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How Deep Is Incumbency? Introducing a 'Configuring Fields' Approach to the Distribution and Orientation of Power in Socio-Material Change

Andy Stirling

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Contact

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HOW DEEP IS INCUMBENCY? Introducing a ‘configuring fields’ approach to the distribution and orientation of power in socio-material change

Andy Stirling, SPRU and STEPS Centre, University of Sussex

September 2018

Abstract

This paper examines a variety of theories bearing on ‘*socio-material incumbency*’ and explores methodological implications. The aim is to develop a systematic general approach, which builds on strengths and mitigates weaknesses in prevailing analytical frameworks. Defining power as ‘*asymmetrically structuring agency*’, incumbency is visible in a diversity of power gradients constituted by multiple economic, political and social processes. But existing representations of these incumbency-reinforcing dynamics often neglect their own exposures to effects of incumbency. The result can be a self-acknowledged tendency to “*reify*” focal categories and assumptions. Under an ostensibly detached ‘*eagle-eye view*’ (as if from a lofty governance ‘*cock-pit*’), ‘*fallacies of misplaced concreteness*’ emphasise unduly simplified notions like ‘*the regime*’. These can serve to exaggerate the *confined, congruent, discrete* and *singular* properties of incumbency in any setting. This picture may in turn overstate the tractability of incumbency to conventional policy instruments. Resulting actions that aim to challenge incumbency, but neglect its wider and deeper forms, may inadvertently help reinforce it.

An alternative is argued to lie in addressing incumbency as a ‘*multiplexity*’ of overlapping ‘*configuring fields*’. Pervading an entire ‘*milieu*’ of imaginably viable socio-material configurations, these gradients in structuring agency display both ‘*scalar intensity*’ (in concentrating power) and ‘*vector intensity*’ (in orienting particular associated pathways for change). For purposes of interrogating empirical evidence, this allows a heuristic distinction between different ‘*topologies of incumbency*’. With a conventional ‘*eagle-eye view*’ of a ‘*closed topology*’ forming one ideal-type, the paper systematically contrasts an alternative ‘*worm-eye view*’ of an ‘*open topology*’ of incumbency. This recognises that patterns in configuring fields that constitute incumbency are often more *pervasive, polycongruent, entangled* and *plural* (so less tractable) than envisaged in an ‘*eagle-eye*’ view. This more nuanced, less instrumentalised, picture suggests other kinds of methodological responses in which some potentially empirically testable questions are explored. Possible practical implications extend beyond narrow *policy* interventions, to embrace broader and deeper kinds of *political* collective action, culture change and democratic struggle. The findings will be tested in a second empirical paper in this two-part series.

Keywords: socio-material incumbency; power; political transformations; sustainability transitions; multi-level perspective; deep transitions; socio-technical systems; sociotechnical imaginaries; systems of innovation; regime theory; social field theory; structuration; material agency; social practices; configuring fields;

Acknowledgements: [1]

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1: Introduction: the Political Importance of Socio-Material Incumbency

Long used to refer to the occupation of a position of authority^{1 2}, the term ‘incumbency’ increasingly also applies to more general concentrations of influence, privilege and power^{3 4 5 6 7 8 9 10}. With many traditionally sanguine voices in global science^{11 12} and governance^{13 14 15} expressing growing concerns about a series of serious and intractable worldwide ‘grand challenges’^{16 17 18}, the salience of incumbency is coming further to the fore. It is increasingly recognised that the depths and extents of particular kinds of incumbency often form a reason why so many grave worldwide problems remain so persistently unresolved – including inequality^{19 20 21}, oppression^{22 23}, climate disruption^{24 25}, ecological destruction^{26 27}, toxic pollution^{28 29} and nuclear risks^{30 31} as well as the age-old obscenity and waste of war^{32 33}. Finding ways to balance the effects of incumbent interests on such issues present some of the most pressing political priorities in the contemporary world³⁴.

Despite their many benefits^{35 36 37}, science and technology are not immune to their own dynamics of incumbency³⁸. Those ‘socio-technical trajectories’^{39 40 41 42} that are most readily realised in research and innovation are usually conditioned not only by declared aims (like mitigating the above global challenges), but also by more private and proximate forces and interests [2]. As a result, a variety of possible responses may be available to address these global challenges that are more favourable than *status quo* directions for change⁴³, but which may remain unduly under-supported. This can be so in sectors as diverse as food^{44 45 46 47}, water^{48 49 50}, health^{10 3 51}, energy^{52 53 54 55 56 9 57}, security^{58 59 60}, mobility^{61 62}, resources^{63 64 65}, computing^{66 67} and industrial production^{68 69 70}. Of course, there remain many complications, uncertainties and ambiguities⁷¹. And the issues are more encompassing than just the ‘socio-technical’ domain of human society and technology. With ‘natural’ materialities also playing crucial roles both as drivers and as implications, the scope extends to wider and deeper ‘socio-material’ dynamics^{72 73 74 75 76}. But for all the resulting complexity and diversity a central common issue is, that there typically exists in any setting, a number of alternative ‘socio-material pathways’ for change that are clearly more generally desirable than the established ‘innovation trajectories’ that dominate both prevailing infrastructures and imaginations of viable futures^{77 78 79 80}.

The simple point is, then, that even where these neglected alternative pathways are scientifically realistic, technically practicable, economically feasible and socially viable, dynamics of incumbency can prevent them becoming historically realisable⁸¹. With high and rising stakes for global social justice and ecological integrity^{82 83 84 85 86}, there could hardly be a more pressing object of attention in academic study or policy making on research and innovation, than dilemmas around what is often called ‘socio-technical incumbency’^{87 88 89 90 91 92 93}. With scrutiny extending from society, through technology to the encompassing material phenomena of the world, it is this wider challenge of ‘socio-material incumbency’ that will form the primary focus of this paper.

However described, these longstanding imperatives are well recognised by much research into patterns of being and change in a range of variously-characterised interacting social, technical and material phenomena. Especially prominent in current understandings in this area are: ‘techno-economic paradigms’^{94 95}, ‘techno-economic networks’^{96 97 98}, ‘large technical systems’^{99 100 101 102 103}, ‘socio-technical systems’^{104 105 106 107 108} and (more recently) ‘sociotechnical imaginaries’^{78 109 110 111}, ‘socio-technical regimes’^{112 113 114 115 116 117} and ‘deep transitions’^{118 119}. Work in related areas has for many decades been giving growing attention to processes and relations implicated in the ‘destabilising’^{120 121 122 123}, ‘discontinuing’^{124 125}, ‘disrupting’^{126 127} (and countervailing ‘maintaining’¹²⁸) of entrenched directions for change in research and innovation. There are many contrasting emphases. But for present purposes, these literatures inform a general definition for the central concept of ‘socio-material incumbency’, as: *a ‘multiplexity’^{129 130} of dynamics through which a particular pathway in interacting social, economic, cultural, political, discursive, cognitive, technical and wider material phenomena, is reproduced by – and reinforcing of – associated power gradients.*

Of course (as always), this definition begs many questions. The breadth of scope, in what might be counted as a ‘power gradient’, will be discussed in detail below. Specific reasons for use of the technical terms ‘socio-material’^{131 132 133} and ‘multiplexity’^{134 135} will also be discussed later. What is most useful to establish at this initial stage in the discussion, though, is that the starting point from which incumbency is interrogated should be as broad-based and unbiased as possible with respect to specific perspectives or instances. So, however associated processes are viewed and in whatever contexts, this understanding of ‘socio-material incumbency’

is sufficiently general as to give confidence at minimising undue emphasise or exclusion. For, despite often dramatic historical turbulence, socio-material incumbencies abound in various senses relating to this understanding. Fossil fuels¹³⁶, military practices¹³⁷, private automobiles¹³⁸, high-input agriculture^{139 140}, the tobacco industry¹⁴¹, organised-criminal narcotics^{142 143}, pharmaceutical based healthcare^{144 145}, nuclear power¹⁴⁶ and nuclear weapons⁸¹ are all, for instance, proving similarly durable and exercising comparably serious and far-reaching effects. Indeed, it is in helping to ameliorate these adverse impacts, that the approaches to the study of research and innovation from which this definition is drawn (and with which it chimes), can offer their most important contributions. And this is the main aim, towards which this present analysis will try to contribute.

To this end, this first in a series of two companion papers will explore key theoretical and political issues in play around these themes, and set out some methodological and wider practical policy implications. With this paper being conceptual, the next paper will be empirical. As an alternative (not necessarily a substitute) for conventional approaches to socio-material incumbency (like ‘innovation systems’¹⁴⁷, ‘sustainability transitions’¹⁴⁸, ‘transition management’^{149 150}, ‘deep transitions’¹¹⁸ or the ‘multi-level perspective’¹⁵¹), the present conceptual analysis goes back to various traditions in the study of structuration, sociality and power in order to propose what is called a ‘*configuring fields approach*’. Drawing on many key strands in preceding social theory, it will be argued that prevailing understandings in policy making and wider politics can do a better job of avoiding expedient simplifications of the kind that can themselves favour incumbency. Greater account can thereby be taken of important ways in which forces of incumbency (as objects of scrutiny) can condition modes of understanding (in subjects of scrutiny – like academic analysis or policy appraisal). Recognising this can help avoid overly circumscribed and ‘*reified*’ frameworks for understanding incumbency, and so mitigate dangers that actions undertaken on this basis can fail to address the deeper and wider aspects.

The next section (2.1) explores issues of complexity and power in socio-material incumbency. Distinctions are drawn between aspects of incumbency alternatively seen to highlight deliberate agency or emergent structure. Likewise, incumbency in general is distinguished from other aspects of socio-material ‘*persistence*’, that can be held to arise even where there operate no power-driven dynamics of incumbency at all. If the diversity of social and material positive feedback phenomena relevant to incumbency is to be duly appreciated and addressed, it is argued that the resulting canvas must be broad in its ontological scope. This helps not only to reduce idiosyncrasies in associated circumscribed engagements with power, but also to avert the many ways in which power dynamics can serve to attenuate and restrict social understandings of incumbency itself.

Some of the consequences are explored in the following section (2.2), which builds on prior social theory around processes of structuration to introduce a distinctive field-like understanding of the social and material power dynamics associated with incumbency. Because this analysis focuses on the general relational processes through which socio-material phenomena are configured, it is called a ‘*configuring fields approach*’. Crucially (and unlike many other social field theories), this avoids simply assuming into being any particular notionally discrete categories of object – like specific kinds or modalities of ‘field’. Instead, the approach applies the field concept in a straightforward way as a general heuristic, applying in principle equally to all aspects both of social and material dynamics. Across all contexts, the most significantly operational feature of these fields are their asymmetries with respect to the relevant processes of structuration at any given focus, that serve to make some outcomes more likely and others less. As such, these structuration fields display properties both of ‘*scalar*’ intensity (in the *power* with which they variously pressure different kinds for change), as well as of ‘*vector*’ directionality (with respect to associated effects on the *orientation* of this change).

On this relational-processual basis, the section that follows (3.1) develops a systematic contrast between a conventional (quite simple categorical) ‘*eagle-eye*’ view of incumbency and a novel alternative (more complex relational) ‘*worm-eye*’ view. Characterising the different incumbency-sustaining dynamics as ‘*configuring fields*’ in a socio-material ‘*milieu*’, it is shown how mainstream notions like ‘*the regime*’ can represent incumbency to be significantly more confined and discrete than may often actually be the case. This is referred to as an ‘*eagle-eye view*’, since the constituting dynamics thereby highlighted appear to be monocongruent and singular – as if viewed from a lofty perspective that foreshortens appreciation of greater complexity, depth or scope. Since these kinds of reduction tend to favour incumbent interests, the point is made that it is

perhaps not surprising that such simplifications are so prominent in academic and policy understandings of incumbency and associated possibilities for intervention.

Accordingly, section 3.2 discusses practical implications for political action that follow the distinction between these two ideal-typical views. It is argued that a ‘worm-eye view’ offers to extend scope for understanding incumbency in many important ways – in particular highlighting necessities for counter-incumbency actions to take forms that cannot be achieved mainly by performance of vertical policy interventions choreographed from a notional governance ‘cock-pit’. What may often be required as well, in order to address the full depth and extent of incumbency, are more unruly, horizontal and mutualistic forms of political action. It is these kinds of engagements that can be restricted in notionally reformist efforts that over-rely on conventionally reified expert models, formal procedures and policy mixes. So, ‘creative destruction’ of incumbency is often better enabled not so much by specific policies – or even ‘policy mixes’^{152 153 154 155} – as by more diverse general and deeply political processes of grassroots mobilisation, collective action, cultural expression and democratic struggle. The analogy here is not with the circumscribed technical orders, understood as ordered hierarchies of categorical objects. Instead, what come to the fore are the more open-ended organic and mutualistic dynamics observable in nature as ‘murmurations’. Here politics and encompassing cultures can be understood in more process-relational ways, with patterns of change sometimes appearing like exquisitely-choreographed flocking behaviours of many animals. Here, when the time is right, radical change can emerge rather easily.

The final section (4) then explores concrete methodological implications. It outlines ways to engage and interrogate socio-material incumbency, that are less restricted by prevailing circumscribed academic and policy understandings, related to the approaches with which this discussion began. This sets the stage for the design of onward research of kinds that may help inform more effective political challenges to incumbency. In particular, the follow-on paper in this present pair of articles, will offer a companion empirical study of the particular circumstances of incumbency around UK civil nuclear power. Although individual case studies can be viewed as a precarious basis for wider generalisation, they can nonetheless serve as a reliable – and potentially important – guide to necessary expansions of theoretical frames¹⁵⁶. Just as the term ‘murmurations’ signifies mutually-coordinated movement, so it also refers to processes of criticism and resistance. Especially when envisaging transformative change, it is thus at least equally pragmatic for research into incumbency to be oriented towards these more ‘unruly’ politics, as towards the orderly incumbent structures of ‘evidence-based’ policy making. It will be on this basis the present theoretical analysis can be tested and substantiated – with the possibility of illuminating potentially significant (but hitherto neglected) practical findings.

2: Complexity and Power in Understandings of Socio-Material Incumbency

2.1: The Ontological Scope of Socio-Material Incumbency

Some processes and relations that are widely seen to help constitute socio-material incumbency are at least partly intentional in deliberate human terms. Examples might include aspects of interlinked and mutually reinforcing feedback phenomena¹⁵⁷ variously referred to with specialist words like ‘entrapment’¹⁵⁸, ‘coercion’¹⁵⁹, ‘dominant prototyping’¹⁶⁰, ‘path creation’¹⁶¹, ‘alignment’¹⁶², ‘social shaping’⁴¹, ‘momentum’¹⁰⁰, ‘routines’¹⁶³, ‘regime resistance’¹⁶⁴, ‘status quo bias’¹⁶⁵, ‘stabilization’^{108 166}, ‘instrumentalisation’¹⁶⁷, ‘autonomy’¹⁰⁷ and ‘imaginaries’¹⁶⁸ – as well as in processes around the forming of ‘paradigms’¹⁶⁹, ‘expectations’¹⁷⁰ and many other kinds of ‘learning’^{171 172}. Of course, the active intentionalities in these dynamics are not always explicitly conscious on the part of individual people or specific social actors. Indeed, the formative condition broadly referred to as ‘agency’ may also unfold in under-appreciated ways, around various more heterogeneous kinds of networks, collective groups or distributed interests – and in contingently emergent societal (or even more diffuse) senses^{173 174}.

Referring simply to the “*capacity for action*”¹⁷⁵, the venerable idea of ‘agency’ can become very complex and slippery¹⁷⁶. Definable in many ways and always at least partly conditional on a subjective perspective and focus of interest, associated issues remain central (at least by implication) to many contemporary social

challenges. Major queries arise around what might constitute ‘capacity’ for action; the roles of intentionality; the degree of human specificity; the implications of materiality; and the underlying meanings of ‘action’. Accordingly, direct discussions of perennial concerns around ‘agency’ – for instance through the lens of structuration theory – have (rather oddly), somewhat fallen out of fashion in current social theory¹⁷⁷. Yet for anyone with interest in the practical politics of real-world struggles to balance incumbent power and enable emancipations of various kinds, some general heuristic idea akin to agency must unavoidably remain central.

In seeking to reconcile these dilemmas, then, a move is necessary that remains practically operational, but which helps avoid some of the pitfalls of overly presumptuous or simplistic notions of agency. Here the work of the philosopher Whitehead arguably becomes especially interesting¹⁷⁸, in reflecting hard about what it means to ‘grasp’ – or ‘prehend’ – anything (including ‘agency’) [3]. A useful distinction thereby emerges between relatively self-contained, categorical procedures of cognitive ‘apprehension’ and encompassing (perhaps less visible) processes of ‘prehension’ that are more materially distributed and relationally ecological in nature. It is in these general terms that agency in many forms becomes characterisable as creative processes (of multiple kinds) for “*orienting among many prehensible pathways for change*”¹⁷⁹. This general formulation may apply irrespective of specific conundrums concerning ‘capacity’ or ‘intentionality’ for agency, the exclusivity of the ‘human’ focus; or what it is exactly, that is thought of as ‘action’. And reference to ‘prehension’ acknowledges that what might ‘potentially’ be ‘possible’ in the orienting of action is not a separable ‘objective’ matter. It is intrinsic to the dilemma that agency itself is at the interface of objectivity and subjectivity. Accordingly, what is needed for the generatively ‘change-orienting’ aspects of incumbency to be recognisable as ‘agency’, is that they must not only in some way be *prehending* in agential ways, but also likewise be *prehended* as such¹⁸⁰.

Whatever the details, however, it is in these general terms that other constituting dynamics of incumbency often tend to be prehended instead to be more about ‘structure’. Whilst always implicating some forms of agency, these aspects can (in some languages) be referred to as relatively “deterministic” in nature¹⁸¹. Either way (as endlessly pored over in theoretical literatures), recognition of possibly-salient distinctions between structure and agency should not be assumed to assert a universalising dichotomy^{182 183 184 185}, nor an ostensibly essential dualism^{186 187}, still less a mutually-constituting duality^{188 189}. To make a distinction in one axis for differentiation of itself says nothing of possible distinctions under other axes. Instances will always present complex constellations on multidimensional scales imposed by subjective perspectives¹⁹⁰. So relations between subjectively-distinguished aspects of structure and agency may thus rather be seen as a more contingent dialectic¹⁹¹ – prehensible only with respect to enacted strategies on the part equally of subjects and objects^{192 193}. Recursively co-constituted with and by ‘agency’, then, the ‘structural’ aspects of incumbency also become implicated in the same broad relational understanding of agentive orientation of change discussed above. In these terms, ‘structure’ (in whatever view) refers to ‘*the conditions constituting potentialities across contrasting prehensible orientings of change*’ [4].

Placing more of an emphasis on this aspect of ‘structure’, then, a range of additional processes also come to the fore in studies bearing on socio-material incumbency. These go by a plethora of further technical names like ‘entrenchment’¹⁹⁴, technological drift¹⁰⁷, ‘channelling’^{195 196}, ‘canalization’^{197 198}, ‘chreodization’¹⁹⁹, ‘inertia’^{200 201}, ‘obduracy’²⁰², ‘inflexibility’²⁰³, ‘longevity’^{204 205}, ‘economies of scale’²⁰⁶, ‘lock-in’¹³⁸, ‘lock-outs’²⁰⁷, ‘crowding out’^{208 209}, ‘increasing returns to adoption’^{210 211}, ‘network effects’^{212 213}, ‘path-dependency’²¹⁴, ‘emerging irreversibilities’²¹⁵, ‘homeostasis’¹⁹⁸, ‘embedding’^{216 217}, ‘endogenous renewal’²¹⁸, ‘technique’²¹⁹, ‘cosmopolitanisation’^{220 221}, ‘technicity’²²² and ‘sociodicy’²²³. Each of these ideas highlights further aspects of the contexts in which incumbencies can be reproduced. Again, all are deeply entangled with the more overtly intentional dynamics listed above. Each is related; all lie on scales defined by others; several are similar; some are variously nested or overlapping; but none are identical²²⁴. Widely-used terms are also employed in contrasting (sometimes inconsistent) ways²²⁴ and many additional and combined concepts are also recognised^{225 226 227 228 229 230}.

In the face of the many resulting ambiguities, a schematic picture of one impression of some key attributes of these diverse positive feedback dynamics is shown in Figure 1. This brings to the fore, three dimensions of differentiation. First (on the left hand side), is the epistemic lens through which these aspects of incumbency are viewed, ranging from interpretive and constructivist through more qualitative and positive to quantitative

aggregative perspectives. Second (on the vertical axis), there is the relative emphasis that is placed on distinctions between the variously-prehended 'structural' or 'agential' aspects of incumbency discussed above. Third, there cuts across both these dimensions (on the horizontal axis), a distinction between relatively mechanistic causes or more emergent influence. Despite the evident diversity in these human and material incumbency-constituting processes, however, what all share in common is that they present distinct aspects of the ubiquitous set of social phenomena known straightforwardly as 'power'. In other words, what Figure 1 shows, are the many ways in which power reinforces particular directions for change and suppresses others.

Despite the 'ontological scope'²³¹ of this picture of socio-material incumbency, then, it is significant that a crucial common feature, is the relevance of various contexts, kinds and degrees of 'power gradient'^{232 233}. Here, there are many resonances with diverse wider literatures in social and political science, cultural studies and institutional theory^{234 235 164}. Among these structuration theories of various kinds represent an especially strongly acknowledged, widely generalized and deeply-developed body of ideas^{186 175 236 237}. Whilst many other theoretical frameworks are available in social science, few (as discussed above) offer such a specific focus on the circumstances of agency. So few are as directly relevant as a practical heuristic, for enquiries focusing on dynamics of progressive political change of the kinds entailed in concerns over incumbency. By unfolding specifically from thinking about dilemmas of agency, then, structuration theories remain (for all their abstraction) usefully focused on practical challenges of political action. And it is in the broadly-applicable process-relational terms of structuration theory, that the multiplicities of power asymmetries which constitute gradients of incumbency can be formulated into a quite easily-expressed and readily-operational heuristic definition for 'power': as different forms and conditions of '*asymmetrically structuring agency*'^{81 238} [3].

To scholarship concerned always to differentiate and nuance, it can be problematic to refer to something as important and undoubtedly complex as 'power', in such ostensibly simple terms as this single colloquial word. Sometimes this aversion merely reflects the identity politics of disciplinary dogmas, institutional conceits or pressures to solicit or assert academic patronage. But where imperatives to attend to contextual detail are more substantive, they still in no way require refusal to recognise generalities. Why should a phenomenon as readily identified in all its multiple forms in any everyday conversation as 'power', find no correspondingly encompassing term in technical vocabularies? Although relatively straightforward in expression, then, it is arguable that a concise general characterisation of power as '*asymmetrically structuring agency*' can workably apply in principle to a first order, across virtually all aspects, dimensions and contexts of power.

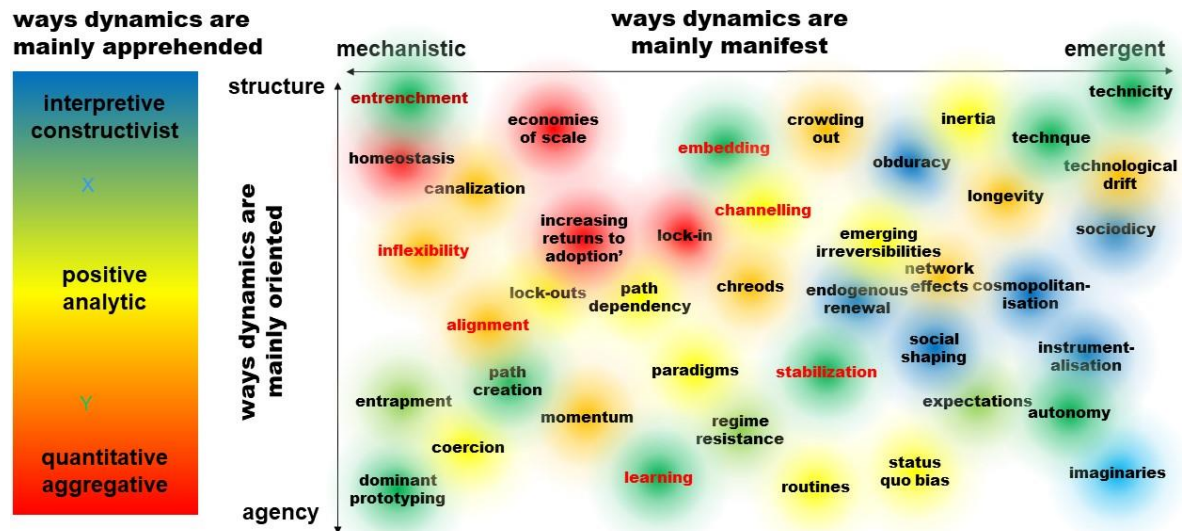
Articulating all broadly prehensible forms, contexts and mixes for action on structure or structuring of agency, this characterisation can include in a relatively balanced way, many otherwise canonically-distinguished notions of power. It applies serviceably, for instance, across jealously-guarded distinctions between: "*power over*"²³⁹; "*power with*"²⁴⁰; "*power through*"²⁴¹; "*power to*"²⁴²; "*power to do things*"²⁴³; "*power to make change*"²⁴⁴; "*power to rule*"²⁴⁵; "*power to manage*"²⁴⁶; "*power to create*"²⁴⁷; "*power within*"²⁴⁸; "*power from within*"²⁴⁹; "*power between*"^{250 251}; "*power as energy*"²⁵²; "*power under*"²⁵³; "*power to negate*"²⁵⁴ and "*power to undo*"²⁵⁵. Each involves at least some subset of aspects relating to structuring agency that is asymmetric with respect to the orienting of some onward course of events rather than others. The necessity in any given situation always to be more precise about the *particular* aspects and dimensions of power that come to the fore, is not necessarily obstructed by a general heuristic framework like this. Indeed, such nuance can actually be assisted by a framework for comparison that is explicit and accountable across divergent views.

Either way, the first order characterisation here, of power of all kinds as '*asymmetrically structuring agency*', begs many specific questions in different contexts. But this simple general understanding does at least crucially address the manifest fact that – whatever form is taken by specific modalities or circumstances for structuring of agency or acting on structure – it is a familiar characteristic of what is known in everyday life as 'power', that all these processes and relations are in some way asymmetrically formative as between different outcomes. So, it is arguably the single most generalised feature of power, that (subject of course to multiple forms of contingent turbulence), its diversely-manifested gradients in any given setting, tend to drive onward dynamics more in some kinds of directions, than in others.

Figure 1: a schematic view of one impression of key attributes in socio-material positive-feedback dynamics (key sources for each dynamic provided in main text)

A Constellation of Incumbency Reinforcing Dynamics

As defined in references cited in main text (albeit contrasting by context), each dynamic reinforces scalar and vector aspects of 'configuring fields' in power gradients driving specific features of a socio-material pathway



So, what *most* shapes and steers the 'ecological' relations among these diverse processes of socio-material change^{257 258 259}. Beyond each individual dynamic, what patterns are evident in their collective 'epi-dynamics' over time [5]? In seeking to answer this, a significant indication again arises in the importance of the processes of *prehension* that (sometimes tacitly) interlink both subjects and objects of attention. This is, that the degree to which resulting patterns might be seen to be about 'power' (and thence possibly 'incumbency') on the one hand; or simply to emergent change on the other; typically remains (at least to a degree) a matter of perspective. As we have seen, intentionalities of many incommensurable kinds are deeply entangled with multiple ostensibly inanimate material phenomena. But there will be circumstances of *prehension* in which entire generative chains of events might alternatively be thought to be effectively contingent in relation to any meaningful notion of social purpose [6].

Depending on how they are manifest²⁶⁰, then, aspects of these more circumstantial *prehensions* of change might be found, for instance, in some of more apparently 'deterministic' forms of path-dependency (like those argued to play large roles in the canonical case of the QWERTY keyboard^{214 261 262 263}). In settings where there are judged to be no specific relevant intense or enduring gradients of power primarily responsible for particular structurings of agency or actions on structure^{264 265 266}, then, the processes in question are arguably not best viewed as 'incumbency' at all: but as a more contingent phenomenon that might be called '*socio-material persistence*'²⁶⁷. In the end, the emphasis placed on the ostensible contingency of persistence, or on kinds or degrees of structuring agency seen behind incumbency, will be a function of more general political subjectivities concerning power. By using a relational notion of *prehension*, as discussed earlier, the present framework encompasses the range of this spectrum, whilst retaining a clear practical focus around agency.

Even when construed as broadly as this, however, the dynamics included in the present notion of incumbency should not be assumed to be the *only* reasons why history unfolds as it does. Yet, this being said, it must also equally be acknowledged that nearly all the major inflections and permutations of contexts, dimensions and modalities of power recognised to operate in society at large, are variously understood to be implicated (in some way, at least in principle) in (re)production of socio-material incumbency^{81 268 269 270}. In this way, general understandings of socio-material incumbency might variously be expected to emphasise aspects of power across the full range of manifestations recognised in a vast array of contrasting approaches to different modes

and contexts of power in political inquiry^{271 272 273 251 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288}. As with the academically-differentiated modalities of power identified above, then, gradients and flows in '*asymmetrically structuring agency*' may variously be prehended in contexts and dimensions of: agency²⁸⁹; organisations²⁹⁰; networks²⁹¹; relations²⁹²; structures²⁹³; structuration¹⁷⁵; institutions²⁹⁴; fields²⁹⁵; practices²⁹⁶; cultures²⁹⁷; discourses²⁹⁸; knowledges²⁹⁹; infrastructures³⁰⁰; and imaginations²³⁸. So: incumbency is evidently not only societally, but also analytically, highly diverse and pervasive. It is a crucial distinctive feature of the present approach, that it also seeks to accommodate this contextual diversity of prehensions of power in a balanced way.

Whatever circumstances or forms of power might be of greatest interest, however, and whichever styles of prehension are most favoured, it will be a characteristic shared in common that key aspects of incumbency can in any view and context be characterised in terms of various kinds relational processes summarised among the many dynamics shown in Figure 1 (eg: 'lock-in', 'obduracy', 'entrenchment', 'entrapment' etc). Left to its own devices and all else being equal, then, any given instance incumbency will (subject to other instances and contingent turbulence) in these terms tend to reinforce itself. But, it is the fact that constituting phenomena are as wide and as disparate as this, that also means that notions of 'incumbency' are not easily addressed under any single generalised analytical framework. Nor are the implications simple. Yet there do emerge even in a general analysis like this, some quite straightforward insights, of potentially significant practical relevance. In particular, the twin components in this conceptualisation of power (as relational 'asymmetries' in processes of 'structuring agency'^{81 238}) highlight two specific main aspects of interest: *asymmetry* and *directionality*.

First, with regard to the *asymmetries* referred to in this formulation (of '*asymmetrically structuring agency*'), there are issues around the intensities of the power gradients themselves. This concerns the repercussions for society and wider environments, of the particular degrees and modalities of asymmetric relations in structuring agency concentrated around any given instance of socio-material incumbency. And here it is important to note, that for this aspect of power to be of concern, need not imply a generally 'critical' position. All that is assumed, is that – as arguably the single most important social fact^{301 302} – power in these very broad senses is at least an issue worthy of attention. After all, it is not necessary to see any given concentration of power as automatically being a problem in its own right, in order to realise that it is most likely to become so, if it is left invisible, uninterrogated or unaccountable³⁰³. In this straightforward 'scalar' aspect of power, then, key issues concern the forms and magnitudes of authority and privilege in which a given incumbency is constituted^{304 284 280 305}.

Second, with regard to processes of 'structuring agency' themselves (like those summarised in Figure 1), there are questions over '*directionality*' – the particular directions of change which these magnitudes of intensities orient^{306 307}. What specific kinds of socio- material pathways are favoured (among other possible orientations for change) by the working of any given instance of incumbency³⁰⁸? What other possible forms of wider interlinked social and material change (socio-material pathway) might be suppressed by these patterns⁷⁷? These questions can be quite independent of general issues around power distributions *per se*. This is because normative judgements over pros and cons of any given power concentration will depend on alignments of interest in subjects and objects. Even a self-styled emancipatory view of incumbency (for instance) might often welcome some specific re-concentration of power, if this favours an alternative pathway that happens to be preferred by the 'critical' interest in question³⁰⁹.

So, this second aspect of interest concerns not just the '*scalar intensity*' of incumbency around a given socio-material configuration – the simple quantitative magnitude of the associated power concentrations. It also concerns their '*vector intensity*'³¹⁰ [7] – the propensity of incumbent power in this instance to reinforce the orientation of a specific social and political *direction* for change. Although neglected in much policy-related discussion of innovation and transition²¹⁸, this issue of directionality is – at least in political terms – arguably the most important single aspect⁴³. With 'technological cultures'^{311 312}, 'tastes'³¹³, aesthetics³¹⁴ and 'genres'³¹⁵ being matters of wider normativity³¹⁶ – and so politics^{317 318} – around particular socio-material orientations as compared with others, it is clear that evaluative questions over incumbency are rarely simple or self-evident. The questions raised are typically intrinsically and unavoidably subjective, with no necessary single 'right' answers even in specific settings⁷¹. In other words, whatever forms they take (and no matter what

academic etiquettes of scholarly distance or policy neutrality might be performed^{319 320 321 322 323}), both socio-material incumbency and any analysis thereof, are necessarily irreducibly political^{324 157 325 34}.

To summarise, by addressing each of these two aspects of asymmetry and directionality in a balanced way, conceiving of power in terms of the simply-stated relational verb^{326 327} of '*structuring agency*' arguably applies in principle serviceably across a wide diversity of approaches. It does this for purposes of generalisation, without unduly reducing the important disparities and context-specificities that remain salient in particular settings. As such, this approach is an aid to heuristic reasoning^{328 329 330}, that allows a number of crucial features to come to the fore, that are relevant across all contexts but may otherwise sometimes be neglected.

Despite the intimately-inseparable co-implication of structure and agency, then, the effects exercised by these dual properties of incumbency ('*scalar asymmetry*' and '*vector directionality*') may in this way (despite their own linkages), often reasonably be seen (both analytically and normatively) as quite independent of each other. For instance, in the face of various contingent kinds of 'forcing' pressures³³¹ or 'focusing events'³³², even the strongest asymmetries in power concentrations may find themselves unable to forestall the tidal momentum of unfolding circumstances in particular directions. This is the declared predicament, for instance, with many of the global challenges with which this paper began. No matter how compelling and consensual the evident solutions, persistent problems like poverty, environmental destruction and war can nonetheless appear, quite simply, to defy even the most powerful forms of human agency^{333 334 335 336 337}. In these respects, scalar concentrations of power are manifest largely without the aspired forms of vector orientation. This is a large part of why it is so important to engage with the phenomenon of incumbency in the first place.

Likewise, there arises here a kind of '*paradox of embedded agency*'³³⁸. For it is equally true in a countervailing sense, that even a relatively weak gradient of '*structuring agency*' operating at a particular '*critical juncture*'³³⁹ may exert a disproportionate influence on the direction of onward developments³⁴⁰. And here again, it is not difficult to think of instances. The history of technology – like history more generally [8] – abounds with dynamics in which relatively modest actions undertaken in particular '*windows of opportunity*'^{341 342}, can in retrospect be seen to exercise disproportionately formative effects on the onward direction of events. Current large-scale wind turbine designs arguably offer one example, which might never have grown even to become a feasible possibility (let alone their current highly commercially competitive status in worldwide electricity supply markets³⁴³), had it not been for crucial exercise of marginalised agency acting at '*salient moments*'³⁴⁴ in very particular settings '*below the radar*' of powerful global energy incumbencies³⁴⁵ [9]. Contemporary commercial wind power is thus an instance of a manifestly generally viable socio-material configuration, that could easily have been rendered by global patterns of incumbency to be historically effectively unrealisable. Strong effects prevailed in the orienting of wider change, without intense concentrations of power. Again, the value becomes clear, of distinguishing '*scalar asymmetry*' and '*vector directionality*' in incumbency.

It is therefore the case that much more may be radically possible in socio-material change, than meets the incumbent eye – or the self-aligning views of its clients (or the thereby-skewed prehensions of wider affected society). And the greatest constraint on the progressive interests that are so often marginalised by incumbency, may often lie in the restrictions on subaltern imaginations and ambitions concerning the scope of what is seen to be achievable³⁴⁶. So it is in this sense, that the title of this paper applies: addressing both the dimensions and the magnitudes constituting the '*depth*' of socio-material incumbency in the social discourses, cultures, institutions and infrastructures that bear on any given pathway. Characterised in ways that will be elaborated in the following discussion, then, it is these magnitudes of intensity and dimensions for orientation in '*asymmetrically structuring agency*', distributed across the totality of socio-material configurations, that can be envisioned as '*configuring fields*'. It is the associated processes and relations like those described in Figure 1 above (eg: '*lock-in*', '*obduracy*', '*entrenchment*', '*entrapment*' etc), that configure the particular directions for socio-material change that actually unfold in any given setting – and which suppress so many others.

2.2: Challenges in Interrogating Socio-Material Incumbency

Alongside the issues discussed above, the fact that socio-material incumbency is fundamentally about power also raises a deeper consideration. This further issue follows from the discussion above, of the importance of how agency is '*prehended*' (ie: the ways in which how it looks and weighs and feels), depends on circumstances both of subjective perspective and object context. The need to consider this, arises in the perennial predicament recognised in Giddens' '*double hermeneutic*'¹⁷⁵. This acknowledges that it is only in social science and humanities (rather than, say, in natural science), that that both subject and object are comprised equally of human *social* processes and relations³⁴⁷. Other disciplines involve such social processes prehending non-social processes. Physical, chemical or biological objects, after all, are not themselves constituted by social phenomena. So it is uniquely in understandings of social dynamics (like incumbency) that *the subjects of understanding are constituted in broadly similar terms to the objects*.

In short, it is only in social science and the humanities that society prehends itself. With natural science itself being a social activity³⁴⁸, but not its objects, it is arguably this 'ontological distance' that renders its categories and processes so apparently enviably clear – and its predictive capabilities sometimes so exquisitely precise. The greater ontological distance between object and subject, permits bolder forms of reduction, generalisation and manipulation³⁴⁹. There are temptations for social enquiry to imitate this³⁵⁰. And this can lead to the ignoring of the double hermeneutic – and a corresponding pretence that social knowledge production is not a social activity. Such denials of the formative effects of society on the substance of resulting knowledges are highly problematic anywhere in natural science. But it is especially pernicious in social science. Here, no matter how inconvenient to aspirationally 'objective' accounts, the ontological proximity of social subjects and social objects is an unavoidable fact of life – with a propensity to bite back hard. Aspirations to emulate the positive idiom of higher status disciplines, can lead to serious forms of denial and self-deception. Expediently for incumbency, the effect is to obscure some of the most important ways in which power works in the world³⁵⁰.

So, the conjunction of the viewing with what is viewed is often ignored, but its effects cannot be escaped. And this is especially so, in the case of incumbency. If only emergently, dynamics of incumbency can often extend from being separate objects of prehension, to entangle strongly with subjective conditions of prehension: the processes of incumbency-related research themselves. It is in this way, for instance, that incumbent pressures can condition '*strategies of obduracy*'³⁵¹ – gravitating a shaping effect on the forms taken by knowledges about itself. When (as is so often the case in study of socio-technical systems³⁵²), notionally independent academic research is subject to explicit pressures (and self-conscious aims) to 'influence decision making' and be seen to have 'policy impact'^{353 354 355 120}, then the effects of these 'gravitational' forces exercised by incumbency can be seriously reinforced. In short, it might reasonably be expected that the constituting dynamics of incumbency will include tendencies to condition knowledges about incumbency, in ways that make the principal constituting phenomena of incumbency more difficult to erode – or even prehend.

If this seems an unduly pessimistic 'critical' take on the circumstances of academic research in this field, it may be worth considering the same issue from another angle. If (as is routinely the case^{36 168 356 357 78}) 'discourse', 'knowledge' and 'imaginings' are recognised to count among the constitutive dynamics of incumbency, then would it not be irrational simply to assume that academic and policy analyses of incumbency (as socially-embedded subjects) will somehow be immune to the very processes on which they focus? And would not this social congruence of subject and object mean there can be few other areas than study of incumbency, where the 'double hermeneutic' discussed above is more salient – and where knowledge is more likely to bear the imprints of power¹²⁸? At least in the absence of conclusive evidence otherwise, it seems a more reasonable default to assume that research on incumbency might – rather than will not – bear the imprints of its object.

Also relevant here, is that it is a repeated finding in science and technology studies^{358 359} as well as in work on regulation and governance more widely^{360 361 362 363 364}, that efforts at ostensibly independent technology assessment or regulatory appraisal that are intended (and claimed) to inform future socio-material commitments, are typically at least as much influenced by prevailing patterns of incumbency, as they are shaping of them^{365 366}. Likewise many kinds of framework for studying processes of 'socio-technical transition' are (with important exceptions) frequently criticised for undue neglect for the importance of various kinds of

power^{367 368 369 370 371 372 373 34 374 375}. This kind of denial or side-lining of politics in any given arena, is well-understood to favour whatever happen to be prevailing vested interests¹⁶⁸. There seems little reason to hold the study of research and innovation to somehow be immune. As a result, it would again be prudent not to rule out that how socio-material incumbency is thought about, can be a major means by which it is asserted.

Once these possibilities are acknowledged, there lurk (amid the complexities), many further important, intractable – but very practical – unresolved questions^{157 372}. This is how at least some of the implications may extend beyond the reach of prevailing academic understandings. What exactly *is* socio-material incumbency in any given setting? What *kinds* and *circumstances* of incumbency might most usefully be distinguished? Under which conditions and perspectives may specific forms of incumbency be judged *positive* or *negative*? How can incumbency be *developed, supported, harnessed, countered* or *reoriented* in order to address wider social goals? How is incumbency most effectively *understood* and *interrogated* to these ends? In particular: how best to advance interests (like *sustainability, peace* or *social justice*) that are undermined by many prevailing forms of socio-material incumbency^{227 376}? How may such efforts be obstructed, by ways in which *understandings of incumbency can bear the imprints of the very power dynamics and relations that they seek to scrutinise*? How might such regressively conservative effects on knowledge itself, best be countered? These questions are crucial to resolving the pressing global challenges with which this paper began.

And it is these particular questions that this paper will seek to help address. In so doing, there arise a number of specific concerns about the adequacy or completeness of many accounts of incumbency offered in currently dominant frameworks for the study of socio-technical systems. How reasonable is it, for example, to seek to confine or partition incumbency according to a scheme of ostensibly separable or strictly-nested entities? Such neatly-ordered structures are ubiquitous in existing study of socio-material incumbency, implicating notional ‘*middle range*’^{377 378} social categories such as ‘levels’, ‘niches’, ‘regimes’, ‘landscapes’, ‘networks’, ‘functions’, ‘industries’, ‘systems’, ‘regions’ or ‘sectors’^{379 380 381}? Such heuristics can offer many insights³²². But they may also raise questions and require some rather strong assumptions, of kinds that may be problematic, but which can be under-scrutinised in the enthusiasm of adherents for “*necessary simplification*”³⁷³. With the defining and bounding of such categories being especially vulnerable to the gravitational effects of incumbency (as discussed above) acting on subjective conditions of knowledge production, resulting framings (despite their professed academic independence) may not be entirely innocent in relation to the dynamics they seek to interrogate. It is here that the present approach may hold profound practical implications for policy.

For instance, many current ways of envisioning sociotechnical incumbency perform a notional posture described by Gyawali as an ‘*eagle-eye view*’³⁸². This is consistent with high profile contemporary accounts of governance, envisioning that policy analysis should aim at informing – even ‘*designing*’³⁸³ – a notional overarching ‘*cockpit*’³⁸⁴. Like the broader phenomenon of “*seeing like a state*” famously observed in relation to other aspects of power³⁸⁵, the frameworks resulting from this kind of ‘*cockpit-ism*’³⁸⁶ present themselves as if ‘*looking down*’ on society [10]. In this way, there unfolds a dynamic under which efforts to gain the attention of power, find themselves pressurised by expediency to pre-adopt an idiom of ‘*seeing like power*’²³⁸. The kinds of problems that can arise from unfettered forms of this dynamic are well known and widely agreed across political divides. They are well documented, for example, in histories of high-rise housing³⁸⁷, modernistic urban design³⁸⁸, forced agrarian collectivisation³⁸⁹, the re-engineering of river systems³⁹⁰ and large hydro-electric schemes³⁹¹ – as well the many repeatedly oddly-unanticipated disastrous outcomes of war^{392 393 394 395 396 397 398}. Despite the wealth of evidence and experience qualifying romanticised aspirations to control³⁹⁹, the inconvenient fact that ‘*there is no cockpit*’ in global governance, remains effectively ignored⁴⁰⁰.

Yet, although they are so effectively wrong, representations of society as if from an epistemic standpoint so elevated as to transcend the phenomena under scrutiny, serves potentially highly instrumental alignments of interests. Resulting storylines emphasise ‘*control*’, in the sense that feasible interventions are held not only to correspond with intended ends, but to map so closely with these that other collateral kinds of outcome may effectively be ignored^{401 402 403}. Such representations are expedient equally to academic disciplines striving to assert status and individuals seeking to acquire policy ‘*impact stories*’⁴⁰⁴, as well as to incumbent interests seeking to sponsor research that reinforces justification for its own prior commitments^{405 406 407 408}. The feedbacks between the two further intensify the instrumental dynamics. So acute can this regress become,

that resulting intensely romanticised ideas of elite agency can foster potentially seriously misleading ‘illusions of control’⁴⁰⁹. In the ‘real worlds’ of governance and politics – especially the long run dynamics of technology – such idealised forms of control simply do not exist [11]. But the belief that they do, can help sustain prevailing patterns of privilege. So, it is in this fashion that – even where the aim is to challenge incumbency – the implicit reproduction of such ‘fallacies of control’^{410 411 81} can (even if only in analysis) have the effect of supporting it.

In such ways, some existing research on socio-technical change may be at risk (if only inadvertently and tacitly) of some rather eccentric assumptions concerning the simplicity and tractability of relevant patterns of socio-material incumbency and associated possibilities for any kind of ‘complete’ ‘independent’ analysis of these. This can be so, even if research is aware of the diversity of dimensions, processes and relations mentioned above. Despite acknowledged complexities, the multiplicities of patterns in incumbency-sustaining dynamics may be characterised as more confined and monocoherent than might actually be the case. This can be seen, for instance, with many kinds of ‘middle range’ social categories referred to above⁴¹². In varying degrees, concepts like ‘levels’, ‘niches’, ‘regimes’, ‘landscapes’, ‘networks’, ‘functions’, ‘industries’, ‘systems’, ‘regions’ and ‘sectors’^{379 380 381} may each be treated as more discrete, robust and self-evident in their instantiations (and so apparently tractable to policy), than justified by the underlying phenomena⁴¹³. Indeed, the same can be true of different kinds of notionally discrete categories and instances of dispositional^{414 415 416}, social⁴¹⁷, socio-technical⁴¹⁸, organizational^{112 419 420 421}, institutional^{422 423}, strategic action^{424 295} and policy⁴²⁵ fields [12]. It is a distinguishing feature of this configuring fields approach, that – whilst many indicative examples are summarised above (eg: Figure 1) – the approach does not rest on partitionings of assertedly separable kinds.

But this kind of deconstruction is not enough on its own. The gravity of the issues around incumbency with which this paper began, also requires a sense of responsibility towards the finding of better practical responses. The main value of criticism – especially in this present unusually expansive form – is to prompt positive alternatives. So, it is in order to enable more direct interrogation of the concerns raised here and to identify less problematic possibilities, that a ‘configuring fields’ approach will be elaborated in the next section. And it is on this basis, that attention will turn to the development of a systematic complement and possible substitute for this prevalent ‘eagle-eye’ view of incumbency. To see the value of this, is not to assume automatically that the above analysis is correct, or that the ‘eagle-eye’ view described here is necessarily problematic. It is simply rational not to neglect possible alternatives.

3: A ‘Configuring Fields’ Approach to Socio-Material Incumbency

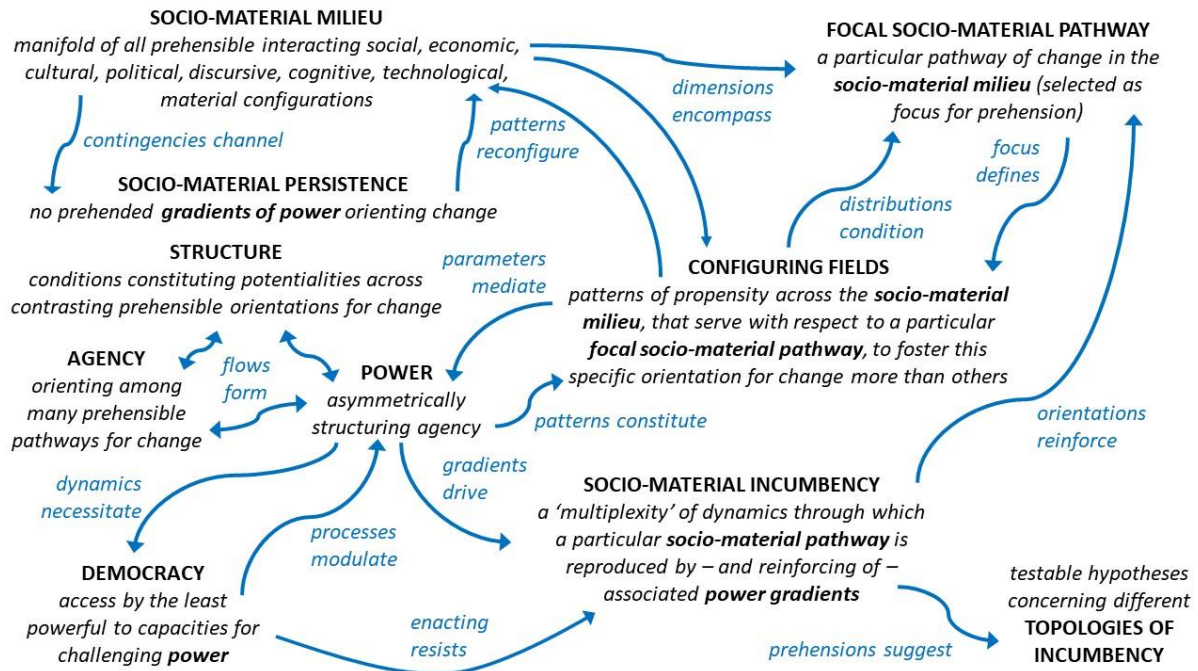
3.1: Ideal-Typical ‘Eagle-Eye’ and ‘Worm-Eye’ Views

Discussion in the last section was based on seminal findings in the analysis of ‘structuration’, which themselves relate to foundational insights across a large sweep of historical and contemporary social theory^{186 175 236 237}. Acting in particular concrete settings, but extending across a multiplicity of dimensions in social and technological phenomena, a large array of more-or-less human-intentional or material-emergent positive feedback phenomena were identified as helping to shape directions for socio-material change (cf: Fig. 1) . Among these, it was argued that the diverse power dynamics that constitute socio-material incumbency can be envisaged as multiple topologies in ‘*asymmetrically structuring agency*’. In ways that will be returned to in discussing methodology later, the notion of topologies is useful because it offers a way to help bridge the chasm between quantitative and qualitative phenomena – and calculative and interpretive perspectives⁴²⁶.

To have such a broad and balanced way of thinking about power and incumbency is helpful because it must, as has been argued, address asymmetries associated with incumbency that have properties not only of scalar intensity, as concentrations of power, conceivable in a broadly quantitative idiom. Also crucial, it has been shown, are questions over the vector directionality of incumbency, in terms of variously-characterisable – and thus more interpretive – normative orientations in the social and material *effects* of these power dynamics. Put in one sentence, then, a pragmatic way to approach what is envisaged, might be in general terms of ‘*configuring fields*’ – as ‘*patterns of propensity with respect to a particular focal socio-material pathway, across the totality of all imaginably possible socio-material configurations, that serve to foster this specific orientation*

for change more than others' [12]. A schematic illustration of mutually-defining relations between the key concepts that this entails are shown in Figure 2 below.

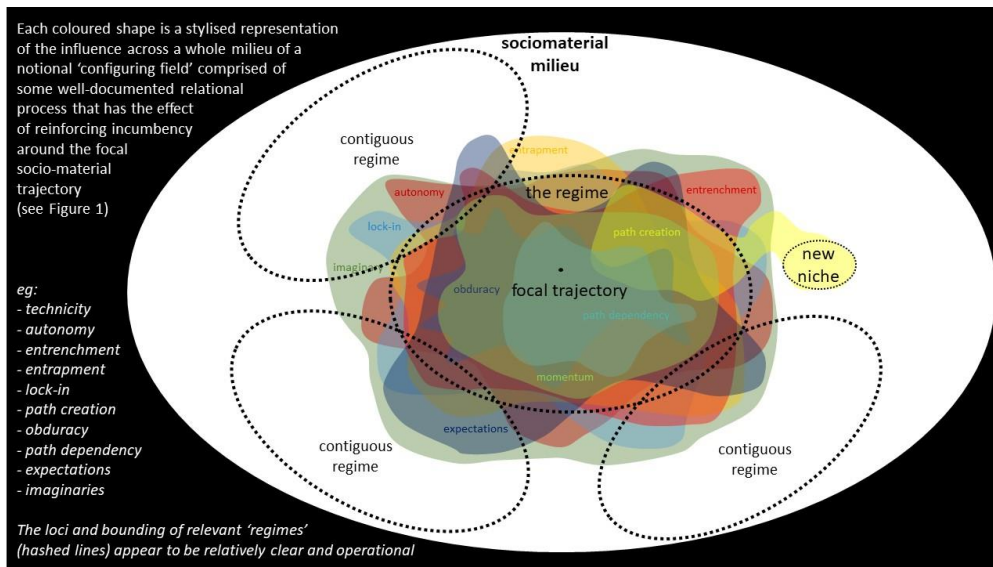
Figure 2: schematic picture of mutually-defining relations between key concepts in this analysis (formative sources for each concept are variously discussed in the main text)



Any merit in such theoretical abstractions must rest strongly on the utility of the insights they help generate – and their practical implications for action. So, the potential value of this ‘configuring fields’ approach, might be examined first in its possible application to systematically defining meaningful alternatives to the conventional ‘eagle-eye’ view of socio-material incumbency characterised in the discussion so far. And a first step towards this, lies in clearly characterising the salient attributes of this orthodoxy itself. To this end, then Figure 3 (below) provides a schematic illustration of some key features of the ‘eagle-eye’ view. The white ellipse in the diagram can be thought of as a two-dimensional projection of a multidimensional manifold of all possible socio-material “configurations that work”¹⁶² [13]. This total ‘milieu’ for socio-material change does not represent any kind of literal (‘territorial’⁴²⁷) space, but uses extension and positioning in the plane of the page as an analogy for radically high-dimensional relations of proximity, dependency and association in the constituting of different prehensible socio-material configurations⁴²⁸. So it is the generally possible topologies that matter in the milieu projected in Figure 3, more than the detailed geometries of particular forms [14].

Unlike other spatial metaphors applied in this kind of analysis [15], the compound term ‘timespace’^{429 430} is used here to refer to the white elliptical representation of the milieu in Figure 3. This addresses an essential issue in socio-material incumbency that might otherwise be neglected, concerning the vector (as well as the scalar) properties of associated configuring fields. This engages with questions over the particular directions in which incumbency might be driving socio-material change and with what degree of reversibility⁹⁶. The ‘space’ side of this metaphor captures aspects of the dynamics that might be regarded as reversible. But the ‘time’ analogy evokes better the irreversible path-dependencies that often characterise the directionalities of change. This was arguably a crucial issue, for instance, in the earlier example of wind turbines. If all else remains equal, reinforcing the ‘vector intensity’ of incumbency around any one pathway might be expected to make such reinforcement more likely for adjacent (necessary, associated or dependent) pathways^{96 431 432 433}. It is in this sense, that incumbency can be thought of as ‘contagious’ in socio-material timespace.

Figure 3: an 'eagle-eye' view of 'closed topology' in 'shallow incumbency':
 confined, monocongruent, discrete and singular
 (sources for concepts ordered here are given in the main text)



It is not necessary however, fully to fathom all such technical details – still less to concur with them – in order to appreciate what is summarised in Figure 3. In showing the total context of all possible loci and extents of incumbency, this schematic diagram illuminates an encompassing 'milieu' for the social and material dynamics of power as they relate to interlinked social and material change^{434 435}. Nor is this a particularly novel notion. Indeed, one version of this general idea that is especially widely known in mainstream studies of research and innovation, is "the socio-technical landscape"¹⁶². In these terms, the socio-material milieu in Figure 3 can also be thought of as an "external environment" constituting the "deep structural trends"⁴³⁶ [16] that shape social and technological change over time. The reasons for turning back to an older vocabulary will become evident below. However it is interpreted or referred to, though, the elliptical white area of Figure 3 can usefully be thought of as the 'stage' on which to explore different kinds of performances by the power dynamics that constitute socio-material incumbency. It is by this means, that crucial differences might be distinguished.

Despite contrasting emphases⁴³⁷, the particular picture of these power dynamics referred to in Figure 3 as an 'eagle-eye view' are shared in common across a variety of otherwise differing kinds of socio-technical 'regime theory'^{438 439 440} (as well as the many other approaches mentioned above [17]). Key features are well expressed in a multiplicity of diagrams developed in various literatures on socio-technical change^{151 441 149 116 121} (one of which is reproduced in Figure 4 below). Across many forms, however, what all such representations tend to hold in common, is the following characteristics.

First, these 'eagle eye' pictures generally represent each incumbency-constituting dynamic in any given setting as being relatively *confined*, rather than extending across the entire milieu. This is shown by the restricted extent of each coloured field in the total milieu of Figure 3.

Second, the different incumbency-constituting dynamics are seen to be *monocongruent* with one another. This term refers to the tendency of the distributions of the fields strongly to overlap with each other in just one particular area of the wider milieu.

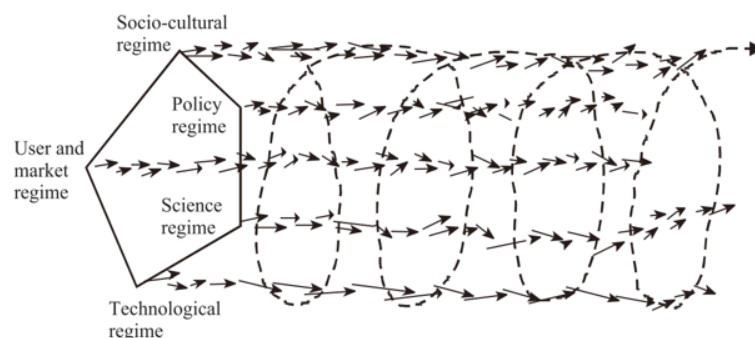
This in turn means, as a third characteristic, that the resulting picture of incumbency – for instance of 'the regime' – is quite *discrete* and *singular* in each case (Figure 3). In other words, the palimpsest of all coloured fields taken together, is quite readily representable as a single coherent combined nexus.

As mentioned above, it is not the main purpose here comprehensively to critique the often-useful frameworks for understanding socio-material incumbency that take this kind of 'eagle-eye' form. The aim is instead, simply

to substantiate the principal shared distinguishing features of this eagle-eye view, so that a clear practical alternative can be formulated for equal consideration. What will be focused on for purposes of illustration to this end, then, is the currently most well-established way to view socio-material incumbency: as ‘the socio-technical regime’. Associated notions are arguably paradigmatic in this field ⁴⁴². So if this criticism is sustainable even in this best-elaborated case, then it might be held to apply even more strongly to less-established but epistemically similar ‘middle range’ frameworks. The particularity of this illustrative criticism with respect specifically to ‘socio-technical regimes’ should therefore not detract from the essential point, that the same basic issues arise with respect to *all* the frameworks mentioned above – including terminologies (for instance) of ‘systems’, ‘industries’ or ‘sectors’ as well as ‘regimes’ ^{379 380 381}.

To start then with one especially widely adopted formulation, ‘the socio-technical regime’ as shown in Figure 4 below (after Geels ^{443 436}), is defined as “*the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures*” ^{162 444 445}. This “*semi-coherent set of rules*” ¹⁵¹ represents “*the dominant way that a societal function is fulfilled*” ⁴⁴⁶. Often repeated ^{151 443 445 116 447 448 121 321 449}, the term ‘semi-coherence’ evidently refers not so much to the monocongruence of any given regime (as described above) as to “*...the possibility of tensions between rules from different sub-regimes*” ⁴³⁶ [18]. Crucial to the constituting of each given regime in these terms, are processes of “*alignment*” ^{162 436 116}, in which “*regulations, infrastructure, user practices, maintenance networks are aligned to the existing technology*” ¹⁵¹.

Figure 4: presumptively confined, “semi-coherent” dynamics yield an ostensibly discrete, singular ‘regime’ (after Geels, 2004; 2011)



Alignment of ongoing processes in a socio-technical regime.

This property of alignment shown in Figure 4 is reflected in the congruence of the configuring fields shown in Figure 3. In accord with established conventions in this field, the hashed lines in Figure 3 delineate an envisaged overlap in the distributions of the coloured fields, such as to suggest that a given focal ‘regime’ displays relatively clear boundaries that partition it within a “*patchwork*” ¹⁵¹ of notionally discretely contiguous regimes ^{450 437 436} and from associated phenomena like ‘challenger’ ²⁹⁵ ‘niches’ ^{451 162}. What this stylised picture brings out as a notable general feature of conventional approaches, then, is the relatively discrete and singular manner in which ‘the regime’ is commonly held to relate to the wider milieu, and to other social categories ³⁷². The resulting ‘closed topology’ portrayed in Figure 3, is why leading figures in this field can (with respect to particular activities), routinely refer to (for instance) ‘*the energy regime*’ ^{452 40 453}, ‘*the electricity regime*’ ^{454 452}, ‘*the fossil fuel regime*’ ⁴⁵⁶, ‘*the coal regime*’ ¹⁶⁴, ‘*the oil regime*’ ⁴⁵⁷, ‘*the gas regime*’ ^{458 431 459}, and ‘*the solar regime*’ ⁴⁵⁷. The point for the present argument, of course, is that the apparent clarity and assertive singularity of the definite article in each case, may contrast with the latent ambiguities in the overlapping pluralities and nestings of the specific sectoral references.

Of course, much analysis in this genre acknowledges that ‘the regime’ is just a “*heuristic*” construct ¹⁵¹ and “*an interpretive analytical concept*” ⁴³⁶. So it is clear to practitioners of regime-based understandings, that real-

world instances and their connections will be more complicated. Beyond issues of regime boundaries^{218 460}⁴⁶¹, there is often sophisticated discussion of these ambiguities in this literature concerning nuanced details relating to regime structure⁴⁶², culture⁴⁶³, power^{464 268}, discourse⁴⁶⁵, agency⁴⁴⁸, relations between regimes^{466 450} and nestings of regimes and 'sub-regimes'⁴⁴³. To also be fair to the present critique, however, such complexities are already acknowledged in the overlaps and fine-grain structures shown in the characterisation of the 'closed topology' in multiple configuring fields in Figure 3. Despite such details, the crucial point is, that what nonetheless typically prevails in much current academic understanding in this field, remains a relatively simplistic and challengeable assumption concerning the degree to which the constituting dynamics of any given 'regime' can safely be assumed to be relatively confined and congruent with respect to the regime itself.

A good illustration of this assumption – and of the associated vision of 'alignment' – is provided by a further detail in Figure 4. It is notable in this illustration from a key text by a leading protagonist, that the term 'regime' refers to some strongly contrasting things: first, to a specific focal 'socio-technical regime' (in the diagram label); and, second, to general patterns in entire milieu-spanning societal phenomena (eg: 'policy', 'science', 'technology', 'markets', 'culture' – on the left hand side). Which of these two, is 'the regime' that this is supposed to illustrate? This results in a range of serious – and rather surprising – ambiguities at the core of this framework [19]. But for present purposes, this is not the main difficulty in the performed clarity and completeness of this notion of 'the regime'⁴⁴³. More striking in this regard, are the simplistic and challengeable assumptions underlying the picture of 'alignment' in Figure 4. In short, Geels' canonical diagram also displays a conflation between the *orientation* of a particular 'incumbent trajectory', with the *dimensionalities* of the general dynamics that foster this.

To see this, it is worth asking what is meant to be illustrated by the little near-horizontal arrows in the middle of the picture in Figure 4? Most obviously, these represent an *aligning effect* on the trajectory of the specific focal socio-technical 'regime' (in the sense used in the diagram label). But what these little arrows also suggest is a much more general *alignment between* the milieu-spanning 'regimes' (in the different sense indicated on the left-hand side of the diagram). In other words, the phenomenon of alignment in any particular instance, is taken here to imply a high degree of congruence in the wider general processes and relations that are responsible for this. It is the resulting impression of clarity that arises from this conflation, that makes it possible to assert in the face of much wider potential multiplicity, such an ostensibly simple and singular term as 'the regime'. And it is this picture of assumed congruence, that is reflected in the presumptively high degree of overlap in the configuring fields of the 'eagle-eye' view shown in Figure 3.

The problem with this implication is that just because certain social and material processes and relations have the *effect* of sustaining a specific socio-material pathway, does not necessarily mean that each of these constituting dynamics are themselves *enacted* in dimensions that are congruent with – or confined within – all the others that also constitute the associated incumbency. That the general milieu-spanning phenomena help constitute the particular socio-material configurations associated with this pathway does not necessarily mean that they all also (separately and in all other ways) neatly align with each other, in a fashion shown by the monocoherent overlaps in Figure 3. The possibility also seems worth including in such a supposedly general framework, that a given socio-material pathway might be sustained by dynamics that are themselves in (perhaps many) other respects *not* aligned with one another [20]?

Seen in this light, then, it seems highly questionable simply to assume that the processes and relations that constitute incumbency in any given locus, will also be so *congruent* with one another as to effectively be *confined* to the identity of a *discrete* and *singular* 'regime'. Holding potentially massive practical implications for the interrogation of incumbency – and for practical efforts to modulate it – it is this highly questionable feature of currently widespread regime theory that is inadvertently highlighted in Figure 4 – and represented by the schematic overlaps in Figure 3.

What is at issue here, however, extends far beyond the details of particular diagrams. And it is not a matter for parochial academic wrangles. Indeed, what is at issue is a flaw in prevailing understandings that Geels himself incidentally regrets as "*a tendency to reify*" notions of 'the socio-technical regime'^{436 372}. In short, both Figure 4 (and its translation in Figure 3) convey a lofty sense of 'looking down' on a set of *monocoherent* dynamics, effectively coterminous with the regime that they notionally constitute, which therefore appears to be discrete

and unitary. However applicable it might be thought to be in any given setting, this picture at least prompts a possible alternative view. This contrasting approach might embody an immersive sense of 'looking around' at a partially-obscured encompassing milieu, rather than 'looking down' on a notionally clearly-surveillable 'landscape'. Although the dynamics in focus are still sufficiently 'coherent' (in Geels' terms) to help constitute a focal pathway (and thus not entirely incongruent with one another), they nonetheless display so many separate loci of overlaps, that they must be recognised as '*polycongruent*' rather than monocongruent [21].

Given the diversity of incumbency-reinforcing dynamics referred to in Figure 1 (eg: 'lock-in', 'obduracy', 'entrenchment', 'entrapment', etc), this alternative ideal-typical possibility might readily be seen to be at least equally plausible, to what even key authors of regime theory acknowledge to be problematically-reified current default understandings. Here, the manifest disparities between many well-recognised contrasting reinforcing dynamics like those summarised in Figure 1, are acknowledged to admit far more multifarious topologies across contrasting settings, than are admitted in conventional regime theory. In this wider view it emerges as quite eccentric simply to assume such simplistically congruent patterns of reinforcement as shown in the 'eagle-eye' view of Figure 3. At minimum, the possibility is opened up for acknowledging that a least some of these incumbency-constituting processes around a particular pathway, may be radically mismatched with each other in respect of their implications for other socio-material configurations. In this sense, the idea of a singular proximate 'regime' defined by a notionally coherently-aligned set of 'rules' can be seriously misleading in its wider policy implications. If a deeper, more distributed, complex and plural idea of incumbency is appropriate, then the associated political challenges are far less tractable.

Figure 5: a 'worm-eye' view of 'open topology' in 'deep incumbency':
pervasive, polycongruent, entangled and plural
 (sources for concepts are given in the main text)

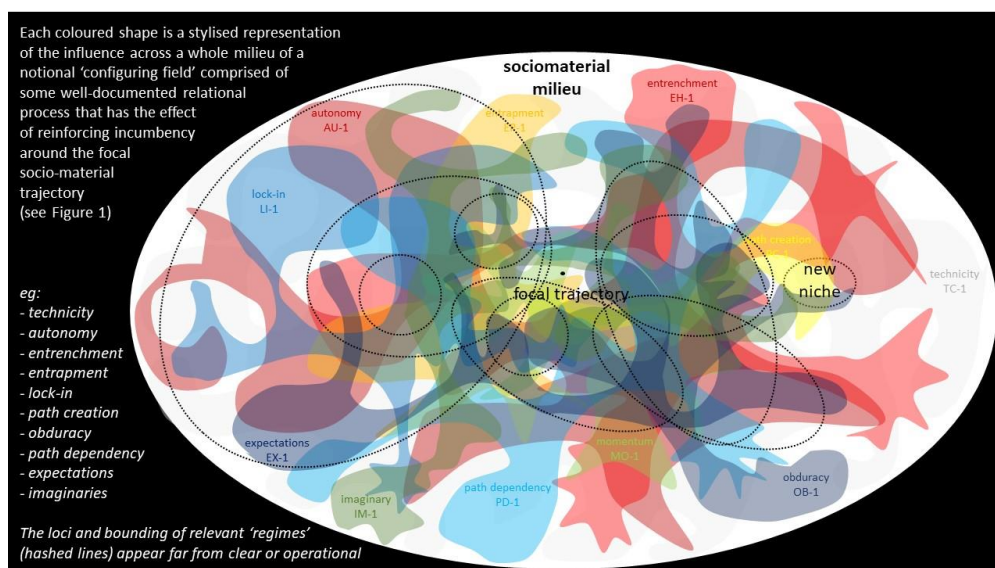


Figure 5 (above), then, illustrates just such an alternative view of socio-material incumbency. It provides a clearly contrasting ideal-typical representation to what Geels laments as the 'reified' conventional views of 'the regime' envisaged in Figure 3^{436 372}. And it is on this basis that the particular ways in which Figures 3 and 5 differ may offer fruitful axes for heuristic comparison, also holding practical implications for political action. Perhaps the most crucial contrast involves the divergent complexity (and thus tractability) of the two views of socio-material incumbency. In Figure 5, diverse incumbency-sustaining dynamics are viewed as if ('horizontally') from *within* the same milieu, rather than ('vertically') assuming congruence and detachment. This refers back to the earlier discussion of the double hermeneutic, to acknowledge that subjective efforts at understanding power-laden social processes around incumbency are deeply embedded in the notionally

‘objective’ phenomena they seek to understand. Far from the hubristic ‘cockpit-ism’ of presumptively ‘seeing like an eagle’, then, Figure 5 reflects the greater epistemic humility of ‘seeing like a worm’.

3.2: Contrasting the Eagle- and Worm-Eye Views of Incumbency

For purposes of research design, these contrasts might usefully be interrogated more forensically. A first practical consequence of contrasting the ‘eagle-eye’ view in Figure 3, with the ‘worm-eye’ view of incumbency in Figure 5, is that the latter is explicitly immersive. Rather than being foreshortened by performative distance into a roughly singular constellation, diverse incumbency-sustaining dynamics are much more clearly divergent in Figure 5, in their social and technological provenance and implications. Represented by strikingly different – complementary and overlapping – ‘configuring fields’ within the milieu, each dynamic (like ‘lock-in’, ‘obduracy’, ‘entrenchment’, ‘entrapment’ and so on) is seen as reinforcing disparate subsets of relevant socio-material configurations. Indeed, each field is itself shown as comprised of interlinked multiple separate parts, because the orthogonal dimensions in which these parts are linked are recognised to be invisible under any particular low-dimensional projection (like Figure 5) of the milieu as a whole.

This raises again a point made in defining incumbency at the beginning of this discussion – as being constituted by a ‘multiplexity’ of dynamics. Referring in colloquial terms to the quality of “[h]aving many aspects, elements, characteristics, parts, or (esp. interrelated) features”², technical usage of this word in network analysis^{129 130} further underscores the strikingly different distributions of configuring fields in the worm-eye view in Figure 5, as compared with the closed topology assumed in the eagle-eye view shown in Figure 3. And focusing on these dynamics as fields in the milieu of socio-material timespace (the white ellipse in Figures 3 and 5) also recalls another point made earlier. Incumbency was characterised in the last section as being (re)produced by ‘vector intensities’ in power distributions – intensities not just in the scalar values of concentrations of ‘asymmetrically structuring agency’, but also in their relations with contrasting possible orientations for change. It is in these terms, that the contrasting incumbency-sustaining dynamics in Figure 5, might be thought of as a multiplexity^{129 130} in the ‘configuring fields’ defined above, whose overlapping distributions collectively foster or suppress different possible pathways in socio-material configurations [22].

A second related feature of this multiplexity-acknowledging worm-eye view of incumbency, is that it is clear that many of the phenomena under scrutiny cannot reasonably be limited to any particular confined ‘region’ of the socio-material milieu – of a kind associated with ‘the regime’. In other words, it is difficult to justify seeing incumbency of any particular kind, as being so distinctively coterminous with anything as ostensibly discrete and singular as conventional ideas of ‘the regime’ (or ‘the system’, ‘the industry’, ‘the sector’). The point here is not that different patterns of intensity in the sustaining of incumbency are entirely *incongruent* with one other. With many overlaps, they are actually mutually reinforcing in a multiplicity of different ways and settings. But rather than there being a single notionally instrumentally-tractable site of overlap in ‘the regime’, these overlaps can be seen instead as more intractably *polycongruent* across an entire political milieu. Such additional epistemic and operational humility offers a crucial consistency with the general importance of the double hermeneutic in social science, which is arguably neglected in conventional eagle-eye views. What the more immersive worm-eye view underscores, is that what counts as ‘the regime’ in any given context is a function not only of the supposedly objective phenomena being prehended, but also of the more overtly subjective conditions of prehension themselves.

It is in these terms, that ostensibly neatly-partitioned ideas of ‘level’ and ‘scale’ in conventional theories of socio-material change are – like notions of ‘the regime’ – apparently straightforward in exposition, but in practice open to radical ambiguities and confusions [23]. Despite the performed simplicity so expedient to discipline-building pedagogy, then, these framings can obscure many crucial real-world complexities. For instance, there may exist ‘*fractal*’ orders in configuring fields, whose self-similarity at every scale would undermine the asserted distinctions between ‘levels’^{467 468 181} that are so essential (for instance) to the ‘*multi-level perspective*’^{151 441 149 116 121}. Likewise, ‘*rhizomic*’ patterns and flows also subvert rigid differentiations between both hierarchical scales and horizontal categories within these^{469 312}. In this light, simply to assume universal neatly-nested category structures with self-evident boundaries (like ‘the regime’), is to commit an

error diagnosed by the philosopher Whitehead as *'the fallacy of misplaced concreteness'* ^{470 372}. As with control fallacies discussed earlier (to which they are related in their presumed tractability), such fictions might be expedient in 'the real world' of policy making (as conditioned as this is by incumbency). But they can be deeply misleading (and so impractical) in 'the real world' of sociotechnical phenomena themselves ⁴⁷¹.

A third important point that arises in comparing Figures 1 and 3 is the possibility envisaged in the open topology as seen under a worm-eye view, that relations and processes that sustain incumbencies even of the most *particular* kinds, may nonetheless effectively pervade the *entire landscape* of socio-material phenomena [24]. Understood in this way, a worm-eye perspective holds further potentially profound implications for interpreting the generative dynamics of incumbency. Incumbency cannot in this view simply be assumed in a reductive fashion, to be something located in (pressuring 'outwards' from), some particularly-located and -bounded socio-technical trajectory (eg: 'the regime'). As with physical phase changes like condensation or precipitation, incumbency is in this view a function of system-level properties: it is formed more from 'wholes-in', than from 'parts-out' ^{434 435 472} [25].

As in other applications of field ontologies in social science, it is the need not to ignore the possible importance of these more open and pervasive social relations and processes, that substantiates the value of the concept of 'configuring fields'. Informed by many different kinds of social field theory [9], this is nonetheless quite distinct in its direct phenomenological style. To envisage *"patterns of propensity across the totality of all possible socio-material configurations, that serve with respect to a particular focal socio-material pathway to foster this specific orientation for change more than others"*, requires no assumptions that there exist in reality, particular middle range social entities or structures. Each 'field' is, after all, as extensive (in varying intensities) as the milieu as a whole. All that is required for the above analysis to hold, is that it be conceded that incumbency is characterised by many kinds of power gradients.

Expressed as asymmetries in processes of structuring agency, then, the resulting patterns of intensity may be envisaged (without any privileging either of structure or agency), to have the effect of orienting directions for socio-material change [26]. So, what has been described amounts simply to the patterns of scalar and vector intensity introduced at the outset, without introducing presumptively concrete discontinuously-bounded and congruent categories like 'levels' or 'regimes'. Also avoided, are the kinds of assertions common in some other social field theories, where claims are often made to be able to identify supposedly individually discrete and operationally distinct categories or instances of the fields in question ^{415 418 112 419 420 421 422 423 424 295 425}. Whilst indicatively diverse forms of field are shown in Figures 3 and 5, the analysis here does not rest on any claim that these are precisely separable. Instead, the argument is pitched at the more general level of contrasting topologies, rather than implying the feasibility of more fine-grain characterisations. By focusing on topologies, no assumptions are introduced that are not already immanent in the fabric of the problematique itself.

It is these features of a configuring fields approach, then, that allow application to multiple variants of (for instance) the dynamics of 'lock in' — which may (after all) in any given setting also relate to an even greater multiplicity of different socio-material elements constituting a notionally single 'pathway'. What is enabled in a configuring fields approach is that these multiplicities of dynamics (like those relating to other incumbency-sustaining processes shown in Figures 1, 3 and 5) can be represented in ways that avoid the restrictive assumptions of the eagle-eye view. In topological terms, these dynamics can be seen as pervasive, polycongruent, entangled and plural (as in Figure 5), as well the usual representation as confined, congruent, discrete and singular (as in Figure 3). It is this higher possible level of generalisation — without simply assuming crucial features of the phenomena under scrutiny — that arguably constitutes a key merit of this approach.

Equally capable of rendering either ideal type without bias, then, a configuring fields framework can be used for comparative purposes in ways that do not simply presume an outcome. If it is assumed that a given 'regime' is moncongruent, then this is what an analysis will find. Whilst not forcing a 'worm-eye' view, a configuring fields approach at least allows the possibility that an eagle-eye view be avoided. It allows it to be more easily understood, how even particular instances in a single family of processes can (like lock-in) be radically differently distributed throughout society. And if this point can be recognised to apply with respect even to such an ostensibly relatively straightforward, positive and material dynamic as 'lock-in', it evidently applies far more to diverse classes of supposedly regime-aligning dynamics taken together (such as: 'policy',

‘science’, ‘technology’, ‘markets’, ‘culture’ in Figure 4). It is these more highly aggregated milieu-spanning aspects of society that are routinely disciplined under an eagle-eye approach into justifying bounded unitary notions of ‘the regime’, which might be especially usefully envisaged as constellations of configuring fields.

The implications of the alternative worm-eye picture of socio-material dynamics in Figure 5, are also entirely independent of whatever language might be used to describe it (like the terminology here, of ‘configuring fields’). In whatever terms, the repercussions are potentially profound for general understanding of phenomena of incumbency. If the formative dynamics of any given instance of socio-material incumbency are distributed in incommensurable ways throughout what regime theory refers to as ‘the socio-technical landscape’, then it follows that political remedies cannot so easily be reduced and confined to relatively tractable policy interventions around a notionally singular and bounded entity called ‘the regime’.

When allowed by a configuring fields approach to also be seen in a worm-eye view, however, the constitutive dynamics of incumbency may be recognised instead (at least in principle) inconveniently to implicate entire political economies, cross-national polities, institutional cultures, global discourses and social epistemologies. Where the task is seen to lie in countering these far deeper and more pervasive dynamics, interventions must be more about distributed, unruly, rhizomic collective action through social movement and democratic struggle than about centralized orderly strategies and policies targeted hierarchically by incumbent governance actors on some specific sector. In short, like social transformations more widely, ostensibly circumscribed socio-technical ‘transitions’ become visible as being more about ‘politics’ than ‘policy’⁴⁰⁰.

And it is here that we can think back to the earlier discussion of the double hermeneutic in all social research – and the implications of the dynamics of incumbency for how incumbency itself is studied. For it is also in these political terms, that it can be understood why worm-eye views like that elaborated here, tend to be far less well established in policy appraisal (or the ‘impact’-hungry careers and disciplines that compete for privilege in this arena), than the eagle-eyed views of various forms of middle range theory like the multi-level perspective. Almost irrespective of their validity, it is the presumptive levels of confinement and congruence in the constituting dynamics of incumbency shown in Figure 3 – and the associated relative degrees of singularity and discreteness – that can arguably on their own explain the favoured status. For it is these properties that serve to support the crucial political commodity of justification^{405 406 407 408} in representations of incumbency .

No matter how mistaken it may be as a representation of the real-world phenomena under scrutiny, then, an eagle-eye view like that in Figure 3 may nonetheless remain convenient to incumbency – in providing a means to justify the ‘fallacies of control’ that work to maintain incumbent privilege. On the other hand, even if it offers a manifestly more valid picture, a worm-eye view like that in Figure 5 can be quite seriously inconvenient to incumbency, in that it makes discursively-expedient control stories far more difficult to propound. That this is so, is amply demonstrated by many energetic reactions to the present analysis!

So, it is this asymmetry of subjective expediency (rather than any mismatch in correspondence with underlying objective realities), that may help explain the preponderance of ‘eagle-eye’ views [27] in established approaches to socio-material incumbency. But if realities of incumbency are in fact more akin to the picture in Figure 5, then the prospects for the kinds of cockpit-style interventions that tend to be prompted by this view, are far less positive. Indeed, it might in this event reasonably be thought that this eagle-eye style of intervention is more likely serve to *protect* the complex hidden complexities of incumbency, rather than *challenge* them. This is because there would in this case be few more effective ways to sustain the open topologies of incumbency illuminated in the worm-eye view, than to establish a closed imagination of incumbency generated by the eagle-eye picture.

It is in this way, that the stakes are indeed very high in any setting, around the choice of which view is most appropriate. If incumbent pressures on mainstream analytical approaches to socio-material change discussed here, force them inadvertently to emphasise an eagle-eye response to the many pressing global challenges highlighted at the beginning of this paper, then it will be eagle-eye ‘solutions’ that can be expected to ensue. But if such preferences for simplified, controlling, power-reinforcing eagle-eye responses is actually a key part of the challenge in the first place, then even the most genuinely progressively-intended analysis for transformation, may become part of the problem rather than part of the solution. And it does not need to be

argued that such a perverse dynamic will necessarily always – or even sometimes – be the case, for the logic to be compelling, that a more general framework that does not force this syndrome, should at least be considered.

4: Challenging Socio-Material Incumbency: From Method to Action

4.1: Summary and Lessons for Methodology

Drawing on a wide body of theory in social science – especially processual and relational understandings of structuration and power – this paper has developed an approach to socio-material incumbency built around a novel heuristic concept of ‘configuring fields’. A broad axis of contrast has been proposed between two ideal-typical patterns in such fields, with ‘eagle-eye’ and ‘worm-eye’ views, respectively, seeing incumbency in the form of relatively ‘closed’ and ‘open’ topologies. This reflects an empirical contrast in subjective ways of scrutinising incumbency, as well as in different forms of incumbency as objects of scrutiny. Crucially (and perhaps ironically given its debts to constructionism⁴⁷³), the resulting distinction is, in principle (and despite important general limits to these qualities^{474 475}), relatively testable^{476 477} – and even potentially falsifiable^{478 479}. This penultimate section will focus on practical methodological implications that may arise from this.

Based on the preceding discussion, Table 1 below summarises the main points of this analysis, highlighting the most salient theoretical and practical characteristics of the two contrasted prehensions of socio-material incumbency, as well as some concrete issues that arise for methodology and research design. The underlined bold phrases in the first part of the table indicate (with a few lines of summary explanation) the main distinguishable features in respect of each of these two ideal types, concerning in each case their respective: *foci of scrutiny* (what they are looking at); *processes of scrutiny* (how they do the looking); *styles of prehension* (how resulting pictures are portrayed) and the general forms of typically-highlighted *policy and political interventions* (what broad kinds of action are entailed). Key phrases from the earlier discussion in this article are italicised in bold in each respect.

The underlined bold phrases in the second part of Table 1 indicate a series of potentially empirically-testable properties of these ideal-types, of kinds that might be useful in informing onward academic research and strategic appraisal. This highlights quite readily-conceivable contrasts in the *distribution* and the *patterning* of whatever are held in any context, to constitute the relevant – and sufficiently-visible – ‘configuring fields’. Table 1 also highlights associated features in the observed *identities* and *relations* of candidate instances of incumbency that can help diagnose them on the continuum from the perceived ‘closed topology’ of the (currently mainstream) eagle-eye view to the ‘open topology’ of the (proposed alternative) worm-eye view.

The efforts made at methodological clarity, specificity, transparency and testability in Table 1 (albeit only partially successful), reflect struggles towards elusive qualities that are sometimes lacking in many extant approaches to socio-material incumbency and change⁴⁸⁰. Although there can be no panaceas, the framework sketched there may help point towards a remedy for some currently key obscurities and ambiguities in other approaches discussed in this article⁴⁸¹. By contrast with many presently well-established ‘middle range’ social theoretic approaches to incumbency (like those based around ‘innovation systems’, ‘socio-technical’ systems, ‘transition management’ or ‘the multi-level perspective’ for instance), this configuring fields approach does not take for granted so many conveniently reductive methodological constructs⁴⁸². In itself, this may help avoid what even protagonists of mainstream approaches have criticised as the reification of what may mistakenly be held to be neatly-separable levels and instantiations of incumbency, like ‘the’ sector, industry, or regime.

Table 1: configuring fields analysis of socio-material incumbency – key implications for method and practice

	MAINSTREAM 'EAGLE-EYE VIEW' (a stylised ideal-typical abstraction describing diverse current practices in academia and policy and illustrated schematically in Figure 3)	ALTERNATIVE 'WORM-EYE VIEW' (a correspondingly stylised ideal-typical abstraction, proposed in present paper as a complement to current practices and illustrated schematically in Figure 5)
RELEVANT PRACTICAL AND POLITICAL CHARACTERISTICS of two contrasting circumstances equally in the (interlinked) apprehending and constituting of <i>socio-technical incumbency</i>		
focus of scrutiny of notional objective phenomenon of incumbency	shallow incumbency with closed topology each instance of incumbency is understood in terms of <i>neatly-scaled</i> 'levels' of analysis and ' <i>middle range</i> ' theoretical categories like 'regimes', 'sectors', 'systems', 'industries'	deep incumbency with open topology each instance of incumbency is a specific reflection of such diverse, pervasive power relations and processes, that it is robustly understood only in <i>irreducible terms of entire societies</i> , cultures, economies and materialities
process of scrutiny salient <i>self-identified</i> aspects of subjective view	reification of coherence inadvertently aligns with deep incumbency in giving a " <i>semi-coherent</i> " picture which " <i>tends to rely</i> " some key categories and relations	engagement with multiplexity resists aligning with deep incumbency by <i>illuminating complexity</i> , aiming to <i>balance incumbent pressures</i> for reifying of categories and exaggerating of coherence
style of apprehension associated vision of key roles for <i>knowledge production</i> in social appraisal of incumbency	positive expert explanations ' <i>objective</i> ', ' <i>evidence-based</i> ' academic research and policy analysis are <i>independent of incumbency</i> ; producing " <i>necessary simplification</i> " to enable <i>practical control</i>	reflexive inter-subjective understandings knowledge and action are co-constituting – and of incumbency and its reactions. So <i>stories of control</i> are <i>expedient fallacies</i> to justify <i>incumbent privilege</i> . And, like others, this <i>apprehension is itself an action</i>
associated interventions main <i>societal actions</i> for rebalancing incumbency	orderly policy instruments and mixes engineered vertically down on 'regime' from hierarchically separate governance 'cockpit'	unruly, irreducibly political, democratic struggle diverse mutualistic 'murmurations' in collective action; rhizomically engage relevant susceptible configurations
POTENTIALLY EMPIRICALLY TESTABLE PROPERTIES of dynamics constituting <i>socio-technical incumbency</i> – viewed as <i>configuring fields</i> in a <i>socio-material milieu</i> of all possible <i>configurations</i>		
	CLOSED TOPOLOGY	OPEN TOPOLOGY
distribution of each <i>configuring field</i> in the <i>socio-material milieu</i>	confined relatively circumscribed and neatly-scaled, helping to define a clearly 'mid-level' 'regime'	pervasive expansive and fractal (so neither scaled nor ubiquitous); transcending levels of 'regime', 'niche' and 'landscape'
patterning of relationships between different <i>configuring fields</i>	monocongruent strongly overlapping, such as to delineate one broadly contiguous set of configurations	polycongruent both complementary and overlapping in disparate ways, so implicating a diversity of noncontiguous configurations
identity constituting of notional <i>instances of incumbency</i>	singular apparently "semi-coherent" and quite clearly bounded, so as to justify idea of " <u>the regime</u> "	plural neither coherent nor clearly bounded, raising questions over individualised ideas of ' <u>the regime</u> ' in any setting
relations between <i>different instances of incumbency</i>	discrete sufficiently mutually separable to avoid confusion over which 'regime' is which	entangled rhizomically interconnected and inseparable; querying which 'regime' is which and how they interlink and nest

The main reason for this, is that it is not simply assumed that the many constituting relations and processes of incumbency (the different configuring fields), will all be conveniently monocongruent and confined in their differing effects. So, a configuring fields approach does not expediently presume in advance that the phenomena that constitute incumbency will necessarily resolve into the kinds of finely-partitioned prior ontologies of notionally discrete 'levels', 'phases', 'scales' that tend to be so prominent in current academic

and policy analysis. It resists conflation between radically different concepts that happen to share the same name (like the two elided notions of 'regime' in Figure 4). It avoids implying that 'alignment' in one subset of socio-material parameters, must necessarily entail 'alignment' across all relevant dimensions (as also in Figure 4). Perhaps most importantly, by relationally addressing both subjective and objective circumstances, a configuring fields approach helps avert the performing of an illusory transcendent status for analysis, tacitly asserting as much separation from phenomena of incumbency themselves, as a soaring eagle (temporarily) achieves from 'the landscape' below.

By focusing more relationally and processually (rather than categorically) on contrasting topologies in what are acknowledged to remain intractably uncertain complexities in configuring fields, more scope may be provided for greater methodological appreciations for nuance³⁵⁸, variability⁴⁸³, plurality⁴⁸⁴, conditionality⁷¹, diversity^{485 486}, uncertainty⁴⁸⁷, mess⁴⁸², thick description⁴⁸⁸, reflexivity⁴⁸⁹, and phenomenological openness to surprise⁴⁹⁰. This does not mean that these aspects will necessarily be highlighted over more straightforward characteristics, where they are apparent. For a configuring fields approach to simply acknowledge the possibility of this kind of 'multiplexity'^{129 130 134 135}, is not to presume that this quality is relevant everywhere. In the face of strong incumbent pressures for reduction and simplification in academic and policy analysis⁷¹, it simply helps to ensure that there is at least some chance that aspects of multiplexity will be recognised under conditions where they are relevant. So, by opening up the possibility of recognising more deeply penetrating 'open topologies' in socio-material incumbency this approach in no way undermines or denies the possibility of identifying more closed topologies in the relatively shallow kinds of incumbency described by entities like 'the regime'. All that is happening, is that regimes are not simply assumed into being [28]. Otherwise, research frameworks whose only means to represent incumbency are in such relatively circumscribed and shallow ways, will not simply be wrong in many important cases. They will be part of the process of incumbency itself.

Equally when focused on different subjective ways of seeing incumbency, then, or on its ostensibly objective instantiations in different settings, a 'configuring fields' approach seems quite readily amenable to refutation, testing, validation or further exploration and development by a variety of different methods. Where a number of contrasting incumbency-sustaining dynamics can be considered with confidence to be resolvable in available disaggregated quantitative data, the framework might be held to offer a basis for well-established methods for analysing different kinds of 'big data' around alternative socio-technical pathways^{491 492 493 494} – such as topic modelling^{495 496}, corpus analysis^{497 498} or agent-based modelling^{499 500} as well as other non-aggregating quantitative approaches like (for instance) principal components^{501 502}, cluster analysis⁵⁰³ or diversity analysis^{485 504}. Especially when triangulated in conjunction with one another, the potential ability of such methods to discriminate between the traces left in disparate societal media can assist identification of contrasting geometries of incumbency and their relations with divergent socio-material pathways⁵⁰⁵.

This is especially so, if methods like these (capable of wide but 'thin' prehensions of whatever are held to be the relevant socio-material milieux) are carefully triangulated and complemented with the deeper but 'thicker' descriptions provided by interpretive enquiry^{506 507}. Indeed, the focus of this proposed configuring fields approach on an ontology of *topology* ('closed', 'open' or some more nuanced permutation thereof), may be especially fruitful for such mixed-method approaches^{508 509 510 511}. Both as a class of phenomena and in its associated disciplinary style, the concept of 'topology' is, after all (as alluded to earlier), itself something of a 'boundary object'^{512 513} between the Cartesian geometries of quantitative frameworks and the more flexible dimensionalities of interpretive sensibilities⁴²⁶. In this regard, hybrid analytic-interpretive methods (like, for instance, Q-method^{514 515} or multicriteria mapping^{516 517 518}) may offer particular value in specific contexts. In general, such approaches can also help bridge between the unduly estranged 'two cultures' of (roughly, but not perfectly, corresponding) quantitative-aggregating-instrumental and qualitative-differentiating-critical enquiry^{519 520}. Here again, the focus of a configuring fields approach on an ontology of topology, may make these and many other forms of methodological hybridisation especially relevant.

One mode of usage of these kinds of method to interrogate topologies of configuring fields is in comparative research. Here, operational divides between notional 'eagle' or 'worm' eye views – or, indeed, other views and corresponding topologies – becomes a matter for whatever may emerge as salient axes of contrast in the contexts in question. Another possible style of inquiry, however, might take the form of a single case study¹⁵⁶.

Of course, there would arise in this situation (just as with any other generalisation), questions over the degree to which single case study research is capable inductively⁵²¹ or deductively⁵²² of substantiating any wider relevance for any distinction between closed and open topology for incumbency in a particular setting^{523 524}. But a single case study does still remain a useful way abductively^{525 526 527} to illuminate a wider range of aspects for possible general explanation^{528 529 530 531 532} [29]. So, if the phenomenon of socio-material incumbency can be seen even in only one relevant instance, to extend beyond the usually-assumed boundaries and modalities of a 'closed topology', then at least a similar potentiality would have been opened up for consideration in other instances. It is in this sense, that a single case study may also offer a fruitful way to apply a 'configuring fields' approach. This is the spirit in which the accompanying empirical article will report on an analysis of the circumstances of incumbency around civil nuclear power in the UK.

In respect of a single case study like that in the companion article to the present paper, then, the foregoing discussion above (as summarised in Table 1) also yields a series of quite practical possible questions – each suggestive of various associated hypotheses. In this way also, then, a 'configuring fields' approach might usefully help inform any investigation of possible incumbency around a specific socio-material pathway:

- (1) First (and in terms substantiated earlier in this paper): are observed commitments of structuring agency around the focal pathway in the chosen case, judged to be sufficiently intense such as to clearly identify this as an instance of 'socio-material incumbency', rather than merely of 'contingent persistence'?
- (2) Second: do diverse patterns of political commitment to the focal pathway, demonstrate with confidence that incumbency is aligned in this case in such a confined, monocongruent, discrete and singular way as to imply a single particular uniquely-definable 'regime'? If so, this would tend to confirm an 'eagle-eye view'.
- (3) Third: are patterns of commitment to the focal pathway such that incumbency seems more distributed, polycongruent, entangled and plural, than is satisfactorily described as a single regime identifiable specifically with this pathway? If so, this diversity might be seen to open the possible relevance of a 'worm-eye view'.
- (4) Fourth: can this 'configuring fields' approach to illuminating diverse possible modalities of socio-material incumbency, help yield practical insights for political action to address the observed form of incumbency in this focal case, of kinds that might arise less easily for attention under conventional 'regime theory'?

It is on this last point, that the present methodological discussion can rest. The argument has been sustained, that the topological focus of a configuring fields approach does present a basis equally for comparative enquiry according to a quite clear set of clear criteria concerning 'open' and 'closed' topologies in Table 1. And single in-depth case study research has also been shown to be potentially applicable, subject to the systematic series of questions (1 – 4) identified above. Although raising many onward methodological queries, the levels of operational specificity offered here are at least as favourable as those typically yielded in mainstream incumbency research.

4.2: Wider Political Implications

It remains, in closing, to turn attention from issues of theory and methodology, back to questions of practice. The paper began with a series of momentous challenges for research on socio-material incumbency. What are the prospects that a 'configuring fields approach' might have anything substantive to offer as one further means among many for seeking to address these challenges? Here, it is obvious that the most important single quality lies neither in parochial rivalries between this and any other approach, still less in hubristic attempts to integrate some grand general framework (of the kind whose performed authority is so favoured by incumbency itself³⁷²). The proposal here of an alternative view, is made more in a spirit of methodological flexibility^{533 534} and disciplinary pluralism^{535 536} – of kinds whose forms can be as challenging to incumbencies in knowledge production as their contents may be to incumbencies in wider practice⁵³⁷. After all, what is at issue in this area, is far more than just the fortunes and misfortunes of contending academic disciplines,

research frameworks or styles of policy appraisal. However they are viewed, if the deepest forms of incumbency are to be effectively interrogated and challenged, then it is likely that no single approach will be sufficient – and that a radical diversity of contrasting tools will be needed.

Of course, the validity of all this also remains to be established. As in the much-used phrase (attributed, among others, to Engels ⁵³⁸) “*the proof of the pudding, lies in the eating*”, the ultimate justification for any mode of understanding, will (whether acknowledged or not) typically lie in normative and operational judgements over the kinds of actions with which it is co-constituted – and which it can variously help enable or undermine ⁵³⁹ ⁵⁴⁰. In this sense too, then, the stakes are very high. Just as the urgency and severity of their worldwide impacts are coming to be recognised, so global incumbencies are evidently further entrenching on a planetary scale ⁵⁴¹ ⁵⁴². Across the range of different settings with which this paper began, mutually reinforcing historical contingencies and path-dependencies are seemingly further amplified by growing pressures of globalisation ⁵⁴³, standardisation ⁵⁴⁴, concentration ⁵⁴² and control ⁵⁴⁵. In policy analysis as elsewhere, space for diversity and pluralism is under pressure ³⁰⁸ ⁵⁴⁶. This is the sense in which the ‘gravitational effects’ exercised by incumbency discussed here, can warp the very processes through which incumbency is interrogated and understood.

It is in this light that the contrast between ‘eagle’ and ‘worm’ eye views comes out of the plane of the diagram in Figures 3 and 5. Alongside the trends towards global intensification mentioned above, burgeoning processes of specialisation ⁵⁴⁷, professionalization ⁵⁴⁸ and technocratisation ⁵⁴⁹ are widely seen to be further undermining the space for democracy itself ⁵⁵⁰ ³⁰³ ⁵⁵¹ ⁵⁵² [30]. And this is not just a parallel contingency in academic research or policy analysis on incumbency, but strikes to their core. For, it may be instructive to consider in relation to the kinds of political action described in Table 1, the implications of past experiences of transformative progress. Despite many crucial contrasts over time and in political-economic and institutional-cultural contexts, there seems a clear message from historic unfinished reorientations of incumbent interests achieved by serfs ⁵⁵³, slaves ⁵⁵⁴, colonized people ⁵⁵⁵, workers ⁵⁵⁶, oppressed ethnicities ⁵⁵⁷, women ⁵⁵⁸ and queer sexualities ⁵⁵⁹. Orderly separations of action and knowledge and neatly ‘integrated’ vertical policy-based prescriptions of the eagle-eye view undoubtedly played key roles. But it is difficult to avoid concluding from these histories, that whatever kinds of success have been won in these struggles, is more often and more deeply due to unruly pluralistic ‘murmurations’ of dissenting understandings and values, direct collective action and horizontal culture change ⁴⁰⁰ ⁸¹ ⁵⁶⁰ [31]. This is why the re-orienting of the ‘open topologies’ of deep incumbency does not mainly rely on gaining access to policy ‘cockpits’. Indeed, an over-emphasis on such aims repeatedly features in these histories, less as means of resistance to incumbency by its opponents, than of defensive reinforcement on the part of incumbency itself.

Despite the obscuring efforts of incumbency itself, then, what may unfold in even the most specific efforts to challenge even the most circumscribed of incumbencies, is the age-old general struggle between privilege and emancipation ³⁰⁷. In the end, the best ways to disembed any given instance of entrenched power, may lie not so much (nor so wholly) in the narratives and routines of policy making and ‘good governance’, as in the rather different stories and practices of emancipatory democratic struggle. Without the resulting murmuring flows, waves, gyres, pivots, ratchets and levers – extending throughout political culture as a whole – even the most ostensibly minor forms of incumbency may be pressured into changing their masks, and yet remain more deeply immovable in their underlying configurations ²³⁸. If so, then – as a form of practice in their own right – understandings of incumbency in research and policy analysis may lie as much at the heart of the struggle as many other kinds of political action. For if there can be no deeper foundation for incumbency, than when it has colonized its own critique, then there follows an important corollary. There may be no more rigorous or formative basis for redistributing and reorienting incumbency, than when this warping effect is corrected.

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Endnotes

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- 2 As well as academic drivers like disciplinary interests^{561 562}, organisational agendas⁵⁶³, personal career incentives⁵⁶⁴ and professional rivalries⁵⁶⁵, wider shaping forces and interests include various kinds of profit motive and economic pressures to: standardise infrastructures⁵⁶⁶, establish organisational momentum¹⁰⁰, appropriate intellectual property^{567 568}, build monopolies¹⁰², realise rent on value chains⁵⁶⁹, condition user preferences through marketing³¹⁷, capture regulators³⁶² or entrap competing political interests¹⁵⁸.
- 3 Owing a debt especially to Mike Michael's very helpful discussion (after Whitehead¹⁷⁸) of contrasting meanings in this context⁵⁷⁰, between 'comprehension', 'apprehension' and 'prehension', what is intended in the pivotal usage here of the term 'prehension' is an emphasis on the process-relational nature of structuring agency⁵⁷¹ as well as on the tacit and material dimensions^{572 573 574}. In these terms, prehensions of or by structuring agency (like power – or the topologies of incumbency discussed later) are reciprocally self-constituting processes [3]. What is in focus, are not the notional categories of subject or object, but the interlinking dynamics relating – and partly constituting each of – the two. And it is also in the interests of emphasising the embodied materiality of such processes, that it is arguable that the appropriate term for this relation is (after James⁵⁷⁵ and Whitehead¹⁷⁸) the word 'prehension'⁵⁷⁶. Further worthy of note about this distinction concerning apprehension and prehension, is that it is itself a relational result of prehension, rather than exclusively either an 'objective' property of what is prehended, or a 'subjective' feature of what is prehending.
- 4 Here, a diversity of specific forms of 'agency' are implicated in literatures bearing on socio-material change. Although many ideas in this field are (even for social science) especially hotly contested, it is important to note that some notions of 'nonhuman'⁵⁷⁷, 'distributed'⁵⁷⁸, 'collective'^{360 579}, 'cultural'⁵⁸⁰, 'relational'^{581 582}, 'inter-'⁵⁸³, 'prosthetic'⁵⁸⁴, 'synergistic'^{585 586}, 'textual'⁵⁸⁷, 'technological'⁵⁸⁸ and 'material'⁵⁷⁴ agency can (at least in some analyses and despite objections) be effectively *independent* of any direct or explicit process of human cognition, intentionality, deliberation or decision⁵⁸⁹. Although experienced very vividly as singular and personal, after all, even individual human intentionality is shown in recent research to be far more neurologically, metabolically and socially implicit, plural, distributed and emergent^{590 591}. And in Nature, likewise, myriad plants⁵⁹², animals⁵⁹³, ecologies⁵⁹⁴ – arguably evolution⁵⁹⁵ and the Earth itself⁵⁹⁶ – are all revealed in different scientific disciplines to be routinely exerting their own forms of 'agency'^{597 598}.
The willingness of a '*nonhuman turn*'⁵⁹⁹ to contemplate such possible broadly-inclusive (biological and potentially material) prehensions of agency, can be challenging to dogmatically exclusive anthropocentric accounts⁶⁰⁰. However, it is not necessary for present purposes to take a firm position among the deep scientific-religious theologies motivating these ontological wrangles, to appreciate that at least some of the several kinds of 'agency' shaping directions for socio-material change, *need not* take *individualised* human forms. In these terms, the potential scope of the present analysis of socio-material incumbency is in principle quite radically wider than the particular socio-technical processes focused on in this paper²⁵⁸. And in keeping with the general picture here of what counts in any given context as salient '*configuring fields*' (cf: Figure 2), this same aspect will be developed more generally with respect to later discussion in this paper of the '*double hermeneutic*'¹⁷⁵ – that subjective orientations, modalities and frameworks for comprehension, apprehension and prehension [2] are as much a part of the formative context for characterising salient configuring fields, as any notionally objective conditions.
It is in this sense, that 'agency' can be defined for present purposes (as in Figure 2), in very general terms as '*orienting among many prehensible pathways for change*' [2]. As illuminated in the structuration theories discussed in the text, this jointly objectively- and subjectively-defined concept of agency is co-constituted along with myriad structures – as '*conditions constituting potentialities across contrasting prehensible orientations for change*'. Thus seen in terms of general generativity of change, these entangled aspects of structure and agency may alternatively be prehended in narrowly human, or wider material terms. So this way of thinking about '*structuring agency*' is effectively independent of subjective lines drawn under any given perspective between (or around) sociality and materiality. With 'sociality' thought of simply as a relational mode of association, 'social materiality' extends in principle beyond the human domain, to also encompass a "*sociology of things*"²⁵⁶. The term 'socio-material' can thus acquire a much broader meaning. Whatever the conditions of prehension, however, the basic conceptual framework outlined in Figure 2 arguably still holds [6][23].
- 5 A distinct term like '*epi-dynamics*' seems necessary here, because even the large array of incumbency-constituting phenomena organized in Figure 1 only addresses (roughly-distinguishable) *individual* processes. In excluding crucial *aggregate* issues of relational interactions, emergent patterns and cumulative effects over time, this picture misses many of the most salient aspects in the shaping of socio-material continuity and change. For, as in familiar experience of other interacting metaphorical fluids and solids⁶⁰¹, it is these collective epi-dynamics in contending modalities and orientations among these different processes and their responses that are often most important⁶⁰². Insights here can be found in recent studies of diverse kinds of *mobilities*^{603 604}. For instance, moving in cumulative as well as oscillating and erosive ways, these aggregate patterns may be seen not as fixed *formations*^{605 606}, but as alternatively 'slow' or 'fast'⁶⁰⁷ *political flowmations*⁶⁰⁸, continuously reproduced by restless ecologies of practice^{609 610 611 612}.

To illustrate this, phenomena to be found on an everyday beach might be pondered as heuristic analogies for the complex – typically nonlinear – temporalities of social affairs. Here, what might variously be imagined as *historical tides*^{613 614}, *cultural currents*^{615 616}, *civilizational waves*^{617 618}, *industrial surges*^{619 95}, *macroeconomic swells*^{620 621}, *revolutionary floods*^{622 623}, *subaltern eddy-flows*^{624 625}, *financial gyres*^{626 627} and *market swash*^{628 629} – all punctuated by irregular variously-scaled ‘tsunamis’ to ‘splashes’ of disruptive violence^{630 631 632 633 634} – each bring their own specific forms of *dialectical backwash*^{635 636}. As if left by waves of agency on beaches of structure, then, layered *institutional sediments* may persist^{637 638}, adorned with shifting *organisational shingles*^{639 640}, strewn (and channelled) by – often highly generative and onwardly instrumental – *infrastructural strand-wrack*^{99 641 642}. And if the relatively simple materialities and temporalities of a beach can be so richly ordered, how much more so might this be prehended in the dynamics of structuring agency? In each, what is ‘fluid’ and what is ‘solid’ will typically be so inseparably entwined in the formative dynamics, that what exactly counts as each is not only relative but effectively irrelevant to the jointly emerging orders. Either way, the imaginable broadly analogous patterns in structuring agency are much too extensive to be addressed by the specific atomistic details in Figure 1. But they are also far too fine-grain for unqualified broad-brush terminologies (especially in the singular) like ‘*structuration*’^{175 236}, ‘*practice*’^{643 644} ‘*transition*’^{645 148 149}... or undifferentiated ‘*mobilities*’^{603 604}. If lame analogies around seas and beaches are to be escaped, then greater academic attention is needed to particular kinds of ecologies and epi-dynamics of incumbency^{609 610 611}.

- 6 The author is very grateful on this point to Ed Steinmueller for his challenge to further clarify the contrasting implications of what is here termed ‘incumbency’ and ‘persistence’, within what might also be distinguished as the more general phenomena of social and material continuity. Relating to the vexed question of quite how distributed the notion of ‘agency’ should be (cf: [3] and [5]), this raises what is likely to be a highly prevalent concern among more positivistically-minded readers. To define socio-material persistence by relevance to ‘*salience*’ is one way in which to avoid this becoming an unnecessary obstacle or distraction. If agency is prehended in very inclusive supra-⁶⁴⁶ or transhuman⁶⁴⁶ terms, then salience will be defined accordingly broadly. If not, then the domain of what is prehended (without reference to agency) merely as socio-material ‘*persistence*’ will correspondingly grow (cf: [23]). Either way (resting as it does on notions of prehensions that span subjective and objective conditions, the basic framing of the present analysis (see Figure 2) will remain intact. In other words, all the key points made here with respect to dynamics of power in socio-material incumbency, may be argued to stand insofar as the focal phenomena are prehended to relate to agency.
- 7 This refers to a form of field in which the quality of intensity at each point has a property not only of ‘scalar’ magnitude, but also of ‘vector’ orientation with respect to the focal pathway by reference to which, the field in question is defined. Here, a link can be made with discussions of ‘*vector intensity*’ in epidaemiology, defined for that context as “*a product of propensity and activity*”³¹⁰. So, socio-material ‘*vector intensity*’ might be defined here as “*a function both of the scalar intensity in power concentrations implicated in an array of socio-material configurations and of the associated propensity to orient a specific onward pathway for interlinked social and material change*”. Such configurations are referred to here as ‘socio-material’ (rather than more narrowly ‘socio-technical’), because they implicate not only the momenta, affordances and constraints embedded in artefacts, but also those embodied in wider ‘natural’ material phenomena. The dynamics in question are referred to as ‘pathways’, rather than ‘trajectories’ to help avoid the implication of relatively simple and deterministic dynamics and to emphasise the complex formative role played by the encompassing milieu, as a ‘landscape’ that helps shape these pathways (that it both constitutes individually and is collectively constituted by).
- 8 On a wider canvas than just the history of technology, institutional theory in particular arguably identifies many further illustrative examples. Cappocia holds such cases to include, for instance: the long-run effects of the 1832 British Reform Act; the emergence of ‘confessional parties’ in nineteenth century western Europe; policy reactions to the US Great Depression; the contrasting fates of democracy in Guatemala and Cost Rica; or micro-dynamics around figures like Mahatma Gandhi or Nelson Mandela⁶⁴⁷.
- 9 Subject to the perils of counterfactuals^{480 262}, this example is readily elaborated. Early high profile experiments with prematurely large wind turbines by major utilities in many countries were widely asserted in mainstream energy policy in the 1970s and 80s, to show that wind power was simply not feasible at what were held to be the necessary scales^{648 649}. Yet meanwhile, collective action by social movements in favour of alternative energy experimented and learned from a diverse array of much smaller designs^{650 651 652}. But these experiences were systematically marginalised by incumbent interests in energy systems^{653 654 655 656 657}. Only under the relatively idiosyncratic conditions of the small explicitly anti-nuclear nation of Denmark, was it possible to build up an early critical mass of linkages between grassroots enthusiasm, engineering expertise and requisite levels of public support and financing^{658 659 660}. But for this contingency, the early necessary stages for the gaining of later global momentum might never have been achieved towards machines that are now far larger and massively more efficient than the early utility-sponsored failures⁶⁵¹. If it had not been for the crucially divergent early experience in Denmark, then, wind power might now still be judged to have been proven non-viable. The currently highly globally competitive mainstream applications of this technology might conceivably have been entirely foregone^{345 661}.
- 10 Gyawali’s vividly-expressed concept resonates with Haraway’s influential identification of “*the God trick*” in science and technology and feminist studies⁶⁶² – and Jasanoff’s associated distinctions (riffing on Nagel⁶⁶³) between “*views from somewhere*”, “*views from everywhere*” and “*views from nowhere*”⁶⁶⁴. In Gyawali’s own metaphor, the contrast to an ‘*eagle-eye view*’ is a ‘*toad-eye view*’⁵⁰. But the worm has been chosen here as an alternative counterpoint for a number of reasons. First, (although usually not compared with that of an eagle) a “*worm’s eye view*” is already a colloquial phrase^{665 666}. Second, it arguably better addresses the crucial point of immersion in the phenomena under view. A toad’s view is (after all) still elevated above a notional ‘ground’, but simply less so than that of an eagle. Worms are embedded in an entirely different medium. And in relation to this medium of the soil, a third reason is that the idea of a ‘worm-eye view’ also accords better with relational ‘rhizomic’ (or root-like) understandings elaborated later in this paper. Fourth, association with a toad might (unfairly) seem pejorative, with the elite/subaltern connotations seemingly suggesting a predator-prey relation. Worms, by contrast, are inaccessible to being eaten by eagles. Indeed, it is kinds of worms that consume most eagles in the end! And if it jars to think of worms having ‘views’, then it can be recalled that some ‘worms’ do, in fact, have eyes⁶⁶⁷.
- 11 There are many straightforward extant concepts of different modalities of agency. That the analogy is so often made with such manifestly inapplicable simplistic tightly-circumscribed mechanistic models, is itself an indication of the power of pressures for justification. The function of these stories of control is not plausibly about securing stated substantive goals (without collateral effects) in the manner actually evoked by strict notions of control. Their political prominence is instead far more credibly explained as a means

to maintain prevailing patterns of privilege, whilst seeking to 'stay on top' (as Gross quotes Domhoff⁶⁶⁸), in the 'surfing'⁸¹ of inherently uncontrollable contingencies reputedly lamented by one British Prime Minister as "*events, dear boy, events*"⁶⁶⁹.

- ¹² The concept of a 'configuring field' is developed here in relatively directly phenomenological^{670 671} terms by reference to the focus of central interest in interrogating the dispositions^{414 672} of socio-material incumbency. Whatever their nature, it is these dispositions across the totality of all possible socio-material configurations, that condition a propensity towards one particular pathway for change rather than others. In conceiving of these propensities within a 'milieu' of all possible configurations, there naturally arises a sense of the relevance of many other well-established kinds of social field theory. With so many extant variants of such theorising, however (including social fields⁴¹⁷, organizational fields^{112 419 420 421}, institutional fields^{422 423}, strategic action fields^{424 295} and policy fields⁴²⁵.) doubts may arise over the necessity and rationale for any new approach. So a further footnote might be useful here, in explaining why a 'configuring field' approach as described here might be thought more applicable than these other alternatives.

For Dolata, for instance, 'socio-technical fields' correspond quite closely to the middle range category of the industrial 'sector'. So this falls foul of the concerns raised here regarding misplaced concreteness in the assertion of such categories. And the association is anyhow also directly critiqued later in Dolata's own analysis as a basis for understanding incumbency⁴¹⁸. Perhaps more relevant then, in building on Giddensian structuration theory (as also used defining power for the present analysis), is Fuenfschilling and Truffer's analysis that provides a useful and sophisticated review of other field theories of socio-technical change¹¹². But their approach is also undertaken disproportionately by reference to what is also critiqued later here as an 'eagle-eye' view of the 'socio-technical regime' – as what they call "*the paradigmatic core of a sector*"¹¹². In these terms, 'configuring fields' are better understood as fields in processes and relations of structuration itself, rather than as distinct and discrete phenomena which relate in independent ways to the notionally categorical 'levels of structuration' or 'degrees of institutionalisation' referred to by Fuenfschilling and Truffer.

Perhaps more relevant on this point, then, is Jessop's 'strategic relational' view of fields^{673 193} – for instance in ways well explored in sociotechnical regime theory by Paschek⁶⁷⁴. This involves criticism of Giddens' structuration theory in a manner that relates to exactly the point made above. But this framework in its own turn displays a series of divergences with the present approach and depends on a series of clashing assumptions. For instance, it adopts a critical realist position, rather than being open to the more constructionist insights highlighted here concerning the importance of Giddens' double hermeneutic in the understanding of incumbency. And, by contrast with the present generalized scope, Jessop's framework highlights particular spatial and temporal specificities. As a result, it also seems to neglect to generalise the importance addressed here, of both structure and agency being intrinsically normatively-oriented in ways that vary in all kinds of particular objective settings and subjective perspectives (not just across space and time).

So, what seems to most distinguish the present idea of a 'configuring field', is that it does not depend for its applicability, on detailed commitment to the above kinds of more particular and circumscribed explanatory frameworks and categories. Instead, it simply requires a shared interest in the focal phenomenon of socio-material incumbency as defined here. Applied in various guises in many areas (like philosophy⁶⁷⁵, linguistics^{676 677}, psychology⁶⁷⁸ and social anthropology⁶⁷⁹), perhaps the closest approximation in extant field ontologies, is the rather general idea of 'dispositional fields'⁴¹⁴. Widely understood in social science by reference to Bourdieu's formative concept of habitus^{415 416}, this does share the process-relational structure-agency understanding of power adopted here – and relates to well-established notions of 'social practice'⁶⁸⁰. So, practice theory may offer an especially helpful basis for testing or development of these ideas. But even here, intense paradigmatic divides in social science make it sadly necessary to point out, that the heuristic value of this concept of configuring fields does not require wholesale adherence to detailed features of practice theory.

- ¹³ Technically, the picture in Figure 3 is a 'Mollweide projection'⁶⁸¹. This shows the manifold containing the relevant socio-material configurations as an enveloping hypersphere, which is then projected onto the two-dimensional plane of the white ellipse. Usefully for analysis of 'worm-eye' / 'eagle-eye' contrasts, this sphere can be viewed (respectively) alternatively as from within or without.
- ¹⁴ Rather than simply a 'space', however, this white ellipse might better be understood (heuristically and metaphorically), as a 'timespace' of affordances and constraints around the material feasibility and societal viability of different socio-material pathways^{612 682}. The orderings of such pathways are, after all, functions equally of different kinds of social and material latitude ('space') and unfoldings of various possible histories ('time'). In these terms, by definition, any particular kind of incumbency-sustaining dynamic will have the effect of reinforcing only a subset of all possible pathways encompassed in the timespace. As with all projections, any given assemblage of configurations will look different under contrasting perspectives. Furthermore, it follows from this metaphor not only that representation of contained phenomena will vary depending on the angle of projection, but that the relative visibility of different dimensions will also depend on this orientation. Any of the (potentially many) dimensions that are orthogonal to the perspective of the projection will remain effectively invisible. So the metaphor includes account of the double hermeneutic discussed here, in that the subjective angle of view is as formative of the resulting picture as the features of the viewed objects themselves.

- ¹⁵ Like "*phase space*"^{162 683 684}, "*possibility space*"^{685 686}, or (perhaps most appropriately for this analysis) "*configurational space*"^{687 688}.

- ¹⁶ Somewhat confusingly, but (as will be seen below) significantly, it is not just '*the landscape*' that is held in regime theory to constitute socio-technical '*deep structure*', but also the ostensibly-distinguished '*regime*'^{436 481}. That '*deep structure*' thus conflates in this approach supposedly defining attributes equally of '*the regime*' and of '*the landscape*', supports the present analysis that incumbency is more rhizomic, distributed and multiplex than the apparently neat segregation of these '*misplacedly concrete*' categories suggests.

- ¹⁷ There are many examples of aspiring policy-informing academic approaches in which focal Mertonian 'middle range'^{377 378} social categories tend to display this feature. Even without including some of the more overtly instrumental theories of 'technology acceptance'^{689 690}, these might include: the 'multi-level perspective'¹⁵¹, 'sustainability transitions'¹⁴⁸; 'transition management'^{149 150}; 'strategic niche management'^{691 692 693}; 'dialectical issue life-cycle model'^{694 695}; 'triple-embeddedness framework'³²¹; 'technological innovation systems'^{379 380}; 'socio-technical systems'^{225 41}; 'large technical systems'^{99 100 101 102 103} and 'techno-economic paradigms'^{94 95} and 'deep transitions'^{118 119}. Also sharing these tendencies are 'innovation ecosystems' and 'systems of innovation'¹⁴⁷ frameworks – including: 'national'⁶⁹⁶, 'sub-national'⁶⁹⁷, 'regional'⁶⁹⁸, 'continental'⁶⁹⁹, 'sectoral'⁷⁰⁰ (and many other) notionally discrete kinds of 'system'. Especially prone to instrumentalisation, are grand ambitions to articulate many such approaches in order to achieve 'complete' explanations⁴⁴⁸ through single 'integrated frameworks'^{437 149 701 702 701}, 'integrated models'³²², or 'unified theory'⁷⁰³.

It should be noted, however, that (for reasons addressed later in this paper), important exceptions to this pattern of instrumentalising '*misplaced concreteness*'^{470 372} can be found in the relatively open and flexible '*flat ontologies*'^{704 705} of '*social practice*'^{644 706 609 707},

'social construction'^{708 224}, 'techno-economic networks'^{96 97 98} and 'actor network'^{709 710 704 711 712 713 714} approaches. But these in their turn have been criticised for failing to give due levels of consideration to power⁷¹⁵. The present approach seeks to reconcile this.

¹⁸ To anticipate a later part of this analysis at this point, the term 'semi-coherence' (when evidently understood in this restrictive way), seriously misses the possibility addressed in the worm-eye view in Figure 5, that incumbency can be distributed, complex and polycongruent in far more radical ways than are captured by ostensibly categorical interactions with other notionally discrete regimes. The 'worm-eye view' goes beyond this kind of circumscribed eagle-eye picture of "possible" "internal conflict"⁴³⁶ between what are still seen as ostensibly neatly-nested 'sub-regimes' of what effectively remains 'reified' as a (notionally discrete and singular) 'regime'. Under a worm-eye view, it is the orderly vision of neatly-bounded regimes and sub-regimes itself that breaks down.

To appreciate further why this is, it is necessary to consider an important general feature of socio-material dynamics, relating to the ubiquitous predicament in social science of Giddens' 'double hermeneutic' discussed above³⁷². This concerns the difference between seeing focal phenomena as 'monothetic' or 'polythetic'⁷¹⁶. The contrast here is between, first: a *monothetic* view of a phenomenon as if adequately definable according to a specific stated characteristic (like membership of the category 'regime'); and second: a *polythetic* view in which the focal phenomenon is acknowledged instead to require characterisation encompassing a more complex diversity of cross-cutting dimensions, defying Euclidean category structures⁷¹⁷. As illuminated in Wittgenstein's metaphor of 'family resemblances'⁷¹⁸, the resulting disparate attributes may not relate to each other in the kinds of conveniently orderly ways that allow categories to be confidently partitioned and instances neatly segregated⁶⁷⁹. With resulting relations often then taking a 'fractal' form⁷¹⁹ (transcending clearly distinguishable 'levels' or 'scales'^{720 468}), correspondences may be radically more mismatched than is expedient for assertion of analytical frameworks with the requisite "necessary simplification"³⁷³. To ignore this more directly phenomenological view⁷²¹ and reduce such polythety to monothety⁷²² is to fall foul of Whitehead's 'fallacy of misplaced concreteness'⁴⁷⁰ and so risk the error of 'reification'⁷²³.

To some, such errors may seem like somewhat esoteric concerns, but it is difficult to overstate the practical importance – especially for research purporting to address high stakes environment and political challenges like those around socio-material incumbency. To treat a set of neatly-bounded, segregated and ordered frameworks of words and categories as settled upon within a particular discipline, as if these necessarily correspond in directly consistent ways with the implicated phenomena in the outside world, is not only to perpetrate an error, but to become dangerously vulnerable to inevitable to mismatches⁷²⁴. Where a focal phenomenon "cannot be described simply by a conjunction of properties"⁷²⁵, it is (as Borges has it) "hazardous to think that a coordination of words... can have much resemblance to the universe"⁷²⁶. Another result is a blindness to particularity – as Bourdieu points out: "in reducing the polythetic to the monothetic, objectivism destroys the specificity"⁶⁴³. To recognise a phenomenon as polythetic, by contrast, is to acknowledge that "the occurrence of a single feature in every member of a category is not sufficient to justify any claim that this is the essence of the category"⁷²⁵. The resulting complexities are inconvenient to the kinds of 'simplifications' held to be 'necessary'³⁷³ for purposes of disciplinary policing and policy justification. But they are crucial if the understanding of socio-material incumbency is to move away from the superficiality of what Ritzer calls a 'monothetic glance' and be open instead to prehending what he calls the 'polythetic flux' in associated power dynamics⁷²⁷.

Perhaps the most crucial implication of reduced monothetic representations of incumbency, however, are turned to at the end of this paper. For it is this same 'reified'^{436 372} characteristic of apparent simplicity that supports the impression that incumbency might satisfactorily be addressed by equally reductive societal responses. Attention can in this way more easily be deceived into preoccupations with more depoliticised notions of 'governance'^{728 360 729 730 731 732}, under which attention fixates on circumscribed strategies, instruments and interventions as if viewed from the same imaginarily detached vision of a 'cockpit'³⁸⁶ that inspired the seeming 'eagle-eyed' view of incumbency itself²³⁸. With incumbency is viewed instead in a polythetic way, attention more easily moves beyond just instrumental 'policy mixes'⁷³³, towards an appreciation for the broader and deeper kinds of political 'mess'⁴⁸². And it is only then, that the importance of comes clearly into view of the political processes of democracy itself, rather than the merely administrative procedures of 'policy making'^{400 560}.

It is in this way that apparently abstract features in representations of incumbency can become crucial to prospects for success in addressing imperatives of environment and social justice – and the fate of associated essential democratic struggles. Indeed, it is in these terms that a key distinction between the 'shallow' and 'deep' manifestations of socio-material incumbency distinguished in this analysis, can be seen to lie in the holistically-pervasive nature of deep incumbency. The 'metastasizing' of incumbency to encompass contexts not only of the relevant range of prehensible objects of incumbency, but also the diversity of salient prehending subjects might be seen as a crucial reference point of concern in democratically-motivated thought and action.

¹⁹ In addition to the present point, the names, definitions and partitionings of both the putative categories in this diagram and their instantiations also vary radically between analyses^{151 436 734 121}. Indeed, even when restricting attention to discussions specifically of the electricity generating system alone, a systematic review by Kinn of contrasting usages by Geels of the same term 'regime', enumerates twelve substantively different meanings attached to this core concept by this single canonical author⁷³⁵.

Likewise, it can become highly ambiguous exactly what might be meant in the standard definition of socio-technical regimes, by the crucially-constituting concept of 'rules'⁷³⁶. In one recent detailed and insightful analysis, Schot and Ghosh acknowledge that the core concept of the regime is "hardly systematic"⁷³⁶. Yet in seeking to remedy this situation the resulting analysis (albeit unusually clear in this field) risks compounding the very confusions it sets out to address. Further more finely-partitioned variants of the same ontology yield concatenations of tacitly-asserted permutations in kinds and degrees of notionally distinct concepts and instances. Included alongside 'routines' and 'heuristics', for example, as constituting parameters of the focal regime, are notionally distinct categories of 'rules', elaborately classed as: 'meta' (and by implication 'regular'); 'formal/regulative'; 'cultural-cognitive'; 'normative' and 'ground' rules. It is unclear how reliably all these categories can be differentiated from setting to setting, let alone in distinguishing the particular instances under each. If they are interrogated systematically (rather than just taken on trust), such heroic taxonomic impulses yield their bewildering complexity in determining what exactly might actually count in any given setting as a 'regime'.

Such problems grow with each defining category of rule being further divided between five apparently firmly-distinct kinds of 'regime dimension', each apparently displaying their own further distinguishable 'trajectories' and 'super-trajectories'⁷³⁶. And whether these 'trajectories' refer to particular socio-material configurations, or to the 'dimensions' these are defined under, is also surprisingly unclear. Yet amidst all these degrees of conceptual freedom, research is expected to be able confidently to grade different degrees of change in each, such as to allow meaningful comparative distinctions across radically different national and sectoral settings. As

ambiguities recursively compound, this proliferating menagerie of categories, instances and intensities quickly grows prohibitively baroque. Mismatches between performative precision and ‘hardly systematic’ ‘reification’ are exacerbated rather than relieved by the ostensibly finer grain resolution. Like unfalsifiable Ptolemaic epicycles⁷³⁷, the main weight is placed on scholastic assertiveness.

So, it is against this background, that the relatively simple general heuristic distinctions made in the present paper (for instance) between ‘open’ and ‘closed’ topologies, might be recognised (despite their own degrees of abstraction and the complexity of the language necessary in order to sustain and specify this) to actually be in many ways both more parsimonious and more operational.

- ²⁰ In a spider’s web, for instance, the processes and relations that keep the spider aloft in the centre are actually able to do this, precisely because they *do not* align with each other^{81 560}. So, the balancing of orthogonal and counterposing forces seems just as potentially important as their alignment? This suggests a necessary feature of rigour and prudence in the understanding of dynamics in any multidimensional manifold (like a socio-material ‘phase space’, ‘possibility space’, ‘landscape’, ‘timespace’ or ‘milieu’)⁶⁸³. In short, it would be irrational and unreasonable simply to assume from the outset, that the subset of dimensions in which a given pathway is oriented within this manifold will be the same as the dimensionalities of the aligning dynamics⁶⁸⁴. To do this in ways that are obscured by other key conceptual elisions, would be even more precarious.

Indeed, there is a possibility that the importance of this kind of orthogonality is not just contingent in socio-material change, but can be an essential property. If the necessary leverage is to be achieved in order to re-orient the massive momentum of incumbency in some particular setting, then the marshalling of requisite vector intensities in the configuring fields needed to perform this, will require a societal ‘pivot’ capable of bearing such a load. When seen relationally, interventions like this acting in one direction of a societal dimension, can be expected to engender a reaction acting in the other direction. So if an intervention is not simply to reproduce the intensity of the dimension along which it is oriented, the pivot must be orthogonal²³⁸. For example, if incumbent violent control is countered with efforts at subaltern violent control, then what may be most reinforced is an overall axis of violent control⁷³⁸. If cultures, institutions and practices of violent control are instead countered by reinforcing (effectively orthogonal) dimensions around mutualistic solidarity and care, then this orthogonal pivot can offer greater hopes of success in displacing violence than counter-violence⁷³⁹.

- ²¹ The concept of ‘poly-congruence’ is used in mathematics⁷⁴⁰, signal processing⁷⁴¹ and computer science⁷⁴² to refer to properties of polynomial functions that relate in broad terms to the present sense of: “*a pattern between fields, implicating multiple rather than single loci of congruence*”. A different term also sometimes used for similar ideas of mapping in relation to the kinds of social field concepts used here is “non-isomorphic”⁷⁴³. However, in focusing rather more straightforwardly simply on the shape, rather than also the varying intensity and polycentricity of the configurations referred to, ideas around ‘(iso)morphism’ might be taken to imply a greater degree of simplicity and clarity than is invoked in the notion of poly-congruence.

- ²² Either way, the practical implications of multiplexity in Figure 5 are accentuated, by considering that each of the coloured fields refers not to all possible manifestations of a given kind of incumbency-sustaining dynamic, but (as capitalised indices suggest) to a specific instance. For example, the form of the field representing a general dynamic of ‘lock-in’, depends on exactly what is envisaged as being ‘locked in’. So there might be multiple contrasting forms even for a single field like that associated with ‘lock-in’. If all such instances were shown for each field, then qualities of multiplexity would be even more pronounced than is already the case. So, the point stands even more strongly, that a worm-eye view recognises more than an eagle-eye view, that effects of different incumbency-sustaining dynamics may not necessarily map onto each other.

- ²³ This point about the reification of ‘levels’ of analysis, is sometimes well acknowledged in parts of the innovation literature, but remains frequently neglected in mainstream discussion on ‘socio-technical transitions’⁴¹³. It is a particular feature that the present analysis seeks to address. Under a worm-eye view, phenomena under scrutiny are not best represented in categorical ways – as if discrete and unitary and confined to some specific ontological ‘level’ or ‘scale’. When seen as relational processes, the picture is more consistent with emerging studies of complex nonlinear social and physical systems. Here, dissipative gradients (like those envisaged for power as flows of ‘*asymmetrically structuring agency*’ [4]) routinely give rise to ‘fractal’ patterns⁷¹⁹ that are essentially self-similar at different geographical, institutional or socio-technical ‘levels’ or ‘scales’^{720 468}. For reasons also addressed above [17], one further especially fruitful body of thinking around this kind of ontology, may be found in rhizomatics^{469 724 744 745}, as widely explored in areas of practice theory^{746 747}.

- ²⁴ Crucially, recognising such pervasiveness under a worm-eye relates only to the extent of the distribution across the milieu, not to its completeness. It does not, therefore, necessarily entail full saturation of the entire milieu – with every detailed socio-material configurations thereby held to be equally implicated in the specific incumbency referred to. As can be seen from Figure 5, although more extensive than when seen under an eagle-eye view, the form of each field recognised in a worm-eye view nonetheless leaves many ‘gaps’ in the timespace. Many configurations are thereby recognised not to be substantively enrolled in maintaining the focal incumbency. But what does hold under a worm-eye view, is that the collectivity of all incumbency-generating dynamics with respect to any given focal pathway, does nonetheless implicate such a wide expanse of disparate configurations, that this collectivity does preclude confinement in any definable continuously monocoherent domain of the milieu that might be called ‘the regime’.

- ²⁵ This more complex kind of holism is sometimes unfashionable in much contemporary problem-oriented research. This is especially so, where there are strong aims to secure the attention of policy processes for which the most important resource is justification discussed above^{748 71 356}. Given this, it is interesting that this kind of holistic approach does nonetheless resonate with some of the most reductive mechanisms in positivistic policy analysis of socio-technical change. For instance, narrow economic ideas of ‘lock in’ under ‘increasing returns to adoption’ can be characterised in terms of some very particular feature of some single device (like the portability of a mobile phone)^{138 261}. Yet the dynamics that constitute associated positive feedbacks may be as complex and comprehensive in their dispersion through disparate parts of society, as the fields shown in Figure 5. And different features of the same device may actually implicate contrasting patterns in these reinforcing dynamics, distributed in different ways through the milieu of socio-material configurations.

Rather than propagating *outwards* from a specific centre, then, the flows and gradients of power associated with particular socio-material pathways might be seen as if ‘condensing’ *inwards* from generally extant societal patterns in asymmetrically structuring agency⁷⁴⁹. This contrasts with a reductive search for confined generative loci of incumbency like the ‘the regime’. It offers instead a

'holistic' way of seeing the underlying constituting dynamics. As when particular kinds of dust particle are seen to serve more readily than others as condensation points for vapour, so salient features may be recognised that are specific to the focal socio-material pathways themselves. But these will in this worm-eye view be of secondary importance to the general properties of the encompassing 'socio-material milieu' taken as a whole ^{434 435 472}.

²⁶ This idea of 'configuring fields' holds in common with other field concepts in the social sciences, a potentially greater fidelity of fit with topologies of power that are more like the worm-eye view in Figure 5, than the eagle-eye view in Figure 3. It is empirically grounded, in that it takes its meaning from the manifest socio-material configurations which are its visible results. Like other field concepts (but unlike the notion of 'the regime'), an ontology of configuring fields can accommodate a variety of messy formative processes, beyond conveniently-presumed congruence. But unlike other extant forms of field theory, the idea of configuring fields relates to diverse and pervasive processes of structuration, rather than to notionally specific 'mid-range' social phenomena like 'organizations', 'policies', 'institutions', 'social movements' 'community preferences', actor 'dispositions', 'intersubjectivities' or 'strategic action'.

²⁷ Without such instrumental simplification in prevailing understandings of incumbency, for instance, it would be less credible that various forms of 'socio-technical transition' might so often be seen to be achievable merely by means of relatively circumscribed managerial or policy interventions ^{373 371 750 34 367 369 370} undertaken from a notional governance 'cockpit' ³⁸⁶. If socio-material incumbency were acknowledged to be more complex, diverse, deeply-penetrating or pervasive through society than suggested in Figure 3, then the task of countering it might be recognised to be more onerous. Deeper forms of political conflict and social transformation might then be understood to implicated, relating more strongly to collective action, democratic struggle or political revolution affecting an entire socio-material milieu, than to more routine kinds of 'policy' interventions conceived to be confined within a discrete region of the milieu ^{400 560}.

These more expansive visions of transformation are less favoured by incumbency itself, when this takes the 'deep' form described by the open topology represented in Figure 5. Indeed the prompting by a 'worm-eye' view of a deeper, more unruly form of democratic politics can be more overtly threatening than 'eagle-eye' characterisations that invite only circumscribed policy interventions of kinds that this type of 'deep' incumbency is itself a picture in a strong position to condition – especially when it is concealed by an eagle-eye misrepresentation as a 'shallow incumbency'. More explicitly and expansively political 'worm-eye' views of incumbency are less readily subverted, diverted or appropriated by incumbency itself ^{751 752 753 754 755 756}. For instance, more complicated 'worm-eye' understandings make it more difficult to establish stories that demonstrate efficacy and appropriate credit for particular 'policy interventions' ⁴⁰⁴. Likewise, it becomes in this view, more difficult to operationalise patronage through preferential attribution of 'academic relevance' and 'policy impacts' ⁷⁵⁷. Whatever its veracity, then, it can be predicted that the simple singular ('eagle-eye') picture of incumbency would be much more convenient than the 'worm-eye' view, in justifying the policy communities and processes from which these analytic literatures seek to gain attention.

²⁸ In discussing the distinct but related phenomenon of the 'international regime', for instance, Ruggie ⁷⁵⁸ offers an apt quote from Philips in musing that "[a] philosopher is someone who goes into a dark room at night, to look for a black cat that isn't there. A theologian does the same thing, but comes out claiming he found the cat" ⁷⁵⁹. When they are interrogated by 'theological' approaches that simply assume their existence – and are incapable or disinclined to find otherwise – then socio-technical regimes (like the international regimes considered by Ruggie) may be cats that aren't there. This presents a contrast with the operational 'unit of analysis' in the present approach, in that configuring fields are defined more phenomenologically (as 'patterns of propensity with respect to a particular focal socio-material pathway, across the totality of all possible socio-material configurations, that serve to foster one specific orientation for change more than others'). To the extent that it is manifestly the case that there exist such patterns in these far more comprehensively encompassing kinds of phenomena, then a configuring fields approach is less theological in this respect. That the focus is on broadly distinguishable topologies in assemblages of processes and relations, rather than notionally precise configurations in any one categorical entity, may further reduce tendencies to this same kind of epistemic vulnerability.

Likewise, the fact that the present focus is on general topologies of configuring fields, rather than on the notional geometries of particular constituent fields, also strengthens this point. The granularity of the broad distinction made in this paper between 'open' and 'closed' topologies can be investigated with significantly greater humility, than if there were pressures to identify more specific patterns. It may be that accumulated empirical research in this vein might enable finer-grain developments – for instance, perhaps, by distinguishing other slightly more nuanced forms of 'concave' or 'convex' topology of socio-technical incumbency with respect to a focal socio-material pathway, that are intermediate between these 'open' and 'closed' ideal types. But this is presently speculative.

²⁹ A large literature on the role of case study research in social science, can be cited in justification of a variety of different positions in this regard ^{528 529 530}. But the argument at this point is quite modest in its claims and more general than much of this discussion of the analytical value of case studies – remaining broadly consistent with the majority of perspectives on this issue ⁵³¹. Indeed, under some strongly argued analyses in this field, the weight of 'contextualised explanation' ⁵³² that can be borne by a carefully designed and implemented single qualitative case study like this, can actually be significantly greater than is being claimed here.

³⁰ In ways that chime with understandings of power and incumbency in the present analysis, it has been proposed that general social conditions of democracy (especially in process-relational terms, as murmurations of collective action in ongoing struggles for the culturing of more emancipatory societies ⁷⁶⁰) can be characterised in a way that generalises across many otherwise contrasting styles of emphasis. This is consistent with the definitions employed throughout this analysis, in which power is conceived as 'asymmetrically structuring agency' ^{81 238} and associated diverse forms of 'democracy' are understandable as multiple kinds of struggle for 'access by the least powerful, to the capacities for challenging power' ^{81 238}.

³¹ It lies beyond the scope of the present paper, to elaborate the many ways in which distributed, nonscaled, emergent, relational and rhizomic political processes referred to here as 'murmurations' may relate to the present understanding of power and incumbency in terms of 'configuring fields' ^{400 238 761}. The serendipitous dual sense of the English word 'murmuration' at the same time of 'horizontally-coordinated movement' and 'subversive criticism', may itself be seen as a reflection of murmuring dynamics in language ². Either way, what is clear is that deep and pervasive redistributions and reorientations of power are not effectively

achievable by the kinds of vertical mechanisms highlighted in the fallacies of control so favoured by incumbency as a means to secure justification and sustain privilege ⁷⁶².

As in other dissipative relational processes (from small-scale neural to large-scale cosmic activities ^{763 764 765}) the configurations of socio-material incumbency may often be better understood in these 'emergentist' ^{766 767 768} (rather than reductive) terms – in terms of features of the wholes in which they are immersed more than in terms of their own notionally discrete properties. Such a view sees socio-material incumbency as *condensing out* of palimpsests of configuring fields of structuring agency distributed throughout an entire socio-material milieu taken as a whole, not as a discretely-located and bounded category of power. As with other emergent patterns, such incumbency can be expected to be *fractal* ^{467 468 181 719 720} (rather than neatly-scaled) and *rhizomic* ^{312 469 724 744 745} (deeply multiple, pervasive and interconnected) in nature.

As an additional final hint towards implications for action, however, it follows from all this that if socio-material incumbency is prehended in the *monothetic* ^{716 724} terms of many conventional approaches [18], then fallacies of misplaced-concreteness ^{470 372} will likely arise. The present emergentist approach instead upholds a more polythetic understanding ^{716 727}. Likewise, routine actions undertaken against incumbency under this conventional approach are *monovalent* in style ⁷⁶⁹, as if the only salient implications of intervention are those initially intended by notionally controlling policy actors ⁷⁶². Here again, the present emergentist view urges instead that actions be undertaken in the more polyvalent style of mutualistic murmurings ²³⁸. And with regard to the processes by which countering action might be hoped to transform incumbency, a conventional approach tends to highlight one-directional 'logistic curve' trends, unfolding according to orderly monotonic 'phases' ⁷⁷⁰. Again by contrast, the present emergentist approach expects incumbency to be more likely to erode in *non-monotonic* ways – in waves of oscillating effect to and fro, sometimes appearing to be counterproductive. If the possibility of this kind of much more messy process is not at least better understood (if not anticipated), then the likelihood that all kinds of incumbency will be effectively challenged is seriously diminished.

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SPRU – Science Policy Research Unit

University of Sussex

Falmer, Brighton, BN1 9SL, United Kingdom

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