



Science and Technology Studies

MAPPING SCIENTIFIC METHOD

DISCIPLINARY NARRATIONS

Edited by
Gita Chadha and Renny Thomas



Mapping Scientific Method is a superb addition to studies of the scientific method. Challenging the idea of any singular scientific method, the authors of this volume narrate the richness of disciplinary methods, and the innovations and imagination of the sciences. Taking on the 'method ladenness' of knowledge, Chadha and Thomas have assembled a path breaking volume that adds to our understanding of the Eurocentrism of science, and more importantly offering us alternate genealogies and methods from the histories and sociologies of the sciences of South Asia. Eschewing claims of an idealized and false unity of science, the authors call for a multiplicity and diversity of method. They present on-the-ground complexities of how science is done in India in a variety of the natural and social sciences, and the humanities. Deeply committed to a project of reclaiming 'science' as a critically important site for dealing with the complexities of the world, the volume reckons with science's deep and wide global roots. With our growing interest in decolonization, this anthology will prove to be an indispensable collection of how we might diversify not only our methods and methodologies, but also our history, sociology, and anthropology of the sciences.

Banu Subramaniam, University of Massachusetts, Amherst, USA.

How has the career of the 'scientific method' shaped our ways of knowing the world? This innovative and important collection suggests that decolonizing knowledge requires a head-on engagement with this question. And, that it is something more than cutting and pasting 'other' people's histories into dominant historical and cultural narratives. It necessitates nuanced and localised immersion in the history of methods across disciplines at sites beyond the Euro-American academia. This, the volume argues, carries the potential for renewing the possibilities of critical thinking itself. As contributors to the volume lucidly demonstrate, such reflections also allow for an understanding of the post-colonial condition as well as alternatives to the hegemonies of both western scientific method and its caricatures in the non-western world.

Sanjay Srivastava, University College London, UK.



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MAPPING SCIENTIFIC METHOD

This volume explores how the scientific method enters and determines the dominant methodologies of various modern academic disciplines. It highlights the ways in which practitioners from different disciplinary backgrounds – the humanities, the natural sciences, and the social sciences – engage with the scientific method in their own disciplines.

The book maps the discourse (within each of the disciplines) that critiques the scientific method, from different social locations, in order to argue for more complex and nuanced approaches in methodology. It also investigates the connections between the method and the structures of power and domination which exist within these disciplines. In the process, it offers a new way of thinking about the philosophy of the scientific method.

Part of the Science and Technology Studies series, this volume is the first of its kind in the South Asian context to debate scientific methods and address questions by scholars based in the Global South. It will be useful to students and practitioners of science, humanities, social sciences, philosophy of science, and philosophy of social science. Research scholars from these disciplines, especially those engaging in interdisciplinary research, will also benefit from this volume.

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SCIENCE AND TECHNOLOGY STUDIES

Series Editor: **Sundar Sarukkai**, *former Professor of Philosophy, National Institute of Advanced Studies, Bengaluru, India, and Founder-Director, Manipal Centre for Philosophy and Humanities*

There is little doubt that science and technology are the most influential agents of global circulation of cultures. Science & Technology Studies (STS) is a well-established discipline that has for some time challenged simplistic understanding of science and technology (S&T) by drawing on perspectives from history, philosophy and sociology. However, an asymmetry between 'western' and 'eastern' cultures continues, not only in the production of new S&T but also in their analysis. At the same time, these cultures which have little contribution to the understanding of S&T are also becoming their dominant consumers. More importantly, S&T are themselves getting modified through the interaction with the historical, cultural and philosophical worldviews of the non-western cultures and this is creating new spaces for the interpretation and application of S&T. This series takes into account these perspectives and sets right this global imbalance by promoting monographs and edited volumes which analyse S&T from multicultural and comparative perspectives.

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Disciplinary Narrations

Edited by
Gita Chadha and Renny Thomas

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We thank all our contributors for agreeing to write for us. It was because of a shared commitment to the theme that this volume could be conceived, curated, and actualised. A special thanks to Sasheej Hegde, Sanjay Srivastava, Yasmeen Arif, and Savyasaachi for walking some of this path with us.

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An interdisciplinary volume is difficult to review, considering that most of us are trained within the silos. We thank the anonymous reviewers for their important and insightful suggestions that have helped us craft the volume in a better fashion. Further, we thank our contributors for agreeing to do an internal peer review. Amber, Chitra, Neetha, Probal, Sabah, Saraswati, Sharmila, Sridhar, Sundar, Yasmeen, thank you for your intellectual camaraderie.

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Gita Chadha and Renny Thomas

Introduction

METHOD-O-LOGICAL DIVERSITY: SEEKING DISCIPLINARY NARRATIONS

Gita Chadha and Renny Thomas

Neither our scientific knowledge, nor the constitution of our society, nor traditional statements about the connections between our society and our knowledge are taken for granted any longer. As we come to recognize the conventional and artificial status of our forms of knowing, we put ourselves in a position to realize that it is ourselves and not reality that is responsible for what we know. Knowledge, as much as the state, is the product of human actions.

Steven Shapin and Simon Schaffer (1985)

India as a culture area will be nowhere, I think, in the world of knowledge, the sciences and the arts if it does not first defy the European monopoly of the scientific method, established in modern times.

J.P.S. Uberoi (1984)

The relationship between gender and science is a pressing issue not simply because women have been historically excluded from science, but because of the deep interpenetration between our cultural construction of gender, and our naming of science. The same cultural tradition that names rational, objective, and transcendent as male, and irrational, subjective, and immanent as female, also, and simultaneously, names the scientific mind as male, and material nature as female ... Modern science is constituted around a set of exclusionary oppositions, in which that which is named feminine is excluded, and that which is excluded – be it feeling, subjectivity, or nature – is named female. Actual human beings are of course never fully bound by stereotypes, and some men and some women – and some scientists – will always go beyond them. But at the same time, stereotypes are never idle.

Evelyn Fox Keller (1992: 43)

Introduction: Setting the Frame

We use method to make sense of the world in our daily lives. Even if it might appear that we do not do so, refrains like ‘there is a method in our madness’ are commonly used to gain logical credibility for our sense-making activities. Method – and its logic – becomes a justificatory strategy for our ideas and beliefs.

We use academic methods, more specifically as ways to organise, enquire, analyse, and explain the world at different levels of abstraction and of scale. These then lead to the making of different domains and separate disciplines in academia. In modernity, what has united academic disciplines is the common assumption that they follow a common method which is distinct from what is commonly used in our everyday worlds. As in our everyday worlds, method – and its logic – becomes the justificatory strategy for knowledge claims even in academia. There are both convergence and divergence between everyday sense-making activities and academic methods.

From the early days of academic life, we hear the word ‘method’ everywhere – from class rooms to informal conversations with colleagues and students. In academic disciplines, the question of method is crucial in developing models of research and theories of explanation. Method becomes the definite marker of the identity of disciplines and how they distinguish themselves not only from everyday thinking but also from each other. Given the fact that most academic disciplines of today emerged in the context of Western modernity, the scientific method has become central to the disciplinary discourse on method. In fact, the scientific method of thinking and reasoning has gone beyond the academic disciplines, finding complex convergences and divergences with everyday thought on this journey. Scientific method, in many *avatars*, has become a wider tool for shaping modern societies on the path of progress. It has become a part of the larger societal imagination and has led to the insistence on ‘scientific management’ of resources, the need to adopt a ‘scientific attitude’ to life, and the building of what we in India call the ‘scientific temper’.

Across the Silos

Writing about methods in multiple and diverse academic disciplines with their distinct stories of origin and distinct histories of development is a challenge. An attempt to understand what method means across the silos of the natural/physical sciences, the social/human sciences, and the humanities is ridden with difficulties of registering – and translating – conceptual languages specifically developed by and for each discipline.

Given the paradigmatic status of the scientific method in modern academics, our volume has practitioners engaged with domain-specific claims of ‘becoming scientific’ – of scientificity – in their origin stories, elucidating

the historical necessity and context of these claims. It is from these stories that we can tell the many strengths of the scientific method as it emerged as a definite tool of rationality and of critical thinking. The essays in the volume attempt to find, and tell, the stories of method in their own disciplines, stepping in and out of the disciplinary gates.¹

We further invite the practitioners to engage with how these claims might have been contested in their discipline domains and what have been the contours and outcomes of these contestations. Through the telling of these contestations, we hope to highlight the limitations of the method of science and how its hegemonic presence might have erased or suppressed alternative epistemic understandings, equally reasonable and critical that are available within the disciplines.

Most importantly, we invited the contributors to indicate how despite the contestations to the scientific method per se, every discipline reaffirms its claim over truth, objectivity, authenticity, and validity. We ask our contributors to tell us how disciplines at times expand the notion of what is science and at other times abandon some of that project. Our aim is to see how different ontological assumptions might shape different epistemic claims, depending on the subject matter of the research on hand in these disciplines. In a sense then, our attempt is to seek engagements with methodology. We use method to mean methodology of research and not just as a tool for research.

In times of specialisations and super-specialisations, it is rare for practitioners to dwell upon common questions, questions that are relevant within disciplinary boundaries and those that transcend disciplinary boundaries. Method is one such question. Also, the authors have different styles of writing, different ways of approaching a question, and different ways of answering the question of method. These multiple narrations are important ways of thinking and reflection. Though we have many philosophical debates on methods: what is method, and what should be the nature of method, we do not have material where practitioners of multiple disciplines ranging from mathematics to sociology are assembled together to reflect and unpack the hidden histories and politics of methods. Our assemblage of essays attempts to open the *black box* of method. We hope this assemblage will loosen the hold of a narrow scientific method in knowledge production and will make space for complex, richer, and plural methodological cultures within disciplinary silos, in the larger academic domain and eventually in the world at large. More importantly, we hope to demonstrate that the assumed unity of methods is probably just that: an assumption, and that academic methods probably need to be brought together in their diversity rather than an ideal unity.

The required disclaimer we make is: the idea of this exercise is not to take the discourse of method towards any form of anti-science positions or the polemics of the science wars (Sokal 1996a, Sokal 1996b; Chadha 1998, Nanda 1998, Chadha 1999). And our academic pursuits in science

criticism are definitely distinct, in intent and terrain, from the science bashing of right-wing political cultures of dominant groups.

Our Disciplinary Background(s)

As scholars in the social studies of science and technology in India, both of us have been addressing questions in science criticism. More specifically, the question of knowledge production in science and the nature of scientific knowledge (Chadha 2017a; Thomas 2018, 2022) has been an area of deep interest to both of us. As sociologists, our own discipline's origin story has fascinated us and we have also been interested in the question of critical and integrated science studies (Shah and Chadha 2015; Chadha 2017b). Fashioned around physics, sociological positivism – the dream to craft a social physics – was the earliest paradigm that set the disciplinary grammar for sociology. Interestingly, this paradigm met with its discontents and critique within the origin story. Known as the positivist–interpretivist debate between Emile Durkheim and Max Weber, it led to the articulation of the distinction between natural and social sciences – in terms of both ontological assumptions and epistemological directions. This complexity of our parent discipline is an important genealogy to trace our practice of science criticism. Though in contemporary sociology we have moved considerably away from this debate, questions of what constitutes an appropriate method for valid knowledge production necessarily refer back to the early grammar of this debate. In the first half of the 20th century, the sub-fields of sociology of science and sociology of knowledge largely privileged science and exempted it from any sociological scrutiny (Chadha 2015). It was only from the second half of the 20th century onwards that we see the emergence of critical approaches to science in sociology. These approaches were propelled by social movements like the pacifist movement that began to look closely at science and its role in the violence of war. These critical approaches opened up ways of examining the inherent violence within the scientific method. In the last quarter of the 20th century, we begin to see – again through the urgency that comes from social movements – how critical perspectives of gender and race challenge the method of science and point to the role it plays in reproducing social organisation of power, all the while being performative of objectivity, value neutrality, and openness. And yet, as sociologists we find ourselves unable to abandon the project of science. Instead we find ourselves trying to extend, expand, and reframe questions of science from within sociology, from within its origin story. As David Bloor, when asked about how sociologists can claim validity for their own disciplinary knowledge, which is also 'scientific', if they critique knowledge of the natural sciences, said,

I am more than happy to see sociology resting on the same foundations and assumptions as other sciences. This applies whatever their

status and origins. That the sociology of knowledge stands or falls with the other sciences seems to me both eminently desirable as a fate, and highly probable as a prediction.

(Bloor 1976: 144)

Within this framework, we curated this volume as a way to understand journeys of method in disciplines other than, and including, ours.²

Backdrop of the Contemporary Moment

Even as we write this book, the question of scientific method surfaces with an interesting urgency for those who aim to evaluate modernity and its institutions in a critical and reflexive manner. For those of us in the field of science criticism, it becomes an important juncture for evaluating the metanarrative(s) – produced by nation states, industry, and civic society – around science, while looking closely at the narrative(s) of/from the practice of science. We set out two contemporary moments as the backdrop for our essays on the question of, critically and reflexively, evaluating science – but primarily the kernel of scientific method – in academic disciplines.

A campaign like *The March for Science* mounted in the last decade by progressive ideologies across the world has emerged as an arduous attempt to counter the rise of cultural nationalism, global capitalism, and a right-wing political economy. Campaigns such as these take the method of science outside of the academic disciplines and make it a larger project of spreading a scientific temper and of promoting scientific rationality. This rationalist movement, like many before it, place a faith in science – its method, theories, knowledge, and institutions – to lead us out of the surrounding political darkness. Like all proponents of the rationalist movement, *The March for Science* propagates the superiority and desirable pervasiveness of scientific rationality in all aspects of life. The ideology of scientism defines such movements, and campaigns. For its proponents, *The March for Science* is not only a protest against political conservatism and religious orthodoxy³ but is also a protest against national and global cuts on scientific funding from national budgets. While individual scientists and the scientific community at large continue to stay apolitical in India these campaigns have surprisingly seen many of them take to the streets. Campaigns such as these are undoubtedly significant for a vibrant civic society but they come with a bottleneck for science criticism. Sadly, they put forth science as the only rational and critical tool for social transformation without tapping into the potential of other ethical and moral tools available in civilisations and cultures – like religion, art, and humanism. In effect, they produce science as an isolated tool of social transformation rather than one of many in a combination of moral and critical methods available to us for resistance and transformation. More dangerously, they erase the role of science in producing and reproducing

non-emancipatory ideologies of gender, race, sexuality, and caste to name a few. They demand a non-reflexive and monogamous commitment to science in all its forms. At their best, these efforts promote a rational way of thinking of traditions – that may or may not work – and at their worst they promote a cardboard version of scientific rationality amounting to a scientism that works only in an echo chamber. Further, campaigns like these polarise most academics to take sides. For scholars of science criticism in India, this becomes an intellectual *cul-de-sac* that does not allow for the critical evaluation of science and scientific knowledge. Though these campaigns bring scientists out of their insulated world, ironically they curb the critical development of science criticism in academia. And yet given the larger political field, most scholars like us have to defer our voice in the public sphere. We are left with no other choice but to resort to a ‘strategic essentialism’ in alliance with these campaigns, hoping that an eventual ‘internal’ critique will lead to dialogues in the future.

In another contemporary moment, that of COVID-19, our worlds have become engulfed in the whirlwind of a global pandemic indicating an increased interdependence and connectedness between communities and nations. While the ‘master narrative’ of nations and communities has been to promote modern science and modern medicine as a way out of the pandemic disease condition, the discourse has been complex. In fact, the response of the scientists and the scientific community towards their knowledge has seen some nuance (Kang 2021). First, we have seen that the nature of research in science is ridden with difficulties of method. This has been a time for scientists to recognise the contingency of their knowledge claims; they have faced the fact that their knowledge too is uncertain, contingent, and precarious. While many a scientist and science enthusiast placed their trust only in science, we have seen that even scientists have articulated the limitations of what science can do in understanding the virus, in predicting its spread, and in finding cures and prevention mechanisms. They recognise that there are no quick fixes that the scientific method can produce, it needs time and will produce results only in due course. In that interim period, a lot will happen which is beyond the control of science and scientific management, something that science criticism has pointed out in the last six decades. Second, the fact that modern science operates, often as an ally, within pressures of capitalist political economies, where not only the nation states but also the pharmaceutical companies control the course that research and medicine will or will not take, making it amply clear that science operates within the un-freedoms of modernity. This moment has once again brought home the fact that we have to put measure on what science can and cannot do (Jasanoff 2019, Horgan 2019, Maani and Galea 2021). The narrative that the method of science is both neat and free stands challenged. For us in science criticism, this has once again demonstrated what we have said all along: that science in practice is more complex and messy than the neat

notion of a scientific method of knowledge production presented to us in the metanarrative of modernity. In fact, COVID-19 clearly brought forth the promise and precarity of science and the scientific method in an unprecedented fashion. Most importantly, it pushed us to face the fact that science, like many other institutions, produces both risk and trust simultaneously. The loyalty to science, and modernity, therefore needs to become more and more a matter of strategic preference rather than one of moral superiority.

At this dramatic juncture of our contemporary moment, where we see both a surge in the self-assured and naïve scientific assertion of a campaign like *The March for Science*, on the one hand, and the sheer power of scientific research, however precarious and however controlled, on the other. Against this backdrop, we attempt to explore one of the central – and perennial – questions of knowledge production in science and technology studies: what is the scientific method, how does it travel across disciplines, how does it meet its discontents, and how is it reclaimed. We mount, through each essay, bits and pieces of the answer.

Why Study Method

Questions of method are latent, relegated, and taken for granted in most academic disciplines. These questions are the *sotto voce* of disciplinary discourses, never sufficiently articulated either in pedagogy or in research. Method and the questions that surround it are often neatened and presented in a linear and non-discursive manner to the students of the discipline, to the rest of academia and to the public at large. If we cast a look back into history, we might find that every modern academic discipline contains debates on method within its historical and philosophical foundations. Often, in the inner courtyards of disciplinary practice, these debates are excavated only in times of epistemological distress caused by questions on the nature of truth, knowledge, and practice. Generally, during periods of ‘normalcy’, where the rush is to generate and transmit content that is useful to the worlds we live in, questions of method are mostly ‘assumed’ and rarely unpacked. If and when imparted to students of the discipline, these debates focus more on how to apply method rather than how to think of it. For instance, questions about what is method, is there a method at all in what we do, how is it similar or different from methods of other disciplines, what are the connections with, and departures from forms of sense-making used by people in everyday worlds are questions left to the margins of teaching and learning practices of most disciplines. One observes that method as means is imparted with a ‘taken for granted’ certitude that blunts a critical engagement with the question of method itself. The method question thus becomes silent in most disciplinary discourses. Debating method is made to seem, by several practitioners, like an exercise in fruitless semantics. When we look at the everyday practices of many disciplines, we see that method is not often

discussed in a detailed manner during the period of training. It is assumed that method is part of every discipline. In certain disciplines such as sociology and history, studying a separate course in ‘research methodology’ is part of their training, but in other disciplines such as physics and literature, a course on research methodology is absent in most of the universities and colleges. If one looks at the course structure of universities and colleges in India, one can see that they start studying the fundamentals of their disciplines, such as Fundamentals of Physics, Fundamentals of Mathematics, without having any discussion on method. A student who enters a PhD program in most of the disciplines is unfamiliar with what method means in the research they do. The mantra is ‘we know how to do research and we learn how to do research’. Writing about feminist science criticism and the question of how method is reified, Sandra Harding says, ‘It is not just particular research methods that are the target of feminist criticism, but the fetishisation of method itself’ (Harding 1989: 18).

Studying Method for Itself

This being the problem, the term method acquires several narrow registers of meaning in the general academia. It often means tools for doing research. The tools are generally finite, validated, and prescribed by what is considered acceptable in particular academic disciplines.

What is forgotten, or put aside, is the fact that the process of research necessarily entails making significant and attentive choices about method. Decisions about how to acquire material and what techniques to use for analysing it are crucial to determining the nature of research. Underlying the discussions on method are methodological propositions of knowledge-making that frame the discourse. In a sense then, the process of knowledge production is method laden. These propositions about the nature of reality and the nature of knowledge set methodological⁴ paths. In a sense then, the ontological and epistemological assumptions made are the basic matter of method. This method ladenness of knowledge makes the study of method important. A study of the methods is a study of these assumptions. We submit that the study of method is integral to knowledge-making practices within disciplines. Given that disciplines are windows only, the study of method must necessarily acquaint the practitioner with methods across and beyond disciplines so that an informed and mindful disciplinary choice can be made. The need to examine method for its historical contexts, its philosophical foundations, and its formal characteristics is compelling for an intellectual understanding of the disciplinary practice. Various scholars have studied method and specifically scientific method and analysed the contexts, histories, myths, and politics of scientific method (Gower 1996, Thurs 2015, Hegde 2014, Cowles 2020). Historical scholarship on objectivity in science also demonstrates the complex pasts and negotiations of objectivity

and its relationship with science and method (Daston and Galison 2007). Through the essays in this volume, we hope to open doors, mark thresholds, and understand the boundaries of methodological discourses in disciplinary practices. We also hope that critical attempts at subversions and transgressions of disciplinary discourses will help us map and chart methodological trajectories as we move in and out of disciplines. We believe that studying the life of method in each discipline is in many ways studying the very history of these disciplines. It is important to note that a discussion on method was crucial in all forms of radical thinking of disciplines and disciplinary formations as we know from the philosophical discussion on methods from thinkers like Paul Feyerabend (Feyerabend 1975, 1981). Through this volume, we attempt to understand how the practitioners of disciplines deal with the method question in their everyday academic activity and in what ways they think about the past, present, and future of methods in their disciplines.

Theory and Method

Apart from the need to engage with the question of method as a question in itself, it is important to engage with method because of its obvious relationship with theory. In many content-driven disciplines in the physical or natural sciences, the distinction between theory and method often gets blurred in practice. In others like the social sciences and humanities, the distinction is marked by separating the study of method and theory.⁵ In both instances, the connection between theory and method is lost. Questions of how theory is generated do not form an active part of the pedagogy of theory. In a sense then, a double injustice gains legitimacy. Not only does method get relegated into the background but theory is also truncated from its methodological foundations. Theory thus gets reduced to its substantive claims about the nature of the world that a discipline studies rather than seeing these claims as being generated and shaped by the complex mechanisms of method. Very often research scholars of social sciences come with the request for theoretical packaging for their dissertations simply because they have to ‘add on’ theory. ‘What theory should I use’ is a question that must come organically and through adequate engagement with what method is to be followed – instead it comes as an afterthought, as a necessary evil. Does theory inform method or method inform theory is a perennial epistemological question. The umbilical connection between the two is undeniable. Method is the way of doing research, a path that leads us to theory. Hence seeing method in theory becomes as important as seeing the theory itself. To develop the ability to witness the presence of method – or its absence – is to develop the ability to testify for – and choose – a particular theory. This will make us recognise that our truth claims, multiple and often contradictory to each other, are both methodologically governed and theory laden. Taking

a radical position on how the incommensurability of theories is resolved, Feyerabend argues that, in this resolution there is no scientific method. He says, 'What remains after we have compared the possibility of logically comparing theories by comparing sets of deductive consequences are aesthetic judgments, judgments of taste, metaphysical prejudices, religious desires, in short, what remains are our subjective wishes' (Feyerabend, 1975: 285).

Scientific Method and the Scientification of Disciplines

Any discussion on method in modern academic disciplines has to be on the scientific method: on the emancipatory and liberation potential it contains, on how it gains a paradigmatic status within disciplines and in academia at large, and how it has become hegemonic. This paradox of the scientific method is indeed a story that needs to be told time and again.

One of the hallmarks of Western modernity and the European enlightenment was the development of the scientific method. The origin stories of many academic disciplines lie in the birth, and the dreams therein, of the scientific method. Scientific method emerged in history by severing links with magical, theological, and metaphysical methods. It promised a better, more progressive, more rational world view. It held within it the promise not only of a better method, but almost by extension, also of a better world, a better society. It also held within it the promise of criticality and democracy. It freed knowledge from the stronghold of unreason. The entire historiography of modern Western science till mid-20th century tells us that story. Our volume too might draw upon that story

The Scientific Method

If we look carefully, at what constitutes this scientific method, we realise that the textbook understanding still dominates most discourses around it. The classic understanding of scientific method equates it to the hypothetico-deductive method, a method that relies extensively on causal analysis, using deductive and inductive logic. It further relies heavily on experimental verifications. Till the 1960s, 'the dominant view of science was that scientific knowledge is a product of logical reason applied to observational and experimental data acquired through value-neutral and context-independent methods, leading to a single unified account of an objective and determined world' (Keller and Longino 1996: 1). At its simplest, it is a method of verification based on an epistemology of empirical testing of truth claims. Knowledge produced by this method lays claim to universality, standardisation, and predictability. The methodological assumptions of the scientific method assume an ontological knowable universe that can be approximated and mirrored. The standard view of scientific method is that there is a universe 'out there' that can be known through the application of the scientific

method of controlled experimentation and observation that can be reined in for theory.

Due to its 'successes' in the understanding of the physical natural world, it was gradually adopted as the method for the understanding of the human natural world. Its normative status made it paradigmatic for almost all the disciplines that emerged as 'sciences' in that period. This includes the social sciences that modelled themselves on the natural and physical sciences. Its shining success brightened many domains of understanding and control, of discovery and invention, and of explanation and engineering. We hope to speak of some of that shine. This scientification of academia became part of all the disciplines and began to define the very essence of academic knowledge. Since scientification also came to be used as identity markers for disciplines, the use of scientific techniques becomes central to its practice, creating its own set of problems discussed in the earlier sections. In a derivative mode, disciplines such as economics and psychology in the social sciences got taught in many places as 'sciences'.

Simultaneously, through the imperialist and colonial project, science and the scientific method spread across the world. Science was an important instrument, less visible than others, in casting the world in the mould of Western modernity. Shiv Visvanathan divides the development of modern science and technology in India into three broad phases: the phases of initiation, education, and institution-building (Visvanathan 1985: 8–14). Like everything else in colonialism, it was both liberating and violent. The scientific method gradually gained a hegemonic status for producing, validating, and legitimising all knowledge across nations and civilisations, freeing us from the 'old'. Through it all, in several new nations, like India, science became an important tool of a 'renaissance', accepted by the colonised. It gave new aspirational and critical tools to imagine the colonial national modern in opposition to the traditional. In fact, social reformers like Raja Ram Mohan Roy who said

The Sangscrit system of education would be the best calculated to keep this country in darkness, if such had been the policy of the British legislature. But as the improvement of the native population is the object of the Government, it will consequently promote a more liberal and enlightened system of instruction; embracing mathematics, natural philosophy, chemistry, anatomy, and other useful sciences.

(Baber 1998: 197)

The hegemony of modern Western science was complete because the dominated accepted the virtues of the dominating. It became impossible for any form of knowledge that did not follow the principles of scientific method to survive in the larger world of knowledge production. In fact,

the enlightenment modern planted its roots across the world through the complex mechanisms of orientalism. As the historian of science Daniel P. Thurs argued,

If we return to a simplistic view, one in which the scientific method really is a recipe for producing scientific knowledge, we lose sight of a huge swath of history and the development of a pivotal touchstone on cultural maps. We deprive ourselves of a richer perspective in favour of one both narrow and contrary to the way things actually are.

(Thurs 2015: 218)

Historian of ideas Jason A. Josephson-Storm in his path-breaking work *The Myth of Disenchantment: Magic, Modernity, and the Birth of Human Sciences* (2017) demonstrates that the world of science, human sciences, and scientific method had always been a messy realm. He shows that, paradoxically, even the most important practitioners of scientific method from sociologist Max Weber to physicist and chemist Marie Curie did not entirely inhabit the world of scientific method. He shows that the grand narrative of disenchantment – the idea that scientific rationality will uncover the mysteries of the world replacing magic and religion and art had always been a myth.⁶ This clearly shows that it is difficult to articulate a neat success story of scientific method even in the *most scientific* of the scientific disciplines. There had always been questions, scepticisms, and challenges. Contributors in this volume write about many such questions, scepticisms, and challenges their respective disciplines experienced and explore the possibilities of a plural way of doing disciplines without thinking about the burden of following *the* scientific method. We believe that such an exercise will make the disciplines more accommodative, democratic, and intellectually diverse.

Scientification

The overreliance on science and scientific method has concerned scholars in the social studies of science and technology for the last six decades. This has been debated by philosophers, historians, and sociologists of science. To some extent, it has also been a matter of debate among scientists. In the name of scientific method and scientificity, the ideology of scientism also gets validation and acceptance in many disciplines. This happens when we proffer science as a totalising system that has the superpower to transform all ignorance, all evil, and all regression. In this volume, we argue that scientism as an ideology has to be necessarily challenged when we think of method in disciplines. Thinking critically about method is to also challenge the hidden scientism in modern disciplines. The idea of scientism as Tzvetan Todorov argued is more dangerous, ‘For people are not usually proud of

being ethnocentric, whereas one can take pride in professing a “scientific” philosophy’ (Todorov 1993: 12). This form of scientism still guides our thinking and debates on methods in many disciplines.⁷

We are interested in this volume to talk about the connection between scientific method and power. Historically as well, the demarcation of natural philosophy and theology was made using ‘scientific’ method. Over a period of time, disciplines have undergone many transformations, and practitioners have asked important questions about the scientific nature of their own disciplines. Social Anthropology for example has started rethinking about the way they write and think about ethnography as a method.⁸ Scholars now even argue for using prose and poem as narrative forms, especially through Literary Anthropology, an emerging field that challenges the mainstream method in the discipline.⁹ Anthropology as a discipline has become more nuanced, accommodative, and pluralist by re-examining and rethinking its own scientificity and method. This volume examines the ways in which different disciplinary practitioners engage with scientific method in their own disciplines, and they show how productive it is to ask questions of method in their disciplines. Asking questions about method in a discipline is also to ask questions about the structures of power and domination in disciplines.

We discuss in detail through various disciplines how modern sciences and knowledge became ‘valid’, ‘useful’, and ‘acceptable’ because of its close link with power. In that process, we also discuss how various forms of knowledge practices became ‘invalid’, ‘useless’, and ‘unacceptable’, ‘unscientific’ because they lacked the ‘scientific method’. This volume is an enquiry into the possibilities of thinking about the past, present, and future of scientific method in disciplines, ranging from physics to sociology.

Scientification is part of all the disciplines and every discipline will have questions asked about its scientific nature and scientificity. Since scientification is used as an identity maker, techniques became an important category in defining the very nature of disciplines.¹⁰ Techniques then define the validity of a discipline, and therefore all disciplines have a compulsory paper on techniques and research methods. It is an interesting space to think about the politics of knowledge production. It is through techniques and research methods that we classify what is scientific and non-scientific in a discipline. What is scientific has to be objective, and things that are not objective are non-scientific. Both science and technology studies (STS) and feminist scholarship inform us how the powerful defined their identity as objective to erase the experiences of outsiders as subjective and unscientific (see Haraway 1988, Subramaniam 2014, 2016).

Scientification is dangerous especially when we study the worlds of people; the so-called natives, where anthropologists, for instance, have the power to write about the community that they are studying or live with, because they use scientific method. This creates the difference between anthropologists, who use scientific methods, and the people whom they study and write

about. How do we deal with the power relation that exists between anthropologists/practitioners of scientific method, and the people/subjects of scientific method? Can we think of an alternative or better way to deal with *the people*? Can we think through conversations and experiences, and not treating the people that we study as mere 'data'?¹¹ The very idea of treating human beings as 'data' comes from the principles of scientific method, and we need to rethink about the very usage 'data' in all disciplines. One of the major concerns in the volume is to look for an alternative view of methods in different disciplines and see if a rethinking of methods leads to a new understanding of disciplines. And the chapters show that there are possibilities of addressing scientification and scientism in disciplines without necessarily being anti-methods.

We also ask this question to rethink the dominance of one form of methods that almost exist as unquestionable in various disciplines, for instance, disciplines such as economics and psychology. They are taught in many places as 'sciences', and the practitioners of these disciplines do take pride in being the most 'scientific' among social sciences. They also don't mind being labelled as 'least scientific' among the 'pure' sciences. Many universities therefore offer courses such as Master of Science (MSc) in Economics and MSc in Psychology as it gives more credibility to the discipline and it attracts students. They will also be happy to say that they are doing a degree in Science. Here, we need to think about the authority and power of science, and that is precisely why disciplines such as economics and psychology try to get a 'science tag' to be accepted and to be respected. For example, the Indian Institute of Science Education and Research (IISER) Bhopal, India, offers a BS programme in Economic Sciences. The usage *Economic Sciences* is not free from the power of science and scientific authority. What gave the Western modern science authority and power was the scientific method, and we can see how various disciplines try to embrace scientific method to be part of the world of power and authority. The chapters in the volume ask questions of power and authority in academic disciplines and attempt to show how that power came into being in the disciplines and how that power continues to shape the identity of many of the academic disciplines.

What does scientification do to these disciplines? What are the challenges therefore practitioners have if they want to come out of the *many scientism* that exist in their respective disciplines? We enquire through various disciplines how there can be a possible way of talking about it and what alternatives can they suggest? In what ways can we differentiate between methods and various forms of scientism that exist in all disciplines? Can we think of a different way of doing physics, chemistry, biology, psychology, history, economics, and linguistics without being pressurised to follow *a/the* scientific method? By asking questions about the possibilities of plural epistemologies, we also enquire into the various histories through which the process of *scientification* emerged in many disciplines. We also enquire into

various changes that took place in these disciplines to deal with the question of method. We enquire into the various forms of resistance that many of these disciplines witnessed, and the ways in which these forms of resistance changed the identity of these disciplines. The authors have addressed these questions in engaging ways in their chapters.

This volume asks if we can think of disciplines beyond the fixed nature of *the* scientific method, and we believe that such rethinking of disciplines will invite more debates in class rooms when we teach courses on methods. This volume is an invitation for more such future work, as we believe that these reflections play a major role in reshaping and redesigning our disciplines. In this volume, distinguished scholars and practitioners of diverse disciplines work in Indian universities and institutions ask this question of scientific method also as a way of democratisation of scholarship and as a part of decolonising scholarship on methods. This volume is one of its first kind emerging from south Asian academia. We invite the readers, be they students, practitioners, or anyone who is interested in the question of method in disciplines to read the chapters of their choice and come with more questions. We hope that this volume will help all of us to engage with the question of method critically and will help us understand its varied histories, practices, contexts, and politics.

Conclusion: Towards Science Criticism

The role of science and technology in producing risk societies has been marked in the mid-20th century. According to J.P.S. Uberoi 'The ruling scientific theories of nature are even more dangerous than the ruling western theories of man' (Uberoi, 1978: 14). Science criticism as it developed through social and people's movements challenged the violence inflicted by science on our bodies and worlds. As a consequence, social scientists began looking at science critically. Naturally, scientific method too came under scrutiny. Shiv Visvanathan, for example, in his deeply incisive account of the vivisectionist nature of science, discusses the works of scientists Claude Bernard and François Magendie. According to Visvanathan:

Bernard's work reflected the intrinsic violence of science as vivisection. Vivisection is the infliction of pain for experimental purposes of understanding and control, where pain and suffering are justified in the pursuit of scientific knowledge as an absolute value. François Magendie 'sacrificed' 4,000 dogs in making a distinction between sensory and motor nerves. Some of the early vivisectionists might have been sadists, but Bernard exemplifies the schizophrenic attitude of 'normal science' to vivisectionist violence. Bernard remarked that 'the physiologist is not an ordinary man: he is the scientist possessed and absorbed by the scientific idea he pursues. He does not

hear the cry of animals, he does not see the flowing of blood; he sees nothing but the idea and is aware of nothing but the organism that conceals from him the problem he is seeking to resolve’.

(Visvanathan 1988: 263)

The decades from the early 1960s to the late 1990s saw rich intellectual debates that challenged the epistemic and ethical supremacy of science, and scientific method. Further, praxis-based epistemologies driven by the need for social transformation from the perspectives and standpoints of people from marginal social locations have driven the academia to re-examine its unchallenged dedication to the scientific method as the paradigm of progress and truth set out by modern Western science. Be it through the environmental movements or the people’s movement, the relationship between scientific method and structural power of dominant groups and the nation states gets firmly established. When translated into disciplinary registers, these movements reveal the situated nature of scientific knowledge and method. Feminist epistemology, especially feminist science studies for instance, has demonstrated the way scientific method was used to support patriarchal structures of modern sciences. They pointed out the need to look at science, and gender, using critical perspectives that science had forgotten. As Sandra Harding says,

Many of the most powerful examples of feminist research direct us to gaze critically at all gender, to take women’s experiences as an important new generator of scientific problematics and evidence, and to swing around the powerful lenses of scientific inquiry so that they enable us to peer at our own complex subjectivities as well as at what we observe.

(Harding 1989: 26)

Further, we see that critical race studies, postcolonial critiques, the pacifist, and the environmental movements all indict modern Western science – and its method – for reproducing epistemic injustice and violence to epistemes of marginal people and cultures (Thomas 2020, 2022). For instance, critics show how in the discourse around modern biomedicine, systems of health and medicine like Ayurveda, Siddha, tribal medicine, Chinese traditional medicine, and Unani medicine are ‘othered’ as ‘unscientific’. In times of late modernity, the promise of science has turned around, and on its head, in multiple ways. From being the institution that would lead us out of hegemonic structures, it has become a part of these structures. What went wrong? Or was it always wrong? Or is nothing really wrong? And wrong for what? For whom? Questions around the twofold problems we have identified – the scientification of the disciplines in the academia and the scientism prevalent in sections of our society – are important to ask. Who will ask these questions? Are people in the academic silo of the natural sciences equipped to do

this? Can they be trained to do this? While we might think that they are the best constituency to do this, we also know that an ‘outsider’ view helps in critique. Who could be the best outsiders? Shouldn’t those in the other silos and those in the humanities and the social sciences qualify? If yes, should they not start with their own disciplines because these are also ‘scientified’? In many of these, albeit the ‘soft’ ones like sociology, efforts towards asking these questions already exist. In others, the ‘hard’ ones like economics need to develop more rigorously. It is important for us, as academics, to begin reflecting on the need to strengthen the field of science criticism in academia. This field, as yet, has no home and must find one. Unlike literary criticism, which is now housed and practised in departments of literature, science criticism is developing on the fringes of social sciences.

Like literary criticism, science criticism attempts to contextualise its ‘text’. Both are academic exercises and might or might not impact the world in which science and literature are consumed. Yet, the importance of literary or science criticism to the development of literature or science, respectively, cannot be minimised. We envisage the future of science criticism to proceed on similar lines, though we sense the many challenges too. However, as Jonas Salk wrote in his introduction to Latour and Woolgar’s *Laboratory Life* (1979), ‘Scientists often have an aversion to what non-scientists say about science. Scientific criticism by non-scientists is not practiced in the same way as literary criticism by those who are not novelists or poets’ (Salk 1979: 11).

Scientific knowledge is constructed, by its practitioners and enthusiasts, as being produced by a supposedly unbiased method. It is a text perceived as being ‘above context’. Hence, any attempt in science criticism to place science within its social-historical and political context is mostly seen as unnecessary work done by those who do not know or understand science. Much like C.P. Snow indicated in his classic text, *The Two Cultures* (Snow 1959), attitudes from the scientific communities are hostile and generally go like this:

These radical critics of science seem to be having little or no effect on the scientists themselves. I do not know of any working scientist who takes them seriously. The danger they present to science comes from their possible influence on those who have not shared in the work of science but on whom we depend, especially on those in charge of funding science, and on new generations of potential scientists.

(Weinberg, 1993, p. 151)

The adage ‘those who do not do science, do science criticism’ is popular in cultures of science, very similar to what we see in literary cultures: ‘those who cannot write, critique’. It is therefore necessary and recommended that

informed science criticism, as an academic field, be developed within the academia and housed within universities and research institutes. However, the unfortunate science wars that happen, almost like a backlash, with an interesting regularity push these debates into problematic boxes of pro- and anti-science positions. These attitudes in the academic domains foreclose the development of science criticism, particularly if and when there is no academic anchor for these. These attitudes of suspicion and a naturalised arrogance of scientific communities in academia resist the opening of the natural sciences, on the lines of the opening of the social sciences that began in the middle of the 20th century.¹² Problems that riddle the social study of science, according to Barry Barnes, is that science ‘is hopelessly conflated with the ideas of what it ought to be, or must be’ rather than what it is. He hopes that science criticism, as an academic field, will continue its ‘attempts to take science as it finds it’ (Barnes 1974: ix) and would not be deterred by the fact that ‘in the current intellectual milieu where simply to talk of science in other than reverential terms may be seen as criticism’ (Barnes 1974: ix). According to Sandra Harding, science alone is the kind of activity which, unfortunately, demands that it

must be understood only in terms of its enthusiasts’ understanding of its own activities – in terms of the unselfconscious, uncritical interpretations ‘the natives’ provide of their beliefs and activities. That is, scientists report their activities, and philosophers and historians of science interpret these reports so that we can ‘rationally’ account for the growth of scientific knowledge in the very same moral, political, and epistemological terms scientists use to explain their activities to funding sources or science critics.

(Harding 1986: 35).

These attitudes foreclose the development of the field of science criticism.

An important dimension of the hostility to the development of science criticism is with reference to language. It is quite obvious that the split between the world of science, on the one hand, and the humanities and the arts, on the other, is largely due to the fact that these two worlds can hardly comprehend each other’s languages and that there is a crying need to develop a common vocabulary where there can be an exchange of ideas, at least at a non-technical level. There is a widespread attitude within the scientific community that the language and concepts of science (couched as they often are in mathematics) are beyond the understanding of those in the humanities. Scientists also have to debunk the use of technical language and concepts in the humanities as being a humbug. This is part of the process by which science tries to project its own method as being supreme. Nowhere is the above attitude of scientists better illustrated than in the example discussed below. This is taken from a book called *Conceptual Foundations*