Problem Spaces

How and Why Methodology Matters

Celia Lury

Contents

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First published in 2021 by Polity Press

Polity Press

65 Bridge Street

Cambridge CB2 1UR, UK

Polity Press

101 Station Landing

Suite 300

Medford, MA 02155, USA

ISBN-13: 978-1-5095-0793-1 (hardback)

ISBN-13: 978-1-5095-0794-8 (paperback)

A catalogue record for this book is available from the British Library.

Typeset in 11 on 13pt Sabon

by Fakenham Prepress Solutions, Fakenham, Norfolk NR21 8NL

Printed and bound in Great Britain by TJ International Limited

For further information on Polity, visit our website: politybooks.com

Acknowledgements

I would like to thank colleagues, friends and family near and far, including: Nerea Calvillo, Sophie Day, Michael Dieter, Sarah Doughty, Elena Esposito, Carolin Gerlitz, Christina Hughes, Eva Lash, Adam Lury, Giles Lury, Karen Lury, Henry Mainsah, Noortje Marres, Greg McInerny, Mike Michael, João Porto de Albuquerque, Maria Puig de la Bellacasa, Shirin Rai, Matt Spencer, David Stark, Martín Tironi, Nigel Thrift, Philipp Ulbrich, Matías Valderrama, Sylvia Walby, Naomi Waltham-Smith and Scott Wark. Special thanks go to Michael Castelle, who first introduced me to the idea of problem spaces; to Emma Uprichard, who kept me going; to Nate Tkacz and the three anonymous reviewers who read and commented on a draft of the book; and to Ana Gross, the co-author of Chapter 3. I would also like to thank Karina Jákupsdóttir and Jonathan Skerrett at Polity for their patience and support.

Research for this monograph was supported by an ESRC Professorial Fellowship: Order and Continuity: Methods for Change in a Topological Society, Ref No: 978-1444339598. I am grateful for this support.

Introduction: The Compulsion of Composition

> Power is the compulsion of composition … The essence of power is the drive towards aesthetic worth for its own sake. All power is a derivative from this fact of composition attaining worth for itself. There is no other fact. Power and importance are aspects of this fact. It constitutes the drive of the universe. It is efficient cause, maintaining its power of survival. It is final cause, maintaining in the creature its appetition for creation.
>
> Alfred North Whitehead (1968: 119)

Ann Kelly and Lynsey McGoey (2018) suggest that we are witnessing the emergence of ‘a new empire of truth’. Describing the significance of profound transformations in the ‘scaling, pace and symbolic power of fact-making’ for ‘the shifting relationships between knowledge, ignorance and power today’, they ask:

> What constitutes authoritative evidence in this political climate? To what uses is evidence put, and what values does it carry? What obligations must be placed on the companies, such as Google or Facebook, that configure our new public spheres while profiting from the tracking and steering of online behaviour? What counts in the making of facts, and who does the counting? Which empirical tools and metrics garner sufficient political capital to guide policy during times of economic uncertainty? And, critically, how do the social sciences respond to the increasing social and political significance of data while accounting for the deepening popular scepticism of the facts that data are used to support? (2018: 2–3)

This book develops the thesis that to understand this new empire of truth and answer the questions Kelly and McGoey pose, a new concept of a problem space is needed.

So, what is a problem space?

In established methodological terms, a problem space is a representation of a problem in terms of relations between three components: givens, goals and operators. ‘Givens’ are the facts or information that describe the problem; ‘goals’ are the desired end state of the problem – what the knower wants to know; and ‘operators’ are the actions to be performed in reaching the desired goals. In many methodological discussions, the relation between these three components is assumed to be stable and relatively straightforward. Once givens and goals are assessed, operators – concepts and methods – can be identified and implemented, problems can be defined, analysed and solved in sequential steps: the problem space *contains* the problem. But such an approach presumes that we know the problem before we start investigating, and that it remains the same as it is investigated. And this is very often not the case: the problem is a problem, *becomes* a problem as it is investigated. If we take seriously the becoming of a problem then we cannot stick with a container conception of a problem space. Instead, we should pay attention to the constantly changing relations between givens, goals and operators in which a problem is transformed.[1] This requires an understanding of a problem space as a space of methodological potential.

To develop this understanding and consider how this potential may be realized to ‘test the present’ (Stengers 2019), the book outlines a compositional methodology. The distinctiveness of this methodology comes from an emphasis on the vocabulary of composition,[2] a term that

Whitehead employs in the quotation above, but whose everyday definition is ‘the action of putting things together’. Here it refers to the processes, the activities with which the givens, goals and operators of a problem space are put together. When the term composition is used in the visual and performing arts the emphasis is on the creativity of this action of putting things together. It is used here – in a way that it is hoped will be of interest to disciplinary and interdisciplinary researchers of all kinds – to describe a methodology in which the focus is on the ways in which a problem is put together, how it is formed and transformed, inventively (Lury and Wakeford 2012). In this process of putting a problem together, of forming and transforming, the compulsion of composition does not come from either inside or outside the problem; the problem is not acted on *in* a space but emerges *across* a problem space, from with-in and out-with.

For compositional methodology, an understanding of a problem as a form of process is fundamental, where form consists in both the problem and its limits or constraints.[3] To explicate this understanding of form, let me introduce a series of works by the artist Dorothea Rockburne: *Drawing Which Makes Itself* (1972–3). In these works, a double-sided piece of carbon paper, which I invite you to consider as analogous to a phenomenon or situation becoming a problem, is held against a wall or a floor, folded and rotated, with the edges or limits of the space it makes in these activities scored through the paper onto the wall or floor. The activities (the methods) of folding, rotating and scoring move the paper (the problem) into and through another dimension in a process of transformation. The art critic Rosalind Krauss says of these works:

The act of scoring simultaneously deposits carbon onto the wall surface and underlines the fold of the paper itself. The resultant lines or marks are read with a striking ambivalence, for they are both on the wall and yet they are retained *within* the carbon paper that had been flipped into a new position. … one confronts works in which the lines [that are 'out-with' the paper] arise from information that is '[with]in' the paper. (2010: 221)

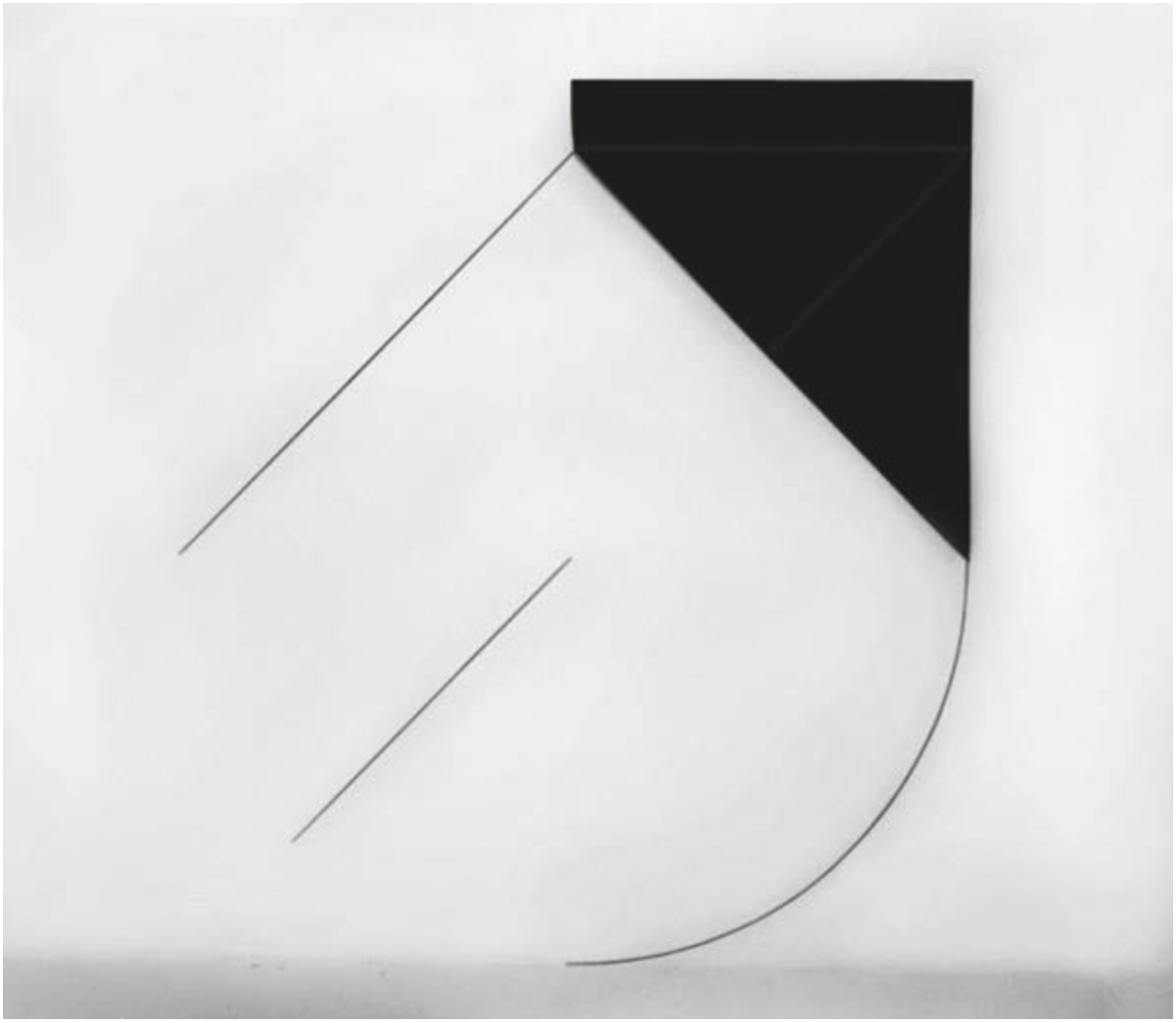

Figure 1 Installation piece: Arc

Source: Dorothea Rockburne (1973) © ARS, NY and DACS, London 2020

Acting methodically on the properties of a situation becoming a problem (trans)forms the problem. The limits of

the problem are with-in and out-with it: they do not contain it, but, rather, express or encapsulate it.

The material-semiotic properties of the double-sided carbon paper mean that some acts – some methods – have expressive effects; it is a drawing that draws itself. At the same time, not only do the material-semiotic properties of the paper – the problem – have methodological potential (to be folded, to be scored, to be rotated), so too does the context in which the work is (re-)presented matter. Rockburne says the context should 'represent' the art. To do so requires that the context be (re)active:

I was very interested in the fact that the whole room should represent the art. I painted the walls with the brightest white paint you could find. As people walked into the room, their footprints became part of the drawing. (https://www.khanacademy.org/humanities/art-1010/minimalism-earthworks/v/rockburne-drawing)

Inspired by this work, the concept of a problem space put forward here is that it is a space of methodological potential that is with-in and out-with the ongoing transformation of a problem. The potential is realized in a methodology that, rather than responding only to the initial presentation of a problem, composes the problem again and again.

Compositional methodology

The activity of composing is not given in advance of a problem, but is rather ever forming and transforming across a problem space. It rarely involves just one action or operation – sensing, categorizing, conceptualizing, scaling, measuring, affecting, experiencing, varying, but involves the doing of many together. In other words, compositional methodology presumes and exploits the fact that a problem

is not given but emerges with-in and out-with a myriad sequence of actions or methods that (trans)forms the problem space. Importantly, this sequencing is not the addition of one action or method after another, but a composition in the sense that the actions or methods are not discrete or independent of each other. As ‘it’ happens, a compositional methodology seeks to recognize and exploit the properties of the problem on an ongoing basis. It composes a problem by recognizing and making use of (rather than minimizing) the constantly changing limits that create a problem and a problem space together, identifying and operating the intensive or ‘live’ properties of the problem it investigates (Back and Puwar 2012).

Compositional methodology is, then, concerned with form in and as transformation, a process involving ‘the interweaving of data, form, transition, and issue’ (Whitehead 1968: 210) organized by the compulsion of composition:

It is not that which is discriminated that is most real, nor is it a completed, self-sustaining composition. But instead the compulsion of composition. (Whitehead 1968: 133)

To adapt Rockburne’s title, for compositional methodology a situation or phenomenon becomes a problem, acquires a form, trans-forms, as a ‘problem that problematizes itself’; that is, compulsive composition is the repeated folding or twisting of problems into forms of problematization. In this twisting, the problem is revealed never to be simply a problem, but also a composition of the methodological potential of a problem space to be expressed in transformation. This is to say problems and problem spaces are compulsively composed together.

Let me give another example, taken from a discussion of the development of staging models for the diagnosis of tuberculosis by Geoff Bowker and Susan Leigh Star (2000).

In a first model – a body–biography chain, the biographical trajectory of an individual and the trajectory of their illness are placed alongside each other.

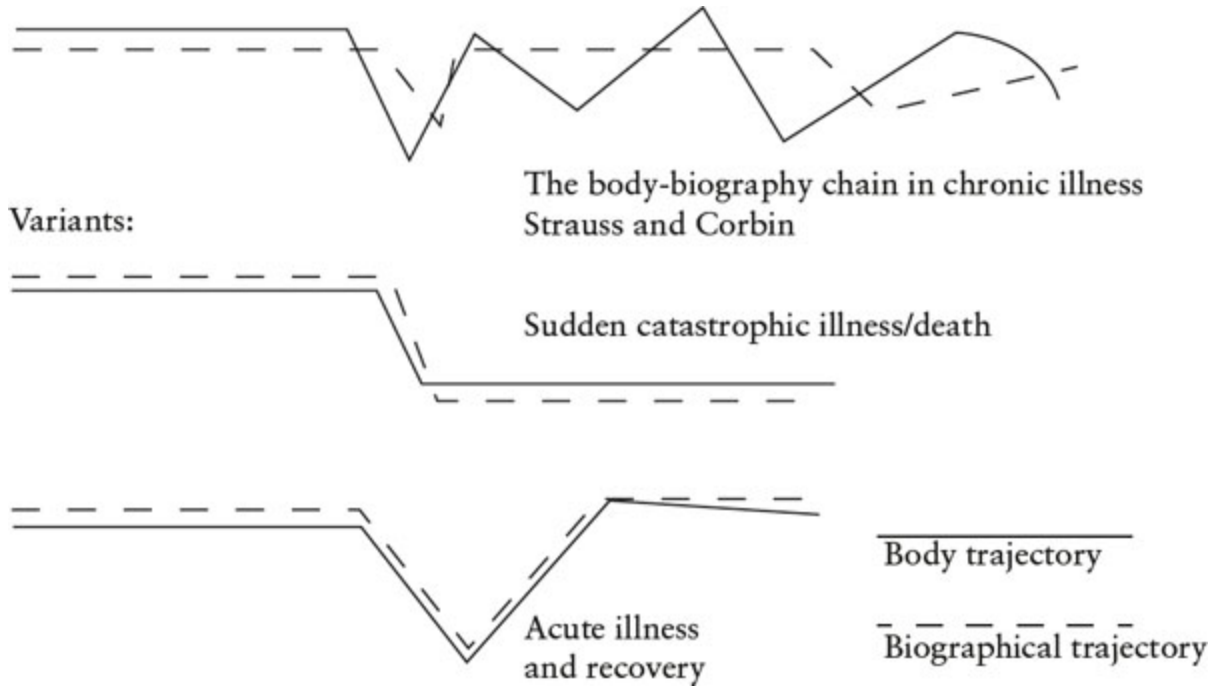

Figure 2 Model I: Body–biography trajectory

Source: Geoff Bowker and Susan Leigh Star (2000)

In a second model, multiple biography/identity trajectories are introduced, as a way of recognizing the multiple dimensions of an individual's life, complicating the understanding of the course of illness in relation to the person who is ill.

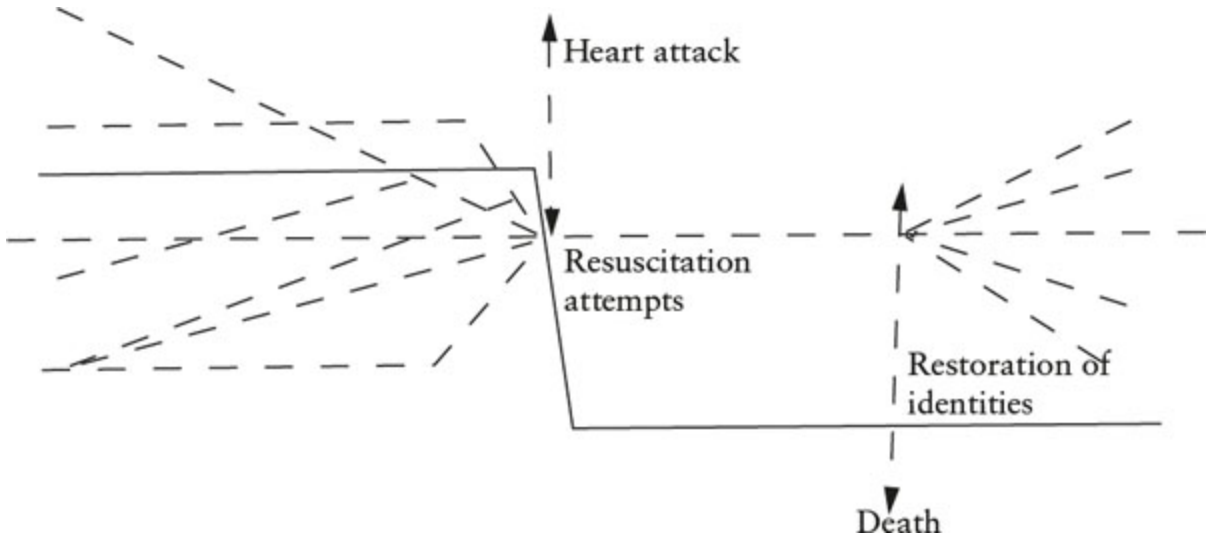

Figure 3 Model II: Multiple identity trajectory

Source: Geoff Bowker and Susan Leigh Star (2000)

In both these models, the problem space is a container space. However, in a third model, the external linear time of the classification system is folded into the model: continuities, discontinuities and layers are introduced into the problem space. In the action of folding the epistemic limit of the classification system across the trajectories, the model becomes expressive; that is, the model acquires inventive methodological potential in the folding of 'the outside' of the problem into the 'inside'. It is encapsulated. As Bowker and Star put it, there is a topology–typology twist: 'The topology created by the body–biography trajectory is pulled against the idealized, standardized typology of the global classification of tuberculosis, itself a broken and moving target' (2000: 190).

To return to the vocabulary introduced in the discussion of Rockburne, this model involves the action of folding the external limit of the classification system into the problem. That is, the method of folding changes the problem even as it persists, creating new methodological potential in the process of transformation. In other words, it is not just a problem that is defined in transformation, but the problem

and the problem space, as they are compulsively composed together.

In what follows it will be suggested that compositional methodology is concerned with the way in which a problem emerges in the relation between two moments; that is, with the addressing of a method or methods to a specific problem, and the capacity of what emerges in their use to change or transform the problem (Rheinberger 1997). As Nina Wakeford and I (2012) argue, it is the relation between these two moments that makes methods answerable to a problem, and provides the basis of the self-displacing movement or auto-spatialization of a problem. We further argue that the inventiveness of methods is a consequence of the articulation of their double force: their constitutive effects and their capacity to contribute to the generative circulation of the problem. Here I suggest that a compositional methodology acknowledges and exploits the fact that the double force of auto-spatialization does not operate to create a space that contains the problem, but, rather, has as its aim the composition of a problem across a problem space that is itself changing.[4] Indeed it is proposed that it is the accomplishment of some kind of continuity and connection in the transformation of a problem that secures epistemological value.

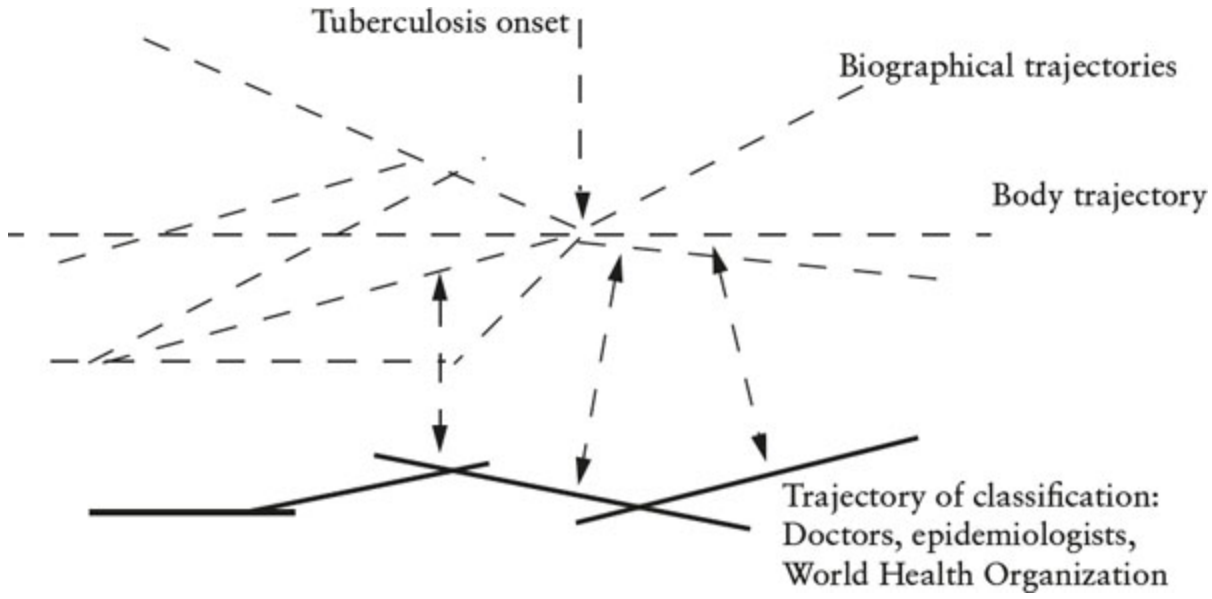

Figure 4 Model III: Classification trajectory

Source: Geoff Bowker and Susan Leigh Star (2000)

Becoming topological

What the discussion above implies, and the example from Bowker and Star illustrates, is that compositional methodology does not employ a container understanding of problem space but is, rather, concerned with the *becoming topological* of problem spaces (Lury, Parisi and Terranova 2012). What might this mean?

Topology is commonly described as a mode of analysis that arises from the study of spatial properties that remain invariant under transformation. It is thus a mode of analysis that is concerned with how continuity and change can take place together. Importantly, while it might seem, from this definition, that topology describes spatial properties that exist outside of or are independent of time, just as the concept of the problem space proposed here does not presume a conception of space as container, nor does it assume a container conception of time. As Steven Connor says, ‘Because topology is concerned with what

remains invariant as a result of transformation, it may be thought of as geometry plus time, geometry given body by motion' (http://www.stevenconnor.com/topologies). The claim that problem spaces are 'becoming topological' is an acknowledgement of the ways in which the compulsive composition of a problem makes time and space in relation to each other in the organization of continuity in transformation. [5]

While some other discussions of methodology employ the vocabulary of topology, the usefulness of the vocabulary of topology for the analysis of social and cultural life has been much debated (Law and Mol 1994, 2002; Thrift 2008; Lury, Parisi and Terranova 2012; Shields 2013; https://culanth.org/fieldsights/series/topology-as-method), with some advising caution on the grounds that topology as an approach has been significantly developed in – and should be confined to – mathematics (Phillips 2013). In developing his geographical analysis of topologies of power, John Allen (2016) disagrees. To do so, he draws on Ian Hacking's interpretation of the transposition of mathematical terms to other domains. In a discussion which acknowledges the complexities of borrowings between disciplines as well as the variety of uses to which knowledge is put, Hacking says:

It is not so clear whether we are discovering that the second domain has the same structure as the first domain, or whether we are sculpting the second domain so that it comes out shaped like the first. Probably both sorts of things happen. (Hacking 2014: 175 in Allen 2016: 5)

Allen says that he is not bothered with policing the borrowings between disciplines, but instead prefers to mobilize a cross-disciplinary understanding of topology – that is, a concern with a form of relations that remains continuous in transformation – and that is the approach

adopted here (see also https://www.theoryculturesociety.org/interview-with-celia-lury-luciana-parisi-and-tiziana-terranova-on-topologies). Following this approach, and as above, a compositional methodology addresses the becoming topological of problem spaces by exploring the continuity in (trans)form(ation) of problems across problem spaces. Indeed, it aims to describe and interrogate how the making of such continuities enables epistemological values to be established. However, with Hacking's analysis in mind it is important to remember that, like the drawing that requires a support to make itself, so does the becoming topological of problem spaces require a (material-semiotic) support. No methodology can operate in the abstract, and so the book is concerned not only with the composition of problem spaces but also with epistemic infrastructure.

The term 'epistemic' is used to signal that what is at issue in this new empire of truth is the nature of understanding, interpretation, explanation, justification and belief rather than knowledge as such.[6] As Karin Knorr Cetina puts it:

Epistemic cultures are cultures of creating and warranting knowledge. This is what the choice of the term 'epistemic' rather than simply 'knowledge' suggests' … [i]t brings into focus the content of the different knowledge-oriented lifeworlds, the different meanings of the empirical, specific constructions of the referent (the objects of knowledge), particular ontologies of instruments, specific models of epistemic subjects. (2007: 363–4)

Alongside 'epistemic', the term 'infrastructure' highlights the ways in which knowledge-making requires and installs material supports in the world, what Knorr Cetina calls knowledge settings, the 'whole sets of arrangements, processes and principles that serve knowledge and unfold with its articulation' (2007: 361–2), including 'buildings,

bureaucracies, standards, forms, technologies, funding flows, affective orientations, and power relations' (Murphy 2017: 6).

An aspect of concern for a compositional methodology in this regard is the material-semiotic capacities of such supports. In short, the use of the term composition in this exploration of compositional methodology is also designed to draw attention to the heterogeneous composition – the mixing, the composting, the mess (Law 2004) – of the material-semiotic processes and entities involved in the making of problem spaces. And while the term 'infrastructure' might seem to imply that the supports of methodological practices are fixed, static and easy to identify, this is not the understanding proposed here. Instead there is an emphasis on what Haraway calls the 'extraordinary range of contexts' (1991: 197) of knowledge production, what Bowker and Star describe as boundary infrastructures (2000) and what Mackenzie calls 'the unfurling, unstable opacity of contemporary infrastructures' (2016: 380; see also Harvey et al. 2016).[7]

In recognition of this unstable opacity, this book explores a variety of changes occurring in the epistemic infrastructure that make methodology a matter of public as well as academic concern. These include processes of explicitation and literalization as well as transformations in the material semiotics of problem spaces, in cognition and in the role of the observer. Other kinds of change include challenges to the Western-centric terms and character of many methodological debates, and the shift from an epistemic culture of representation and representativeness to one of participation and transparency. However, the principal concern of this book will be with the methodological implications of platformization (Poell et al. 2019), that is, in very general terms, 'the process of constructing a somewhat lifted-out or well-bounded domain as a relational

intersection for different groups' (Mackenzie 2019: 1994). The well-bounded domains of interest here are those designed to support the making of epistemic claims by different actors or communities of practice (Lave and Wenger 1991).

Platformization is an ugly neologism, but it is used here to acknowledge both the proliferation of (methodological) platforms and the way in which platforms are not usually discrete or self-contained but are interconnected in a variety of ways, often coming to be embedded in the epistemic infrastructure. Indeed, the ugliness of the term directs attention to the fact that the distinction between platforms and infrastructure is not easy to draw. As Plantin et al. (2016) observe, it is now not uncommon that platform-based services acquire characteristics of infrastructure, while both new and existing infrastructures are increasingly being built or reorganized on the logic of platforms. This logic is important, so it will be argued, because platforms have the capacity to bring together – and modify – the changes in the epistemic infrastructure just outlined, although they by no means contain or exhaust them. They do so through the ways in which they enhance specific formal properties of circulation (Appadurai 2013), specifically those associated with recursion, and in doing so facilitate specific ways to identify and create continuity in the transformation of problems in relation to changing contexts. It is argued that in this way platformization reconfigures the potential afforded by relations between a problem and a problem space, expanding the methodological possibilities of the double force of methods, by creating a boundary infrastructure (Bowker and Star 2000). In doing so, it will be argued, platforms mutate the topologies of knowledge of problem spaces.

The structure of the book

As indicated above, the book aims to address the shifting relationships between knowledge, ignorance and power by developing the concept of problem space. It does this by exploring the inter-relationship of problem spaces and the contemporary epistemic infrastructure in which the composition of problem spaces takes place. To explicate the significance of this inter-relationship, the book is divided into: this Introduction, three Parts, and a Conclusion. Each of the Parts starts from a different point of view on the inter-relationship between problem space and infrastructure, allowing for a shifting – parallax – analysis of the possibilities afforded to a compositional methodology today. Such a structure, while complicated, is necessary since as Martin Savransky so nicely puts it:

… problems have an existence of their own, a mode of existence that is never just immanent to thought, but to a historical – which is to say, processual – world; as such, they can never be reduced to a matter of human psychology, epistemology, or methodology. Problems, in other words, are not that which a certain mode of thinking or knowing encounters as an obstacle to be overcome, but that which sets thinking, knowing and feeling into motion. (2018: 215)

The first Part has only one chapter. It introduces the heuristic of problem spaces through a discussion of five rather disparate writers – John Dewey, Herbert Simon, Donna Haraway, François Jullien and Arjun Appadurai. The aim is to situate compositional methodology, understood as the inter-linking of the formation and transformation of a problem across a problem space, in relation to established methodological approaches.

The second Part has three chapters (Chapters 2, 3 and 4). Chapter 2 describes some of the most significant changes in the contemporary epistemic infrastructure and the new

possibilities they afford for configuring problem spaces. Chapter 3, co-authored with Ana Gross, considers some of the ways in which variation in price is measured, including the Consumer Price Index. This discussion of methods in practice highlight the methodological possibilities of some of the changes described in the previous chapter. This chapter also introduces the idea that these changes are being accelerated by a process of platformization, and begins to describe the implications of this process for the composition of problem spaces. Chapter 4 further develops the idea that we are witnessing the platformization of the epistemic infrastructure through a detailed discussion of the four understandings of platform identified by Tarleton Gillespie (2010): architectural, political, computational and figurative.

Focusing on compositional methodology, the third Part comprises two chapters (Chapters 5 and 6). Chapter 5 introduces some of the challenges – what I describe as the double troubles – associated with the methodological possibilities stemming from platformization including: the natively artificial character of the empirical; the multiplicity of the epistemological object; and the genus of cognitive syndromes that, following Gregory Bateson (1972), are described as transcontextualism. Chapter 6 situates compositional methodology in relation to the account of Mode 2 knowledge production developed by Helga Nowotny, Michael Scott and Michael Gibbons and others (Gibbons et al. 1994; Nowotny et al. 2001), noting shared concerns as well as differences in emphasis by drawing on the concept of the interface. This concept is deployed to develop the argument that contemporary science is neither external nor internal to society, adding to the analysis of the topological characteristics of today's problem spaces. As part of a consideration of the accountability and autonomy of knowledge production, it also paves the way

for the proposal that methods are being operationalized as part of a cultural imaginary of know-ability, and highlights the dangers of the gamification and weaponization of methods. The chapter contrasts know-ability and answer-ability and ends by outlining an ethics for a compositional methodology in terms of care, and the values of response-ability.

The Conclusion looks back at and reflects on the book's account of contemporary topologies of knowledge and power.

Some general comments

Before embarking on this journey, it may be helpful to make a couple of observations about some of the assumptions that inform the book. The first is that the book's understanding of compositional methodology deploys an understanding of methods as practices. In some ways, such an understanding seems too obvious to need stating: in everyday as well as methodological uses, a method is a procedure or process for attaining an object, a way of doing things. But in some accounts, methods are only discussed before or after they are put to work – described in textbooks as a set of techniques to be learnt and then applied or in articles and monographs as completed actions that led to findings.[8] Rather than adopt this approach, the book emphasizes the doing or practice of methods to make visible the work that goes into the accomplishment of epistemological values. As Andrea Mubi Brighenti puts it, while being regulatory ideals, these accomplishments are also 'peculiar creations, … bounded and contingent practices aimed to stabilize certain courses of action and interaction patterns' (2018: 24). Recognizing that epistemological values emerge from the doing of methods as material-semiotic practices enables a recognition of the

composite nature of methodological exploration; for example:

> Calculation thus appears as not merely mathematical or metrical in nature, but rather as a composite work made of different stages including objectification, separation, individualization, comparison, association, transformation, disembedding and distribution. (Brighenti 2018: 24)

As the book proceeds, what becomes apparent (hopefully) is that this doing, the compulsion of composition, comprises not only the intended actions of researchers, but also the actions and operations that are proposed, engaged, activated and (sometimes) automated in the epistemic infrastructure. And such actions and operations are themselves embedded in distributed activities that are not necessarily, indeed are not often, guided by epistemological concerns.

In this regard, the book speaks to and engages with discussions of the performativity of methods, the double social life of methods (Law, Ruppert and Savage 2011; Law and Urry 2003; Giddens 1987) and social epistemology (Collier 2005) as well as learning from studies of how science is done alongside more conventional accounts of methodology. It has been profoundly shaped by the longstanding feminist debates on epistemology and methodology, which are shown to have anticipated many concerns only recently identified in other debates. It also draws on the understanding of methods as interruptions I developed with the co-editors and contributors to the *Routledge Handbook of Interdisciplinary Research Methods* (Lury et al. 2018). There we describe methods as *gerunds*; that is, as the active present tense form of verbs that function as nouns. Put rather grandly, the *Handbook*'s concern is to emphasize the role of methods in the activation of the present: the determination of a situation

as a problem; that is, ‘a state of things in which something that will perhaps matter is unfolding amidst the usual activity of life’ (Berlant 2008: 4). A further source of inspiration is recent work on digital media, including on platforms, interfaces, data and circulation.

In drawing on and developing these ideas, the book describes the use of as many kinds of methods as possible. I do not find much value in, for example, opposing quantitative or qualitative methods or restricting my examples to one or the other; nor do I wish to fetishize either ‘the’ scientific method or ‘the’ hermeneutic method, de-construction or constructionism. The aim is to explore the possibilities for the accomplishment of epistemological values as they emerge in the use of a diversity of methods. In this regard, I follow John Dewey who says:

We are trying to know knowledge. The procedure which I have tried to follow, no matter with what obscurity and confusion, is to begin with cases of knowledge and to analyze them to discover why and how they are knowledges. (1922: 60)

To this end, the book also deploys examples and ideas relating to the use of methods in professional, lay and academic practices. This is not always the case in academic discussions of methodology but it seems especially important at a time of platformization, since platforms are often the site of tensions in collaborative forms of knowledge production (Rabinow et al. 2008), between, for example, the academy and its outside(s), across public and private organizations, with objects that may be more or less objective (Knorr Cetina 1997) and with subjects who may or may not be citizens, able to act as individuals or only be recognized as informants or data points.

The interest in the use of methods inside and outside academia does not, however, assume equivalence between

the various practices described. Instead the aim is to recognize that at a time when scientific registers are losing some of their traditional hold over the deployment and interpretation of experimental interventions, epistemological considerations must contend with alternative repertoires of evaluation (Lezaun, Marres and Tironi 2017), and to acknowledge some of the many ways in which relations between academic and non-academic uses of methods are currently being negotiated.

Noortje Marres (2012a) describes some of the complications associated with these changes and the associated redistribution of expertise when she identifies three positions in contemporary methodological debates in the discipline of sociology. The first is the equation of sociological and social methods, an approach in which the latter are characterized by the (sometimes unacknowledged) naturalization or appropriation of social science methodology. I do not adopt this position: as will become clear I think it is important to acknowledge the two-way exchange that happens between academic and non-academic methods while acknowledging their different concerns. The second position is the marked opposition of sociological and social methods: an opposition between disciplinary and public problems which is developed in various forms of academic critique. In relation to this second position, while I do not want to diminish the importance of critique, neither do I want to start by assuming the terms of exchange as those of opposition or that academic practice is invariably ‘better’. Marres’ third position is to refuse any fixed identity for either sociological or social research and to avoid presuming the nature of the differences between them. In relation to this position, which is the one she adopts, methods are unstable, undetermined and interested; that is, methods are a way of equipping a situation to be a problem. I adopt this third

position, and, like Marres, view methods as sites of engagement. Indeed, it is because I agree with Marres when she says that method development is a way to engage critically and creatively with wider analytical apparatuses that problem spaces are approached through a dual focus on methodology and the epistemic infrastructure. While it is becoming harder and harder to loosen the knots in which the strands of epistemic and social control have become entangled, this does not mean that their entanglement in the new empire of truth can be ignored (Herberg and Vilsmaier 2020).

Notes

1 This approach is thus very different from what has been called solutionism (Morozov 2013), in which problems are identified in relation to solutions that are already available. However, it has similarities with the consideration of problems as wicked (Rittel and Webber 1973; Buchanan 1992). In this approach, problems are wicked because they are indeterminate; that is, they have no definitive conditions or limits. Problem definition is considered a design space just as the solution is, with progress towards a solution affecting the progress of defining the problem. There are no inherent stopping criteria. This understanding of wicked problems has many affinities with the analysis of problem spaces proposed here. However, the emphasis here is on methodology rather than design as such. This is to enable a more open-ended discussion of the issues involved. Perhaps most importantly, however, the focus on problem spaces, rather than problems, even if they are qualified as wicked, draws attention to how problems are made, their becoming, rather than seeing them as having inherent characteristics.

2 Drawing on Whitehead, both Bruno Latour (2010) and Isabelle Stengers (2010) also use the term composition in relation to issues of methodology and politics. While sympathetic to these approaches, my use has a more strongly aesthetic emphasis, indicated by the discussion of form.

3 I hope to avoid the charge of formalism: the understanding of form proposed here is a dynamic social category; that is, it is a modality of social making.

4 I would like to thank Emma Uprichard for this formulation.

5 Roy Wagner says, 'time is the difference between itself and space; space is the similarity between the two. Hence (*pace* Einstein) the nature of perception itself forbids a conflation of space and time as a single continuum' (2019: xiii).

6 Compare with the definition given by Edwards et al.: 'knowledge infrastructures comprise robust networks of people, artifacts, and institutions that generate, share and maintain specific knowledge about the human and natural worlds' (2010: 17; see also: http://pne.people.si.umich.edu/PDF/Edwards_etal_2013_Knowledge_Infrastructures.pdf). Bowker defines knowledge infrastructures as: 'the network of institutions, people, buildings and information resources which enable us to turn observation and contemplation of the world into a standardized set of knowledge objects: journal articles and monographs' (2016: 391).

7 In most early uses of the term in the humanities and social sciences, infrastructure was used to refer to whatever assemblage of technologies, procedures, and people (hardware, software and people) was robust,

stable or solid enough to facilitate a set of organized practices, but the recognition of the mutability of such assemblages has been gradually built into the working definition. There is now a concern with the doing of infrastructures; that is, with infrastructuring as a material-semiotic practice (Bossen and Markussen 2010; Simone 2015; Michael 2020).

8 Law, Ruppert and Savage (2011) describe this understanding of methods – that is, methods as tools – as 'the methodological complex' (presumably in an analogy to the 'patriarchal- military- capitalist complex') or 'the methods machine'. The problem with such an approach they say is the separation it introduces and enforces between theory, substance, and method.