'strategic selectivity' of the state apparatus shaping social forces and political strategies in pursuit of specific techno-political projects.

Finally, the utility of the Gramscian state-theory approach will be demonstrated through an analysis of the relationship between the US nuclear-complex infrastructure, state making, and civil defence education in the early Cold War period. Embracing a national security strategy centred on the bomb occasioned a paroxysm of state building. US officials were determined to inculcate a set of civilian practices and values that would prevent panic among the public in the event of a nuclear conflict, thereby establishing the credibility of second-strike deterrence to the Soviet

⁸ On this lacuna in Gramscian IR, see Daniel R. McCarthy, 'The meaning of materiality: Reconsidering the materialism of Gramscian IR', *Review of International Studies*, 37:3 (2011), pp. 1215–34; cf. Bieler and Morton, *Global Capitalism, Global War, Global Crisis*.

⁹ McCarthy, 'Meaning of materiality'.

¹⁰ Among STS scholarship, Thomas Hughes's work on Large Technical Systems (LTS) is most closely related to the internal-relational ontology deployed here, with his focus on physical infrastructure as a component of a system of necessarily interrelated parts including social and political institutions.

¹¹ See, e.g., Martin Carnoy, *The State & Political Theory* (Princeton, NJ: Princeton University Press, 1984), pp. 37–9. Ellen Meiksins Wood, 'The separation of the economic and political in capitalism', *New Left Review*, 1:127 (1981), pp. 66–95; John L. Brooke and Julia C. Strauss, 'Conclusion: Notes towards a global synthesis', in John L. Brooke, Julia C. Strauss, and Greg Anderson (eds), *State Formations: Global Histories and Cultures of Statehood* (Cambridge: Cambridge University Press, 2018), pp. 347–9; Mitchell, 'The limits of the state', *passim*.

Union. Yet the strategic selectivity of the American state prevented easy recourse to mandatory civil defence training. As a result, American officials pursued educational-cultural hegemony around nuclear weapons, working through civil society and in partnership with private-sector actors. Civil defence education was internally related to the national security project of unifying American political order around its new nuclear infrastructure and the processes of state formation that this occasioned. The relations between civil society, political society, the state apparatus, and nuclear infrastructure constituted a necessary whole in making an American nuclear weapons state.

This article makes three primary contributions to the literature on infrastructure and state formation in IR. First, it clarifies the stakes of embracing different relational ontologies for the study of state formation and infrastructural politics, highlighting points of convergence and divergence and the relationship between these ontological positions and their accompanying political projects. This contribution is not intended as a knock-down argument of ANT but rather an attempt at deeper theoretical engagement between two broadly ‘critical’ strains of thought in IR-STS. Second, it develops a Gramscian historical sociology of infrastructure and state formation, filling a gap in studies of infrastructure and state formation in IR and in Gramscian IR theory. Finally, it highlights the value of employing a processual sociology of infrastructural state formation which can construct plausible future pathways of socio-technical orders based on their past and present internally related properties. It assists us in identifying futures which are more and less desirable and how we might act to shape the politics of technological design to realise these.¹² As IR-STS seeks to make design more humanitarian, or more democratic, or more representative, creating future counterfactuals of potential state-infrastructural forms and locating these within world historical processes emerges as an important task in IR, one grounded in our ontologies of social change.

Materiality in the new political sociology of state formation

The political sociology of state formation has undergone a significant change over the past two decades. Barring scholarship from currents of ‘Big History’ and early world history, studies of state formation traditionally focused almost exclusively on human social relations.¹³ The infrastructural basis of the state, through which infrastructure acts as the ‘connective tissue’ of the body politic, was largely treated as an uninteresting by-product of social relations.¹⁴ Where technological objects have been considered as important causal factors in the process of state formation, as in, for instance, Lynn White’s emphasis on the development of the stirrup as crucial to early modern European state transformation, they have been treated deterministically.¹⁵ By contrast, in the wake of the material turn across the social sciences and humanities since the turn of the century, state formation has been recognised as a complex process through which humans and non-humans, infrastructure and ideas, technology and culture, and society and nature co-produce specific forms of life within and between political communities over time.¹⁶ Political struggles over

¹²See, e.g., Jonathan Luke Austin, ‘Towards an international political ergonomics’, *European Journal of International Relations*, 25:4 (2019), pp. 979–1006.

¹³Schouten, ‘The materiality of state failure’, pp. 553–6. For a sample literature from world history with a wider view of relevant actors, see Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: W.W. Norton, 1997); Leo Gumilev, *Ethnogenesis and the Biosphere* (London: Progress Publishers, 1978); William H. McNeill, *Plagues and Peoples* (New York: Anchor Books, 1976).

¹⁴Martin Coward, ‘Hot spots/cold spots: Infrastructural politics in the Urban Age’, *International Political Sociology*, 9:1 (2015), p. 96; Larkin, ‘The politics and poetics of infrastructure’, *passim*.

¹⁵Antoine Bousquet, ‘A revolution in military affairs? Changing technologies and changing practice of warfare’, in Daniel R. McCarthy (ed.), *Technology and World Politics: An Introduction* (London: Routledge, 2018), pp. 170–2.

¹⁶This literature is now vast. For a small cross-disciplinary sample, see Andrew Barry, *Material Politics: Disputes along the Pipeline* (Oxford: Wiley, 2013); Patrick Carroll, *Science, Culture, and Modern State Formation* (Berkeley: University of California Press, 2006); Jairus Grove, *Savage Ecology* (Durham, NC: Duke University Press, 2020); Shelia Jasanoff (ed.), *States of Knowledge: The Co-Production of Science and the Social Order* (London: Routledge, 2004); Joseph P. Masco, *The Nuclear Borderlands: The Manhattan Project in Post-Cold War New Mexico* (Princeton, NJ: Princeton University Press, 2006).

the form, function, location, distribution, and reproduction of infrastructure are now a central focus of literature on state formation.

Actor-network theory (ANT) is the most high-profile theoretical framework informing these reconsiderations of state formation, particularly in International Relations.¹⁷ As the basic outlines of ANT are by now well known in IR, this discussion will concentrate on the conceptualisation of the state and processes of state formation by ANT-inspired scholarship.¹⁸ Moreover, we will focus particularly on Bruno Latour's work as the mainspring of ANT in IR; while Latour is not the sole mover or representative of this tradition, he remains its foremost exponent and its main reference point in the discipline.

ANT's approach to state formation is rooted in Latour's attempt to unmake the analytical division between the 'two houses' of the 'modern Constitution', those of science and politics, which underpin traditionally dominant approaches to political philosophy and social theory.¹⁹ For Latour, the division of the world into two distinct spheres of science and politics, or nature and culture, obscures the composition of politics through the creation of human–non-human assemblages. Instead of operating with a predefined notion of politics as solely pertaining to human social relations, Latour expands the definition of politics to embrace 'the entire set of tasks that allow the progressive composition of a common world.'²⁰ Crucially, composition is performed by human and non-actants. Latour thereby proposes an ontological, rather than methodological, symmetry. Studying state formation requires that we attend to the creation of state apparatuses as traditionally conceived – police, military, judiciary, and so forth – through their entanglement with infrastructures, laboratories, baboons, weather, and the like, to name just a few actants composing the state. In Latour's succinct formulation, 'to the liberal state is opposed the *liberated* state, a state free of all forms of naturalization.'²¹ Analysing the production of the state requires no distinctive methodological or conceptual tools; there is nothing special about the state as an effect of assemblages in contradistinction, for instance, to public transportation networks as an effect of assemblages.²² The 'quasi-transcendental' definitions of the state mentioned above are, for Latour, themselves part of the composition of stateness. Thus, representations of the state as a unitary actor are folded into the analysis as one part of the larger assembly of the state.²³

Infrastructure matters as much as juridical, executive, legislative, or other formally 'political' institutions, and formal institutions matter as much as infrastructure. As Peer Schouten summarises, 'political society is thus a society assembled, infused, kept together and emergent out of the mediations of human interaction by *other* things ... political society is a socio-material (or material-semiotic) construction.'²⁴ In this way, infrastructure such as roads, telecommunications, electricity, or hydrological networks 'act' in a network as a link in the pursuit of a strategic political

See Patrick Carroll, 'Articulating theories of states and state formation', *Journal of Historical Sociology*, 22:4 (2009), pp. 553–603, for a very good survey that bridges STS and historical sociology.

¹⁷Larkin, 'The politics and poetics of infrastructure', *passim*; Latour, *Politics of Nature*, pp. 201–9, 247. In IR, see Schouten, 'The materiality of state failure'; Jan Bachmann and Peer Schouten, 'Concrete approaches to peace: infrastructure as state-building', *International Affairs*, 94:2 (2018), pp. 381–98; Peer Schouten and Jan Bachmann, 'Buffering state-making: Geopolitics in the Sudd marshlands of South Sudan', *Geopolitics OnlineFirst*, available at <https://www.tandfonline.com/doi/full/10.1080/14650045.2020.1858283>; Passoth and Rowland, 'Actor-network state'; Bakonyi, 'Modular sovereignty and infrastructural power'.

¹⁸For Latour's view of IR, see Mark B. Salter and William Walters, 'Bruno Latour encounters International Relations: An interview', *Millennium: Journal of International Studies*, 44:3 (2016), pp. 524–46.

¹⁹Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993); Latour, *Politics of Nature*.

²⁰Latour, *Politics of Nature*, pp. 53, 247, *passim*.

²¹*Ibid.*, p. 206. Emphasis in original.

²²Latour, *Politics of Nature*, *passim*; Schouten, 'The materiality of state failure', p. 561; Bruno Latour, *Aramis, or the Love of Technology* (Cambridge, MA: Harvard University Press, 1996).

²³Carroll, 'Articulating theories of states and state formation', p. 571.

²⁴Schouten, 'The materiality of state failure', p. 560, emphasis in original; Passoth and Rowland, 'Actor-network state', p. 825, *passim*.

project, such as the construction of an ostensibly unified nation-state. To echo one of Latour's most famous aphorisms, infrastructure makes society durable.

Schouten and Jan Bachmann offer a fascinating recent example in their analysis of infrastructure and state-building projects undertaken by the United Nations and other international development actors. Bachmann and Schouten detail how the investment in infrastructure emerges as a key node in the creation of a peace-building network in which quantifiable outputs are defined as the standard of success for the international development community. As they note:

Infrastructure is so pervasive in contexts of intervention precisely because it can be construed as a 'concrete' output towards a wide variety of goals on the peace-development nexus. Infrastructure seems particularly amenable to a mode of operation, deeply ingrained in contemporary stabilization efforts, in which the main focus is on high numbers of concrete deliverables.²⁵

While donors and host-country governments attempt to overcome political divisions through nation-binding infrastructures, these material objects are often not suited to local contexts, introduced without consideration of how to appropriately embed infrastructures into settings distinct from their place of origin. Rather than meeting peace-building aims, local actors can tap into these large-scale infrastructural projects to enrich themselves at the cost of local peace and stability. Infrastructural development need not generate the outcomes intended by donors. Instead, it becomes part of other, stronger networks to achieve a different set of strategic aims. This notion of infrastructure 'acting' highlights its dynamic causal role in generating political outcomes, in contrast to the passive view of infrastructure which has traditionally constituted approaches to state formation in IR.²⁶

ANT does not present an alternative a priori set of ontological assumptions about the symmetry of the division between human and non-humans in any given network; it allows that *any* 'actant' could exercise agency, or causal power, in the constitution of any matter of concern.²⁷ Rather, it seeks to unmake *a priori* judgements as such, disposing of established sociological categories of power, structure, and agency in favour of network-centric ethnographies.²⁸ And, while the much-discussed and often misunderstood former move is ANT's largest claim to fame, this second theoretical move – the rejection of structural analysis of any sociological stripe in favour of a 'flat ontology' – is equally important, and of signal importance to our present discussion. ANT's thoroughgoing empiricism informs its ethnographic methodology. It asks that we 'follow the actors' as they compose what are always contingent, fragile, and local networks, including the state.

Where the state has been ontologised as an overwhelming force dominating society – the State – ANT whittles away at its purported concreteness. ANT's deconstructive impulse is designed to highlight the fragility of state power. It reduces the state to an effect of practice, in line with what Brooke and Strauss identify as the 'culturalist' tradition of state theorising.²⁹ What emerges is an analysis of state formation as it occurs through everyday practices that constitute and repair it. This focus on reproduction is a significant strength of the ANT approach to the state, albeit one shared

²⁵Bachmann and Schouten, 'Concrete approaches to peace', p. 389.

²⁶Bachmann and Schouten, 'Concrete approaches to peace', p. 387.

²⁷For sympathetic critical discussions, see Edwin Sayes, 'Actor-network theory and methodology: Just what does it mean to say that nonhumans have agency?', *Social Studies of Science*, 44:1 (2013), pp. 134–49; Jacqueline Best and Williams Walters, "'Actor-network theory" and international relationality: Lost (and found) in translation: Introduction', *International Political Sociology*, 7:3 (2013), p. 332.

²⁸Mark B. Salter, 'Security actor-network theory: Revitalizing securitization theory with Bruno Latour', *Polity*, 51:2 (2019), pp. 349–64. That ANT rejects the agent-structure problem is sometimes overlooked in IR: cf. Best and Walters, 'Actor-network theory and international relationality', p. 332.

²⁹John L. Brooke and Julia C. Strauss, 'Introduction: Approaches to state formation', in John L. Brooke, Julia C. Strauss, and Greg Anderson (eds), *State Formations: Global Histories and Cultures of Statehood* (Cambridge: Cambridge University Press, 2018), pp. 1–21.

by other political sociologies of state formation.³⁰ Curiously, and somewhat idiosyncratically, this is paired with an ontology in which the state, when ‘black boxed’ as part of a network producing another effect such as security politics, reappears as autonomous from its society. ANT thereby sits between theories of state autonomy and embeddedness; how the state is understood varies according to the object of study. Actants produce the state, and the state can be an actant in turn. There is, however, an analytical cost in this unwavering commitment to ‘following the actors,’ beyond the methodological difficulties of gaining access to actants’ voices.³¹

ANT’s empiricism misses the constitutive institutional divisions of a given political society, inadvertently mirroring the ahistoricism of liberal approaches to the state even as it criticises liberal social-contract theories. By charting the vast range of actants involved in performing the state, ANT captures the proliferation of actors who produce a singular and local socio-technical settlement. This helpfully shifts our focus away from strictly elite-focused accounts. Yet the constitution of these actors is based on an historically prior series of institutional divisions between public, private, economic, political, and so forth, which define actors and their structural location within a wider social field.³² For corporations, educational associations, religious groups, political parties, and government to exist as formally independent actors brought into ‘association,’ there must be an already-existing state form in which public and private actors are functionally differentiated. ANT’s methodology risks reproducing the phenomenal appearance of the liberal state form, including the appearance of state autonomy.

The methodological limits of ANT’s empiricism are underpinned by Latour’s external-relational ontology which treats actants as singular, discrete, and independent objects *externally* related to each other. Peer Schouten spells out this assumption: ‘If the natural state of things is to be unconnected, and for interaction to be unmediated, then the central research problem for ANT studies becomes accounting for mediated interaction.’³³ As Bertell Ollman notes, ontologies of external relations view the ‘conjunction’ between actors as existing ‘only where found and disappears once the investigator’s back is turned, having to be explained and justified anew.’³⁴ Latour’s ‘occasionalist’ ontology is of this type, in which the relationships between actants in ANT are always contingent. Graham Harman captures the temporal aspect of Latour’s thought with clarity: ‘We have seen that his entire cosmos is made of nothing but individual actors, events fully deployed at each instant, free of potency or other hidden dimensions lying outside their sum of alliances in any given moment.’³⁵ In this way the state can be understood as monad, autonomous from other actants, *and* as embedded in a ‘sum of alliances’.

It is never the case, for Latour, that two actants should be understood as mutually constitutive of each other; they are not parts of a larger whole. Their relations are those between two independent objects whose connection is always fleeting and always in need of renewal. Latour’s work conveys a sense of ahistoricism as a result, captured, as Harman notes, in the claim that ‘everything only happens once, and at one place.’³⁶ What is perceived as temporal endurance is continuous active

³⁰ E.g., Peter Bratsis, *Everyday Life and the State* (London: Routledge, 2006); Brooke and Strauss, ‘Introduction’, pp. 7–8.

³¹ Critical assessments of ANT have long argued that a focus on following networks of actors can ignore subaltern actors unable to make a mark on a given material-semiotic assemblage: see, e.g., Shelia Jasanoff, ‘Future imperfect: Science, technology, and the imagination of modernity’, in Shelia Jasanoff and Sang Hyun-Kim (eds), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (Chicago: University of Chicago Press, 2015), pp. 18–19.

³² Ellen Meiksins Wood, *The Origin of Capitalism: A Longer View* (London: Verso, 2002); Bieler and Morton, *Global Capitalism, Global War, Global Crisis, passim*.

³³ Schouten, ‘The materiality of state failure’, p. 560.

³⁴ Bertell Ollman, *Dance of the Dialectic: Steps in Marx’s Method* (Chicago: University of Illinois Press, 2003), p. 27.

³⁵ Graham Harman, *The Prince of Networks* (Melbourne: Re:press, 2009), p. 30. We are focusing on the ‘early’ Latour, rather than the ‘late’ Latour of ‘plasmas’ and reserve armies, as ‘early’ Latour remains the most prominent application of ANT ideas in IR.

³⁶ Harman, *The Prince of Networks*, p. 17. See also Dave Elder-Vass, ‘Disassembling actor-network theory’, *Philosophy of the Social Sciences*, 45:1 (2015), pp. 100–121 (pp. 105–6, *passim*). Elder-Vass views Latour’s work as historical, in contrast to the position taken here.

renewal, endurance operating as a useful fiction but nothing more.³⁷ As each historical moment is unique, one cannot make generalisations extending from one moment to the next. Moreover, with an emphasis on contingency and a rejection of any theory of causal powers possessed by things, institutions, people, or infrastructures, ANT forecloses the possibility of studying the potential future historical development of a given socio-technical order. The adoption of a flat ontology entails a rejection of historical and temporal endurance of objects, actants, or institutions. This can lead to difficulties in conceptualising the relationship between power, infrastructure, and state formation.

A brief example can clarify what is at stake in this embrace of occasionalism. Consider the difference between a Marxist internal-relational ontology of infrastructure and political order and Latour's occasionalist alternative.³⁸ Marxist ontologies of international relations claim a necessary link between infrastructure and specific historical social formations, most famously in Marx's methodological claim that 'the hand-mill gives you society with the feudal lord; the steam-mill society with the industrial capitalist'.³⁹ By studying the steam mill, we can, for Marx, map out its structurally coupled social formation, identifying the kinds of political, economic, and cultural institutions which must exist to bring about this technological artefact, and vice versa. Once a steam mill is created, it possesses powers which may or may not be activated in the future, depending on the wider socio-technical relations of which they are a part.

This view of power as a relationally produced and productive capacity lies at the heart of concepts of power in critical social theory. And these emergent powers exist as part of the object regardless of their activation – they are latent causal properties, of the kind Latour would reject. In other words, the objects and institutions that populate Marx's historical sociology have at least partially enduring powers rather than mere fleeting agency, even allowing that these will change and decay over time. Historical development sits at the heart of this processual account. The history of a technological artefact is internally related to its own possible future forms. Necessary relations exist between the current form of political institutions or infrastructures and their future incarnation as an extension of these potentials. Infrastructure and state form are internally related parts of a larger whole-in-process coming into being.

By contrast, Latour's occasionalism treats the steam mill, the bush pump, highways, as only contingently related to the social formation of which they are a part.⁴⁰ There is no latent power in the steam mill or the bush pump that is activated in a network; because actants do not exist in an internal relation to each other, they can, in principle, exist in a network with any other actant. But if this is the case, it makes it hard to explain how the introduction of new infrastructural projects disrupts settled political orders.⁴¹ Counter-intuitively, it suggests that the bush pump, for instance, does not carry any 'politics' with it because it has no enduring properties, no causal powers, nothing to be activated or diverted or remade.⁴² Yet whether or not a given infrastructural state is created,

³⁷Jeremy Tirrell, 'Latourian *memoria*', in Paul Lynch and Nathaniel Rivers (eds), *Thinking with Bruno Latour in Rhetoric and Composition* (Carbondale: Southern Illinois University Press, 2015), pp. 171–5.

³⁸Latour's somewhat cryptic remarks on dialectical thought suggest it simply 'beats around the bush' of resolving the antinomies that pervade social theory. Unfortunately, this reading is not substantiated through close argument and seems to rely on a reading of dialectics as a stereotypical triad of 'thesis–antithesis–synthesis'. Cf. Latour, *We Have Never Been Modern*, pp. 54–9; Ollman, *Dance of the Dialectic*, pp. 12–13, *passim*.

³⁹Karl Marx, *The Poverty of Philosophy* (New York: Progress Publishers, 1955), available at <https://www.marxists.org/archive/marx/works/1847/poverty-philosophy/index.htm>. Marx's statement has traditionally been understood as the causal claim of a technological determinist – the hand mill *causes* feudalism – when it is a *methodological* claim appearing in a chapter on the method of political economy.

⁴⁰Marianne de Laet and Annemarie Mol, 'The Zimbabwe bush pump: The mechanics of a fluid technology', *Social Studies of Science*, 30:2 (2000), pp. 225–63; Bueger and Stockbruegger, 'Actor-network theory', p. 51.

⁴¹Dmitrios Strokos, 'China, India, and the social construction of technology in international society: The English School meets Science and Technology Studies', *Review of International Studies*, 46:5 (2020), pp. 713–31; Jon Schmid and Jonathan Huang, 'State adoption of transformative technology: Early railroad adoption in China and Japan', *International Studies Quarterly*, 61:3 (2017), pp. 570–83.

⁴²Langdon Winner, 'Do artefacts have politics?', *Daedalus*, 109:1 (1980), pp. 121–36.

or whether or not a particular state effect is pursued, is hard to capture without an account of the structural conditions of emergence of historically constituted, temporally enduring internal relations between institutions, artefacts, and their powers.

Gramscian state theory: Internal relations and strategic selectivity

Gramscian state theory is not quite a 'paradigm lost' in International Relations. As one would expect, Marxist and Gramscian approaches in IR have productively drawn on Gramsci's, Poulantzas's, and Jessop's theories of the state.⁴³ And, while nearly entirely neglected by realist or liberal institutionalist accounts of the state in IR, historical sociologists and critical theorists working outside the Gramscian tradition have nevertheless developed their work in conversation with Gramscian state-theoretical approaches.⁴⁴ As such, a full recounting of the development of the Gramscian state-theoretical approach is unnecessary here. Instead, we will lay out the main arguments of this approach, first introducing Gramsci's concept of the 'integral state' as the product of historical analysis rather than logical deduction.

The starting point for a Gramscian state-theoretical account of liberal democratic capitalist states is a historically grounded concept: the 'integral state'.⁴⁵ Classically expressed in his abbreviated formula 'state = political society + civil society', the concept was intended to capture the 'dialectical unity of the moments of civil society and political society'.⁴⁶ Whereas liberal state theory treats private and public as separate spheres, Gramsci treats this apparent separation as the form of appearance of modern political power in its hegemonic and coercive moments. The integral state is constituted by the necessary interpenetration of the state apparatus, as the formal juridical, representative, educative, policing, and military institutions; political society, as the realm of political organisation which exceeds the formal state apparatus; and civil society, understood as the arena of private social and economic organisation. The formal state apparatus is an institutional ensemble, rather than a unitary actor, over which and *through* which social forces engage in political struggle. In Nico Poulantzas's seminal formulation of this idea – an idea suggestive for how to conceptualise infrastructure – the state apparatus is the 'material condensation' of the balance of power between social forces.⁴⁷ In contrast to (some) liberal accounts, states do not act as a neutral arbiters between competing interest groups; the state apparatus is biased towards the interests of specific social groups.

Gramsci formed the integral state concept through careful historical research into processes of European, and particularly French, state formation during the long 19th century.⁴⁸ He sought to understand the transition in state form occasioned by the French Revolution, in which the *ancien régime* state, practically and conceptually an authority sitting at a remove from its society, came to be replaced by a bourgeois state which percolated throughout an emergent civil society. Whereas pre-capitalist states were constituted through a unity of political and economic authority, the state in capitalist societies was formally removed from the operation of market-based economic processes. The bourgeois state thereby achieved 'relative autonomy' from the economy and, with it, the appearance of a division between public 'political' sphere and the private 'economic' sphere. The task of the integral state, as it emerged in the 19th century, became educative and cultural:

⁴³E.g., Marjo Koivisto, 'State theory in International Relations: Why realism matters', in Jonathan Joseph and Colin Wight (eds), *Scientific Realism and International Relations* (London: Palgrave, 2010), pp. 69–87; Chacko and Jayasuriya, 'A capitalising foreign policy'; Bieler and Morton, *Global Capitalism, Global War, Global Crisis*, pp. 107–30, *passim*.

⁴⁴Bartelson, *The Critique of the State*, pp. 116–48; John M. Hobson, *The State and International Relations* (Cambridge: Cambridge University Press, 2000), pp. 109–44. Cf. David Lake, 'The state and international relations', pp. 41–61.

⁴⁵Thomas, *The Gramscian Moment*, pp. 140–241, *passim*. The following two paragraphs are indebted to Thomas's account.

⁴⁶Thomas, *The Gramscian Moment*, p. 137.

⁴⁷Poulantzas, *State, Power, Socialism*, pp. 128–9; Jessop, *State Power*, pp. 118–39.

⁴⁸*Ibid.*; Poulantzas, *State, Power, Socialism*, pp. 57–60; For surveys of Marxist state theories, see Jessop, *The Capitalist State, passim*; Jessop, *State Power*, pp. 54–62.

this was the means through which leadership of the new political order could be established and legitimated.

An ontology of internal relations underpins this account in three ways.⁴⁹ First, each aspect of the integral state exists in a necessary internal relation with its ostensible opposite. In contrast to liberal state theory, in which civil society is portrayed as the antithesis of the state, for Gramsci society relations between actors within civil society are also part of the form of the state *and* the relation between civil society and the state. Complex relations between capital and labour in civil society shape strong legal-coercive protection for private property rights and the legal establishment of the right to collective bargaining, embedding, at least partially, the contradictory and antagonistic relations in civil society within the form of the state apparatus. Elements of coercion and consent, or domination and hegemony, cut across both spheres. The coercive power of the liberal state establishes civil society as a separate sphere and uses the state cultural-educational apparatus to reinforce the leadership – hegemony – of social forces in that sphere.

As Bob Jessop highlights, the form of state institutions shapes actors' political strategies and social relations within political and civil society, an outcome he calls the 'strategic selectivity' of the state.⁵⁰ For instance, the presence of institutions of representative democracy makes the realisation of socialism through democratic means a plausible strategy of socialist movements. The precise shape of democratic institutions in different countries impacts such strategies; the US Senate is designed to be unrepresentative, placing a brake on the power of popular majorities.⁵¹ By contrast, where a state lacks democratic institutions a strategy of mass-party building makes little sense. Strategic selectivity shapes actors' political strategies and their abilities to realise their aims.

Second, state theory, with its ontology of internal relations, is always historical. It emphasises, as the empirical analysis below demonstrates, that institutions in civil society or the formal state contain sediments of their historical development and potential future forms. Relatedly, ontologies of internal relations conceptualise power as capacities possessed by actors, artefacts, or institutions, which may or may not be realised at a given moment in time. In other words, an internal-relational ontology allows that entities and relations may be relatively enduring parts of an overarching socio-technical structure.⁵² Entities and relations are certainly always changing, but not necessarily at the same pace; Gramscian theory employs a differentiated historical ontology. Uranium and plutonium decay so slowly that nuclear-waste management is a political project internally related to nuclear infrastructures that will endure for centuries.⁵³ It is, after all, the relative endurance of physical infrastructure which accounts for its importance as an element of state formation. This is a processual conception of structure.⁵⁴ Viewing internal relations as structured enables the analysis of relations of power as they endure over time, a significant point of distinction vis à vis Latour's occasionalism.⁵⁵

Finally, methodologically Gramscian state theory entails a shift away from treating history as a proving ground for a preconceived philosophy of history. Instrumentalist, functionalist, or 'derivationist' Marxist state theories proceed deductively from the logic of capital towards its necessary political form. By contrast, Gramsci's theoretical concepts emerged in the course of historical

⁴⁹ On the philosophy of internal relations, see, e.g., Ollman, *Dance of the Dialectic, passim*; McCarthy, 'The meaning of materiality'; Bieler and Morton, *Global Capitalism, Global War, Global Crisis, passim*. See Shannon Brincat, 'Dialectics and world politics: The story so far ...', *Globalizations*, 1:5 (2014), pp. 587–604, for a survey of the range of dialectical thought in IR.

⁵⁰ Jessop, *State Power*.

⁵¹ Daniel Lazare, 'America the undemocratic', *New Left Review*, 1:232 (1998), pp. 3–40.

⁵² Relations are generative of this totality, not expressive of it.

⁵³ Masco, *Nuclear Borderlands*, p. 18.

⁵⁴ Ollman, *Dance of the Dialectic*, pp. 45–6, 49–50.

⁵⁵ Shelia Jasanoff, 'Future imperfect', pp. 18–22; Benjamin Noys, 'The discreet charm of Bruno Latour', in Jernej Habjan and Jessica Whyte (eds), *(Mis)readings of Marx in Continental Philosophy* (Basingstoke: Palgrave, 2014), pp. 195–210.

research in which the emphasis on historical difference, specificity, and multiplicity is purposefully designed to guard against schematic and deductive positivist sociologies.⁵⁶ This is particularly relevant for our analysis of infrastructure and national security education in the United States, as the process of American state formation significantly differed from the French experience, and the European experience more broadly. Whereas the continual expansion of the state apparatus began itself to colonise the terrain of civil society in the centralising state-formation process in Europe, in the United States a series of institutional barriers were erected to fragment federal-state authority, as in the constraints placed around federal authority over education. This, in turn, has shaped the historical trajectory of struggles over hegemony in the educational-cultural sphere in America. Far from placing ‘capitalism’ as a master variable explaining all social outcomes – *pace* Latour’s criticism of Marxist social theory – Gramsci’s method emphasised the historically grounded nature of its conceptual abstractions and the contingency of those abstractions.

At times, the distance between the Marxist and ANT projects can seem quite large, and a synthesis of these frameworks would do a disservice to the stated political impulses behind their respective social theories. In traditional left–right terms, Gramscian state theory is clearly socialist in orientation, while Latour’s (somewhat ambiguous) politics are best classed as centrist.⁵⁷ Nevertheless, the theoretical distance between Gramscian state theory and ANT is not always as great as it may seem. State-theoretical approaches are not trying to develop a general theory of the state.⁵⁸ Indeed, Poulantzas makes this quite explicit in his seminal *State, Power, Socialism*, anticipating later criticism of generalising social theory developed by Latour among others, in a passage worth quoting at length:

For it is precisely one of the merits of Marxism that, in this and other cases, it thrust aside the grand metaphysical flights of so-called political philosophy – the vague and nebulous theorizations of an extreme generality and abstractness that lay claim to lay bare the great secrets of History, the Political, the State, and Power ... The philosophical fraternity may be enjoying itself in France, but in the end none of this is really very funny. For the genuine problems are too serious and complex to be resolved by pompous and ultra-simplistic generalizations that have never succeeded in explaining anything whatsoever.⁵⁹

Here, we can see affinities between the state-theoretical approach and the idiographic emphasis of ANT. Similarly, Gramscian state theory does not rely on an a priori concept of the state as a unitary actor; it sees unitary action as a potential achievement by state managers at specific historical junctures.⁶⁰

The crucial point is that the rejection of a generalised theory of all states, or even of all capitalist states, need not entail an embrace of a contingency *tout court*. Rather, it is possible to both attend to the historical-institutional dynamics of state formation of specific societies over time *and* to prevent this from ossifying into a reductive account of state formation and reproduction. In sum, a dialectical-relational and processual theory of the state captures enduring forms of hierarchy and political domination without these solidifying into a singular explanatory master variable.

We can now see the shape of a Gramscian state-theory approach to infrastructure. First, projects of infrastructural development emerge as sites of struggle between social forces contesting their development across the spheres of the integral state. Social forces seek to enact ‘technological

⁵⁶ Joseph Buttigieg, ‘Gramsci’s method’, *Boundary 2*, 17:2 (1990), pp. 60–81; Gramsci, *Selections from the Prison Notebooks*, pp. 321–471; Thomas, *The Gramscian Moment*, pp. 140–57.

⁵⁷ Graham Harman, *Bruno Latour: Reassembling the Political* (Cambridge: Pluto, 2013), p. 5; Harman, ‘Entanglement and relation’, pp. 44–5. Latour’s greatest affinity in IR remains the Realist tradition, as indicated by his early engagement with Hobbes. See Latour, *We Have Never Been Modern*; Harman, *Bruno Latour*.

⁵⁸ Jessop, *The Capitalist State*, pp. 211–13; Jessop, *State Power*, p. 14; Poulantzas, *State, Power, Socialism*, p. 19; Ollman, *Dance of the Dialectic*, pp. 193–214.

⁵⁹ Poulantzas, *State, Power, Socialism*, pp. 20–1.

⁶⁰ Jessop, *State Power*, p. 37.

closure' around an infrastructural system, although how they do so remains an open historical question.⁶¹ One cannot know in advance whether or not state coercion, cultural hegemony in civil society, or – most likely – a complex intersection of the two will be pursued to realise social actors' infrastructural projects. Second, the abstractions required to make sense of infrastructure and state formation must be historical, of appropriate generality, and able to analyse specific internal relations as parts of an evolving social whole.⁶² In the case of the American state, for instance, civil society operated as a significant site of power in the cultural-educational legitimation of nuclear infrastructure due to the historical legacies of US state formation, as detailed further below.

Finally, using these concepts as part of a method of incorporated comparison analyses these specific processes as part of the evolving social totality that is world history writ large.⁶³ Incorporated comparisons do not attempt to generalise from individual case studies. Rather, they view individual cases as internally related to other cases as parts of a larger process of world historical development. In this way, incorporated comparison treats international relations as internal to social development within states, in contradistinction to the dominant methodological nationalism of comparative case-study methods. In the empirical analysis below, the process of infrastructural state formation is generated through the 'lateral' causality of the international. In addition to geopolitical competition with the Soviet Union, American nuclear infrastructures were generated by forms of inter-societal comparison and competition constituted by the international and its manifestations in the specific colonial history of the United States.

The materialisation of cultural and political biases – such as the biases of a national security strategy centred on nuclear deterrence, detailed below – emerging from the development of infrastructure subsequently mediates relations within different social forces within the state, between different facets of the 'integral' state, and between the state apparatus and other political communities across the global political system. Closure brings with it the routine reproduction of an infrastructural system which is no longer an object of social and political contestation. Again, to foreshadow the argument below, once dominant social forces in American society achieved a consensus that the establishment of a nuclear deterrent was the sole means to combat global communism, the reproduction of nuclear infrastructure became an accepted – indeed, largely unquestioned – facet of American political life.

How closure occurs is dependent on the 'strategic selectivities' present in a given state form, and it is here that an emphasis on the *enduring* powers of internally related objects and institutions becomes a central point of importance. Where state power is concentrated in legal-coercive state apparatuses, the process of building a road or rail network may involve significant coercion to clear slums or expropriate farmland, instituting a 'regime of dispossession'.⁶⁴ Alternatively, where representative democratic institutions are highly institutionalised, as in the United States, contestations over the right to order a given space via infrastructure cannot legitimately be conducted through legislated violence. Instead, feasible political strategies require the cultural and educational apparatuses of the state to frame a given infrastructural project as rational, modern, aesthetically pleasing, or some combination of cultural values through which consent to an infrastructural project can be gained. And just as the form of the state is the materialisation of political struggle, so too is the form of infrastructures the materialisation of prior political contests. Infrastructures thereby exercise their own strategic selectivity.

These abstract remarks suggest a level of coherence and direction to the design, development, and deployment of infrastructure which belies the messy lived realities of infrastructural

⁶¹Daniel R. McCarthy, *Power, Information Technology, and International Relations Theory: The Power and Politics of US Foreign Policy and the Internet* (London: Routledge, 2015), pp. 8, 52–5, 101–21, *passim*.

⁶²Ollman, *Dance of the Dialectic*, (2003), pp. 73–86.

⁶³On the method of incorporated comparison, see, e.g., Philip McMichael, 'World-systems analysis, globalization, and incorporated comparison', *Journal of World-Systems Analysis*, 6:3 (2000), pp. 668–89.

⁶⁴See, e.g., Mark Levien, 'From primitive accumulation to regimes of dispossession: Six theses on India's land question', *Economic & Political Weekly*, 50:22 (2015), pp. 146–57.

politics. The following section examines the relationship between nuclear infrastructure, civilian defence education, and processes of state formation in the United States during the early Cold War. This section, based upon secondary readings, is not intended to provide a novel account of the development of nuclear weapons, of their embrace by the US national security community, or of American civil defence education. Rather, this analysis highlights the importance of the historical-institutional legacies and strategic selectivity of the American integral state. These enduring facets of the American state form pressed social actors to embrace cultural-educational initiatives as a core element in the construction of an integral American nuclear weapons state.⁶⁵

Nuclear weapons infrastructure, civil defence education, and the American national security state

The United States nuclear infrastructure emerged out of the Second World War an already deeply embedded feature of American geography. By the end of the war, it stretched across the entirety of the continental United States, comprised of nuclear reactors in Tennessee and Washington state, weapons-research laboratories and testing sites in New Mexico, a metallurgy laboratory at the University of Chicago, component-manufacturing sites in Illinois, and a uranium-235 processing facility in Tonawanda, New York, among dozens of other locations.⁶⁶ As opponents of sole American control of the bomb lost the political argument over the future governance of the technology, the momentum behind the development of nuclear infrastructure – and specifically a nuclear infrastructure geared to the production of weapons in support of geopolitical competition – gathered pace.⁶⁷ By the early 1950s, the embrace of nuclear deterrence as the cornerstone of US national security required extending this infrastructure to include more extensive testing sites, including those in American overseas territories, weapons-building and storage facilities, nuclear-waste disposal sites, larger reactors, and so on. As Joseph Masco notes, what had been a ‘project-specific nuclear economy in 1943 [turned] into a major national infrastructure’.⁶⁸

Maintaining this nuclear infrastructure and reproducing the threat of nuclear deterrence transformed the American state apparatus in unprecedented ways. The expansion of the state apparatus was, of course, a response to the end of ‘Free Security’ heralded by Pearl Harbor. During the Second World War, the size and reach of the US government was expanded in unprecedented ways; indeed, the expansion of state power was vital to the success of the Manhattan Project.⁶⁹ With or without nuclear weapons, it was evident that the intensified forms of global violence interdependence developed prior to and during the war would challenge the strands of political isolationism present in American politics.⁷⁰

Nonetheless, the nature of state transformation was indelibly shaped by the emergent reliance of national security on nuclear weapons. Where institutional authority over atomic research, development, and production would reside emerged as an issue of significant contestation by war’s end. The scientific community and traditional American small-state conservatives advocated for significant civilian-led control of the nuclear complex, including over nuclear weapons themselves, through

⁶⁵Please note that this discussion will largely abstract from the impact of the International on American state formation for reasons of space.

⁶⁶Masco, *Nuclear Borderlands*, pp. 19–27, *passim*; Amy F. Woolf and James D. Werner, ‘The U.S. nuclear weapons complex: Overview of Department of Energy sites’, *Congressional Research Service*, 31 March 2021, pp. 8–9; Atomic Heritage Foundation, *Manhattan Project Sites*, available at: {<https://www.atomicheritage.org/history/project-sites>}.

⁶⁷Campbell Craig and Sergey Radchenko, *The Atomic Bomb and the Origins of the Cold War* (New Haven, CT: Yale University Press, 2008), pp. 111–34.

⁶⁸Masco, *Nuclear Borderlands*, p. 18.

⁶⁹Charles Thorpe, ‘The political economy of the Manhattan Project’, in David Tyfield, Rebecca Love, Samuel Randalls, and Charles Thorpe (eds), *The Routledge Handbook of the Political Economy of Science* (London: Routledge, 2017), pp. 43–56; James T. Sparrow, *Warfare State: World War II Americans and the Age of Big Government* (Oxford: Oxford University Press, 2013).

⁷⁰On ‘violence interdependence’, see Daniel Deudney, *Bounding Power: Republican Security Theory from the Polis to the Global Village* (Princeton, NJ: Princeton University Press, 2008).

the creation of a civilian-led Atomic Energy Commission (AEC).⁷¹ By contrast, the military sought to have the AEC remain a 'nearly autonomous commission led by the military'.⁷² Cultural values of anti-statism sat at the heart of these debates, with opponents of military control equating its dominance of an emerging nuclear economy to the planned economy of the Soviet Union.⁷³ Ownership of Manhattan Project resources and sites were transferred over to the AEC's control, and the operation and refurbishment of existing infrastructures were contracted out to the private sector, following the precedent established during the war.

The intersection of military and civilian nuclear infrastructural development mimicked that between the state apparatus and civil society, an infrastructural analogy for the integral state form. While the AEC was formed as a civilian-led government body, its remit remained oriented towards military purposes, part of the wider extension of government control over scientific research which played out in the early Cold War. The resultant focus on rapid application of nuclear technology for military use, particularly the development of nuclear submarine reactors, focused research attention on the development of light-water reactors rather than more advanced but time-consuming research on other reactor types.⁷⁴ A measure of path dependency ensued, with civilian reactor research dominated by light-water technology in its early years. Private-sector development of nuclear energy, as envisioned by the Atomic Energy Act of 1946 which established the AEC, would not occur until 1957. As the American foreign policy community re-envisioned its international role as a global policeman, a new relationship between science and the state was forged, replacing the previously private-sector-led development of high technology pre-war.⁷⁵

The dramatic extension of state power in the late 1940s challenged traditional anti-statist values present in American political culture – those enduring sets of inscribed ideas and practices which defined existing horizons of political possibility. The Truman administration, reflecting the Democrats' New Deal heritage, remained more comfortable with the expansion of the state apparatus than their Republican opponents, or the subsequent Eisenhower regime. Yet even the Democrats remained wary that the United States could transform into a 'garrison state' due to the requirements of geopolitical competition with the Soviets, with programmes for national security preparedness potentially subsuming private economic activity and civil liberties alike.⁷⁶ Both the Truman administration and conservative Republicans in Congress viewed nuclear weapons as a means for the United States to meet its new global purpose without creating a large standing army and an accompanying permanent war economy.⁷⁷ Horizons of government policy were decisively constrained by American political culture and the historical-institutional limits of the American state. Here the 'strategic selectivity' of the US state form can be seen most clearly: those forces in civil and political society advocating for the expansion of the state, for reasons of national security and national welfare, had to confront the institutionalised sediments of American anti-statism.

Changes in the form of the American state apparatus gathered pace after the Soviet Union's successful first atomic test in 1949. With the end of the US nuclear monopoly, US national security officials began to contemplate how to fight and win a war with atomic weapons in which its

⁷¹Michael J. Hogan, *A Cross of Iron: Harry S. Truman and the Origins of the National Security State, 1945–1954* (Cambridge: Cambridge University Press, 1998), pp. 234–9.

⁷²*Ibid.*, p. 236.

⁷³*Ibid.*, p. 238.

⁷⁴Benjamin K. Sovacool and Scott Victor Valentine, *The National Politics of Nuclear Power: Economics, Security, and Governance* (London: Routledge, 2012), p. 65; Audra J. Wolfe, *Competing with the Soviets: Science, Technology, and the State in Cold War America* (Baltimore, MD: Johns Hopkins University Press, 2013).

⁷⁵Wolfe, *Competing with the Soviets*; Audra Wolfe, *Freedom's Laboratory: The Cold War Struggle for the Soul of Science* (Baltimore, MD: Johns Hopkins University Press, 2018); Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993); Hogan, *A Cross of Iron*, pp. 209–64.

⁷⁶Aaron Friedberg, *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy* (Princeton, NJ: Princeton University Press, 2000); Hogan, *A Cross of Iron*; Edward M. Geist, *Armageddon Insurance: Civil Defense in the United States and Soviet Union, 1945–1991* (Chapel Hill: University of North Carolina Press, 2019).

⁷⁷Hogan, *A Cross of Iron*, p. 101, *passim*.

own citizens would be at risk. US officials, like their Soviet counterparts, viewed atomic bombs as war-winning weapons.⁷⁸ This, in turn, made the use of nuclear weapons more rather than less plausible, and American military officials developed strategic plans for their use in conjunction with conventional military forces. The more immediate policy response to the successful Soviet test, however, was a National Security Council research study commissioned by Truman to consider the impact of the Soviet test on American national security.⁷⁹ Noting the potential for a surprise Soviet atomic attack, the report – *United States Objectives and Programs for National Security*, better known as NSC-68 – stressed the need for an immediate strengthening of the military capacity of the American state. The resultant tripling of the US defence budget marked a new commitment to combating global communism.

Producing legitimacy and public support for the nuclear national security infrastructure made cultural-educational work central to the success of American national security policy and the reproduction of its nuclear infrastructure. The state military apparatus and the national nuclear complex required legitimacy derived from civil society if deterrence of the Soviet Union were to be credible. American citizens' existential fear of a nuclear exchange had the potential to signal a lack of national resolve; inculcating practical skills to manage citizens' fear thereby became a project of signal importance to American national security officials.⁸⁰ Public education campaigns such as 'Duck and Cover' are the most memorable exemplar of civil defence education practices, yet 'Duck and Cover' campaigns – teaching the public to find shelter of any kind in the event of a nuclear attack – were one small piece in the wider provision of national security education.⁸¹

Education was central to American Cold War national security thinking and practice in two ways. First, strong emphasis was placed on the need to educate American students in STEM subjects if the United States were to win the techno-scientific arms race, a competition conceived in registers of military capacity and national prestige, as the Sputnik moment would later illustrate. Second, 'civil defence education' was viewed as a necessary component of nuclear deterrence in the US national security strategy.⁸² Whereas the former was designed to maintain current and generate future national security infrastructures by producing large numbers of scientists and engineers, the latter represented an attempt to structurally couple America's nuclear weapons infrastructure and security strategy with a series of hegemonic cultural norms and practices ranging across the integral state.

Throughout the history of American political development, national security, infrastructure, and education have been deeply intertwined. Nevertheless, the ability of the Truman administration to use the apparatus of the federal government to pursue civil defence education remained limited. The creation of centralised administrative structures in the field of education were constrained by the enduring commitment to federalism in this sphere. The development of a unified national educational curriculum was a non-starter; education remained the prerogative of states and localities. Federalism remained a powerful restraint on the centralisation of education in Washington, inscribed in its institutions and reinforced by the interests of Southern segregationists in maintaining the dominance of Jim Crow. Thus, while the United States had developed a sizeable apparatus of administration and bureaucratic institutions since the turn of the 20th century,

⁷⁸David Holloway, 'Nuclear weapons and the escalation of the Cold War, 1945–1962', in Melvin P. Leffler and Odd Arne Westad (eds), *The Cambridge History of the Cold War, Volume I: Origins* (Cambridge: Cambridge University Press, 2010), pp. 376–397 (p. 378); Geist, *Armageddon Insurance*, p. 55.

⁷⁹David Holloway, 'Nuclear weapons and the escalation of the Cold War, 1945–1962', p. 385.

⁸⁰Joseph Masco, *The Theatre of Operation: National Security Affect from the Cold War to the War on Terror* (Durham, NC: Duke University Press, 2014); Masco, *The Theatre of Operations*, pp. 48–62.

⁸¹Victoria M. Grieve, *Little Cold Warriors: American Childhood in the 1950s* (Oxford: Oxford University Press, 2018), p. 2.

⁸²JoAnn Brown, "'A is for Atom, B is for Bomb': Civil defense in American public education, 1948–1963", *The Journal of American History*, 75:1 (1988), pp. 68–90; Andrew Grossman, *Neither Dead nor Red: Civilian Defense and American Political Development during the Early Cold War* (London: Routledge, 2001), p. 38. More broadly, see Hogan, *A Cross of Iron*, pp. 300–1.

and while the war extended this process, the federal government's cultural-educational apparatus remained weak.⁸³

Whereas the Soviet Union could use its coercive state apparatus to make civil defence education mandatory – with some 92 million Soviet civilians passing through its programmes – and shield it from public scrutiny, the strategic selectivity of the American state made a similar approach untenable.⁸⁴ Only through cultural-educational programmes could civil defence be enacted, deterrence ensured, and the legitimacy of the reconfigured state confirmed. This entailed a dual project of simultaneous state formation in civil society and the state apparatus. Novel state institutions had to be created to pursue this cultural-educational work, but this work itself had to be justified through arguments about the pressing Soviet nuclear threat made in civil society. The production of consent thereby cut across the ostensibly separate domains of the public and private spheres. In other words, hegemony in civil society was internally related to the remaking of the state apparatus and central to the production of the integral state form.⁸⁵

A particular focus of this work was K-12 education for school-age children. The Federal Civil Defense Administration (FCDA), established by Harry Truman in 1950 as a response to the Soviet test, NSC-68, and the war in Korea, created the Civil Defense Education Project as its educational arm.⁸⁶ The FCDA did not practically implement civil defence projects, nor did it allocate resources for such projects.⁸⁷ Instead, it produced civil defence education material, with public schools operating as an effective vehicle for distribution. These materials focused on teaching 'mental hygiene', social skills, civil defence, and more rigorous science and mathematics training to compete with the Soviet Union.⁸⁸ The FCDA and the AEC sought to reach children and, just as importantly, their families, by distributing civil defence films and books about atomic energy through schools. School administrators were given teaching material to promote appropriate civil defence attitudes and practices, including information on how to construct private bomb shelters and 'safety "check lists" for shelter life'.⁸⁹

Civil defence proponents thereby sought to build the material infrastructure of the nuclear weapons complex via the initiative of private individuals. Rather than being a purely 'top-down' process, civil society organisations and individual citizens often actively lobbied government for the development of civil defence programmes.⁹⁰ Schools and teachers, no doubt also under pressure from liberal and conservative anti-communist currents to root out any semblance of red-tinged progressive education in the classroom, embraced civil defence education on a large scale, although their enthusiasm remains unclear. Approximately 88 per cent of primary and secondary schools had civil defence education programmes by 1952.⁹¹

A series of practical educational activities were pursued by the FCDA. Schools promoted extra-curricular activities focused on nuclear survival, encouraging students to join first aid and civil defence teams.⁹² The Civil Defense Education Project gave children skits to act out at home, with

⁸³ Stephen Skowronek, *Building a New American State: The Expansion of National Administrative Capacities, 1877–1920* (Cambridge: Cambridge University Press, 1982); Carl F. Kaestle and Marshall S. Smith, 'The federal role in elementary and secondary education, 1940–1980', *Harvard Educational Review*, 52:4 (1982), pp. 385–6; Sarah E. Robey, *Atomic Americans: Citizens in a Nuclear State* (Ithaca, NY: Cornell University Press, 2022), p. 6.

⁸⁴ Geist, *Armageddon Insurance*, p. 88. Geist notes that this official statistic was undoubtedly inflated.

⁸⁵ Andrew Grossman suggests that civil defence education was designed to create a 'civic garrison state' through ideological control, while Edward Geist emphasises the continued weakness of the American state. Conducting the debate in terms of a spectrum of public authority from 'weak' to 'strong' obscures more than it reveals about state formation. See Grossman, *Neither Dead nor Red*; Geist, *Armageddon Insurance*, pp. 10–11, *passim*.

⁸⁶ Grieve, *Little Cold Warriors*, p. 166.

⁸⁷ Brown, "A is for Atom, B is for Bomb", pp. 69–70.

⁸⁸ Grieve, *Little Cold Warriors*, p. 163.

⁸⁹ Grossman, *Neither Dead nor Red*, p. 83.

⁹⁰ Robey, *Atomic Americans*, p. 17–18, *passim*.

⁹¹ Andrew Hartman, *Education and the Cold War* (London: Palgrave, 2008), p. 71.

⁹² Grieve, *Little Cold Warriors*, p. 167.

titles such as ‘Operation Home Shelter’ and ‘Until the Doctor Comes.’⁹³ Children were encouraged to help their parents prepare bomb shelters. In Wisconsin, a group of children repaired and upgraded their school building as part of a civil defence project.⁹⁴ Alterations to children’s clothing was required to support America’s nuclear strategy. Metal identification tags – dog tags – were produced and freely distributed in their millions for children to wear in preparedness for a nuclear attack. New York City alone produced 2.5 million by 1952, enough for every child from kindergarten to grade four.⁹⁵ While the purpose of the tags was not explicitly stated, ‘the tags were designed to aid civil defense workers in identifying lost and dead children in the event of an atomic attack.’⁹⁶ Shaping children’s responses to be ‘alert but not alarmed’, these initiatives aimed to produce children and families who would act appropriately in the event of a nuclear war, corporally institutionalising these capacities; maintaining a second-strike capability and reproducing it over time demanded as much.

The production of consent to the emergent nuclear-state infrastructure thereby ranged across the terrain of the integral state. Political mobilisation of America’s youth was a joint project of government, private corporations, and individual adults, taking place in a vast array of private and public spaces: the White House, Congress, science textbooks, pamphlets, Betty Crocker cookbooks, television, comic books, and on and on.⁹⁷ In the view of US officials, the malleability of young minds presented a threat; it was, for the US foreign policy community, possible that ‘Reds’ could indoctrinate American children, winning the Cold War from the inside out. Ideological formation became a strong focus of federal civil defence education programmes. ‘Mental hygiene’ centred on the embrace of core American values of individual political and economy liberty, the moral and material superiority of the market economy, and the superiority of the American way of life. In a typical example, from 1947 to 1952 the American Heritage Foundation and the Advertising Council ran a campaign about ‘Good Citizenship’, defining nine core values that American children should embrace, including voting, paying taxes, teaching democracy, and accepting wartime responsibilities. Similarly, the Advertising Council produced and distributed a booklet titled ‘The Miracle of America’, to explain the American economy and its benefits to American children; in the four years from 1948 to 1952, 1.84 million copies were distributed to American schools.⁹⁸ In extolling the values of free enterprise, material consumption, political and economic liberty, and collective bargaining, the booklet set out to establish a national consensus among American children about the nation’s unique status. Further, it attempted to impress on children the necessity of acting to secure these facets of American life.

Civil defence education sought to unify the integral state behind a specific set of American values which were, in practice, favourable to dominant social forces in American society. The strategic selectivity of the American state apparatus worked to reinforce existing social hierarchies, with the development of segregationist bomb shelters one appalling archetype of a wider process.⁹⁹ Nuclear weapons infrastructure effectively remade large portions of US territory in New Mexico and the South-west into a ‘quasi-military colony’, a possibility derived from its previous conquest of these political communities.¹⁰⁰ The Manhattan Project, Los Alamos National Laboratory, and its associated infrastructures, including housing for atomic labourers, displaced established relations

⁹³Grossman, *Neither Dead nor Red*, p. 84.

⁹⁴Brown, “A is for Atom, B is for Bomb”, p. 85.

⁹⁵*Ibid.*, p. 81.

⁹⁶*Ibid.*

⁹⁷Grieve, *Little Cold Warriors*, p. 2, *passim*; Laura McEnaney, ‘Cold War mobilization and domestic politics: The United States’, in Melvyn P. Leffler and Odd Arne Westad (eds), *The Cambridge History of the Cold War, Volume I: Origins* (Cambridge: Cambridge University Press, 2010), pp. 420–4; Grossman, *Neither Dead nor Red*, pp. 49–57.

⁹⁸Grieve, *Little Cold Warriors*, p. 129; Brown, “A is for Atom, B is for Bomb”.

⁹⁹Grossman, *Neither Dead nor Red*, pp. 92–102.

¹⁰⁰Joseph Masco, *The Future of Fallout, and Other Episodes of Radioactive Worldmaking* (Durham, NC: Duke University Press, 2021), p. 54.

between the land and the Pueblo peoples, denying access to sacred religious sites to groups already displaced by the expansion of American empire over the previous century.¹⁰¹

Similarly, US overseas territorial possessions acquired over the previous half-century of imperial expansion became nuclear weapons testing grounds. The inhabitants of Bikini atoll in the Marshall Islands were removed to allow weapons testing to proceed, with 68 weapons detonations occurring between 1946 and 1958; information gathered from studies of fallout in the region subsequently shaped American civil defence policy and was diffused among its allies.¹⁰² The domination of specific social groups, explicit in the exclusion by American state apparatuses of, for instance, Bikini Islanders from any democratic political representation, was mobilised towards the production of hegemony in civil society. The emergent integral nuclear weapons state was always embedded within the historical legacies of the American colonial-settler state.

Conclusion

The strategic selectivities of state form – historical products of previous political struggles – ranging across the integral state made it implausible that American policymakers could coercively impose civil defence training for its citizens, in contrast to the Soviet Union. Similarly, the United States could not deploy a national civil education curriculum due to the legacy of federalism, in contrast to states which could deploy a national civil defence curriculum. Rather, the production of American civil defence practices was shaped by the anti-statist political culture and the formal institutional legacies of US state formation in education. The production of civil defence emerged as a project of cultural-educational legitimisation across the public and private sphere. This project attempted to produce consent for the development of an American nuclear weapons state and, concomitantly, domination over subaltern groups opposed to, or standing in the way of, this project.

An American nuclear weapons state was produced through the specific assemblage of a range of objects – dog tags, cookbooks, skits, leaflets – due to the legacies of American political development. In other words, the internal relations between dog tags and nuclear weapons infrastructures produced a novel American social formation, but one whose development was structured by the internal relations between past and present state forms. Infrastructure and state form are mutually constitutive of a larger totality, and these relations of constitution endure beyond singular historical moments.

Clarifying the different relational ontologies between ANT and an internal-relational Gramscian approach highlights the different kinds of explanatory claims one can make using either perspective. ANT is not a false account of infrastructural state formation. It is, rather, a partial account, adept at tracing out assemblages of humans and non-humans that produce states, capturing how state formation appears at singular moments in time. For a Gramscian state-theoretical sociology, though, such accounts must be located within their wider historical and structural conditions of emergence. How and why, for instance, public- and private-sector actors, or imperialism and nuclear weapons testing grounds, *appear* as isolated actors is central to the historical materialist project writ large.

The import of this position is to ask analysts to consider how singular historical moments are connected in ways that enable us to generate visions of future infrastructural state formations and world orders. Processual historical sociologies can generate plausible and realistic scenarios through which we can imagine how novel socio-technical orders may emerge.¹⁰³ Socio-technical orders will change – of this we are certain. To realise better futures – more just, sustainable, and peaceful futures – we need to consider if they are actualisable in our world and, if they are, the steps we can take to achieve them. The careful mapping of existing infrastructural and institutional

¹⁰¹ Masco, *Nuclear Borderlands*, pp. 99–159.

¹⁰² Daniel Immerwahr, *How to Hide an Empire: A History of the Greater United States* (New York: Picador, 2019), pp. 348–50; Tracey C. Davis, *States of Emergency: Cold War Nuclear Civil Defense* (Durham, NC: Duke University Press, 2007), p. 15.

¹⁰³ Note that scenario building is equivalent to forecasting, not prediction.

potentials is the first step in this process of scenario generation. The political relevance of such a project is brought into relief when considering the intensive efforts of far-right movements to disseminate exactly such imaginaries of future socio-technical world orders.¹⁰⁴ For critical approaches to IR-STS, identifying where and how political agency may be mobilised most effectively to realise greater opportunities for a participatory politics of technology in our global machine civilisation has never been more important.

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¹⁰⁴Jean-Francois Drolet and Michael C. Williams, 'From critique to reaction: The new right, critical theory and International Relations', *Journal of International Political Theory*, 18:1 (2022), pp. 35–6.