Silent Performances: Are "Repertoires" Really Post-Kuhnian?

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Abstract

Ankeny and Leonelli (2016) propose "repertoires" as a new way to understand the stability of certain research programs as well as scientific change in general. By bringing a more complete range of social, material, and epistemic elements into one framework, they position their work as a correction for the Kuhnian impulse in philosophy of science and other areas of science studies. I argue that this "post-Kuhnian" move is not complete, and that repertoires maintain an internalist perspective, caused partly by an asymmetrical emphasis on the scientists' side of practice. If we compare "repertoires" to alternative frameworks, like "sociotechnical imaginaries" of Jasanoff and Kim (2015), it is evident that repertoires are missing two specific things. First, I argue that the framework needs to include the role of audience, without whom the repertoires of science are unintelligible. Second, I suggest that the framework also lacks an explicit place for ethical and political imagination, which provide meaning for otherwise mechanical promotion of particular research programs. With these modifications, Ankeny and Leonelli's framework might fulfill its post-Kuhnian potential.

1. Introduction

Though its boundaries are ever contested, science takes place in society; this lesson has been taught many times over since the first publications in science and technology studies (STS), and arguably long before that. We ignore this literature at our peril and, very likely, with a diminished capacity to engage with science and technology. Ankeny and Leonelli (2016) provide a much needed corrective to the Kuhnian impulse in some science studies and especially, as they argue, within philosophy of science. They highlight that society, populated with funding agencies, social media, equipment suppliers and so on, is not separable from the doing science but is actually a condition of possibility for scientific work. People working in the sciences must develop behaviors and habits that help them cope with this social reality, both individually and collectively. In response, the authors present the notion of "repertoire" to capture the material-discursive strategies that scientists develop. They define a repertoire as "the well-aligned assemblages of skills, behaviors, and material, social, and

epistemic components that groups may use to practice certain kinds of science, and whose enactment affects the methods and results of research, including how groups practice and manage research and train newcomers." This definition, they explain, captures several dimensions of "repertoire" as used in colloquial speech; it draws our attention to both the ingredients of successful performance as well as the know-how to put those ingredients to work.

This rejection of more narrow conceptions of scientific practice is not for its own sake. Like most emerging frameworks, repertoires have to be introduced in terms of what they can do for us intellectually or practically. Ankeny and Leonelli argue that repertoires are useful "for analyzing the emergence, development, and evolution of collaborations" as well as understanding the "functioning, flexibility, durability, and longevity of research groupings and their outputs, including the formation of research communities." By situating scientists explicitly in their material and social contexts, we can make sense of why some areas of research thrive, while others fade away. We are given some insight into how individual researchers interact with their community, gather allies, and weave their interests and ideas into the socio-political fabric around them. If you think these goals are the stuff of sociology, then you are not too far off the mark. The authors cite the influence of, among others, Callon's sociology of translation and Howard Becker's study of jazz musicians. Galison's (2010) "trading zones" and Star and Griesemer's (1989) "boundary objects", with their guiding metaphors of exchange and disciplinary pidgins, also make an appearance.[1]

By uniting and mobilizing these sociological perspectives on science, repertoires have the capacity to counteract the problematic Kuhnian influence that the Ankeny and Leonelli identify. The authors thus label their framework as "post-Kuhnian." Yet, the theoretical predecessors of the repertoire framework share their own problematic assumptions. While each gives us a way to more fully situate scientists and scientific communities in their context, they encourage us to unwittingly slip into the internal logics of actors (and perhaps the occasional actant). Like the scallop-taming researchers in St. Brieuc Bay or theoretical physicists "trading" with radar technicians, we become concerned with what must be done to make research stable and successful in the face of a dynamic social and material environment. But left implicit, however, is an understanding of why particular research is worth

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[1]Strangely displaced, however, is Swidler (1986), which the authors footnote as a more narrow use of "repertoire." Yet, it is hard to imagine how fitting repertoires to scientific practice could be more inclusive than a general theory of culture that connects social structure to "habits, skills, styles" and "strategies of action." Swidler's research program seems just as suited to analyze the culture of science as the culture "of poverty" or of Protestantism, etc, so the relation between Ankeny and Leonelli's proposal and that from 1968 is left ambiguous.

doing in the first place, the "why?" behind the strategic "how?" These limitations shine through in Ankeny and Leonelli's proposal. The inventories and know-hows that make up "repertoires" are similarly skewed towards "how" concerns and lack a clear place for the normative content of research programs. The result is a silent rehearsal of performances that are, out in the world, imbued with concrete visions (right or wrong) for human flourishing.

Kuhnian philosophers of science, thus, may not fully escape their bad habits by taking up repertoires, which substitute ethics and politics with mechanistic or strategic social maneuvering. In the present paper, I will give more detailed consideration to this limitation of Ankeny and Leonelli's synthesis of STS work. First, I will re-visit the comparison between Kuhn's "paradigms" and repertoires, showing that the latter does not depart completely from the former. Second, I will showcase a few alternative frameworks that better capture ethical and political content of scientific practice, namely "vanguard visions" (Hilgartner, 2015) and "sociotechnical imaginaries" (Jasanoff and Kim, 2015). These accounts can similarly explain the stability and change of scientific communities, but with a focus on the hopes and dreams, ethics and politics that animate and give meaning to collective human activity. Finally, I will conclude by considering how the repertoire framework might be adapted to better integrate these missing insights from STS. We can, I hope, still provide a normative soundtrack to the otherwise silent performance of repertoires.

2. Incomplete Kuhn Loss: From Paradigms to Repertoires

What does it mean to be "post-Kuhnian?" The answer depends very much on how you read *The Structure*, which often looks like one book to social scientists and an entirely different book to philosophers of science. Rather than re-open that interpretive debate, I will examine a couple of themes from Kuhn's work that are relevant here: first, the methodological focus on the role of theory in scientific practice and, second, the internalist explication of paradigms. Ankeny and Leonelli suggest that by expanding our investigation beyond the structural effects of theory to more social elements of practice, we can better understand scientific change or stability. Repertoires seem post-Kuhnian indeed in this first sense; they fill out the "discplinary matrix" with all the things a sociologically-savvy scholar would expect. But the other dimensions of Ankeny and Leonelli's program still seem rater Kuhnian. It's worth spelling out these comparisons in more detail.

Kuhn's story of scientific change—we all know it by now—says that periods of significant stability ("normal science") feature a shared understanding of what exemplary science looks like. The community's organization rests on some shared experiment or instance of research that unifies the "paradigm." So we have, nominally, an answer to why some research programs stick around; the collective recognition of an exemplar, of certain theoretical values, appropriate techniques, and equipment serve as a reference point for practitioners. This explanation is itself parsimonious because it leaves out the crucial work of finding resources to pay for research, of justifying one's research to others, and all of the other messy social elements of practice. Ankeny and Leonelli know better, of course; their own observations of scientific practice suggest that we should not be satisfied with any explanation that leaves these things out. Kuhn was only able to do so, they suggest, because of his choice of case studies. Studying the Copernican revolution, for example, predisposes one to thinking of change in terms of theoretical upsets, leaving the rest of the story untold.

Rejecting Kuhn's methodological focus on theory, repertoires expand the typology of social and material elements that enable stable research programs. This new methodological awareness is surely one way to be "post-Kuhnian." The research question is more or less the same, but Ankeny and Leonelli surpass Kuhn by theorizing more explicitly and expansively about the role of science policy, funding, marketing, lab technicians, institutional factors, and so on. But there is another related dimension of the post-Kuhnian program, jettisoning internalism. Ankeny and Leonelli claim to have succeeded here too. They identify in Kuhn a tendency to exclude any element of practice that does not affect the propositional content of scientific practice. Their own framework is fortunately not limited by any such *a priori* stipulation. They follow the metaphor of (jazz) repertoire as far as it goes, even if that means studying things that are far beyond the traditional purview of philosophy of science or observing "non-scientific" features of practice. But is that far enough?

Here the idea of being "post-Kuhnian" starts to get complex, so allow me to fill out the jazz analogy a bit further. Jazz is loved for its ability to take us in surprising directions, but here I worry that, as an analogy, it has led us astray. The repertoires used by musicians codify technical directions, creative suggestions, and maybe even affect. You can learn a lot about jazz by looking and listening for traces of repertoires. I can pick out On Green Dolphin Street even as it is transmuted by Eric Dolphy or Bill Evans, or laugh at Thad Jones' choice to solo Pop Goes the Weasel in the middle of April in Paris. But even as I marvel about the performative elements (largely unseen in the case of

recordings) that make these instances possible, a focus on repertoire obscures (at least) two things. First, the audience is taken for granted. Who are they, and why are they sitting there in the middle of the night? What do they expect from the performer? Second, studying repertoires may never help me understand why jazz is important or why people listen to it. The significance of musical expression in our non-musical lives is left implicit, a sort of presupposition by jazz practice. So depending on what you want to discover about jazz, repertoires might or might not do the trick.[2]

Think again about the case of scientific practice. One can "follow the actor" and catalog the things that lead to successful performances (e.g. promise that x, measure using y, collaborate with z), while perhaps never understanding the publics (the "audience") of a given science. And without an eye towards the "why?", the guiding hopes or desirable futures, we don't know why successful collaborations or research platforms matter for society, for you and me. These lacunae amount to a different sort of internalism. Though repertoires expand the Kuhnian framework, they are nonetheless repertoires *of scientific practitioners* (whether lab techs, administrators, or bona fide scientists). For this reason, Ankeny and Leonelli's synthesis is not as post-Kuhnian as it could be. As recipes for stable research programs, repertoires are likely meaningful for practitioners but opaque to outsiders. Even as a philosopher, I am not equipped to evaluate a successful performance like, for example, when a group of biologists organize a state-funded data sharing platform. Unless I'm rooting for them as a participant observer, I have no normative ground to stand on.

The residual internalism in repertoires may be accidental, a consequence of following a metaphor and publishing a big idea in a short paper. Or perhaps it is inherited from a prior framework. Regardless, that internalism may enable scholars to use the framework in problematic ways. Consider, for example, the possibility that repertoires lead to "how-to" papers. One could crudely instrumentalize the concept as "STS for Scientists," a guide for anyone who wants to win grants and influence people. Such use would likely entail a less critical stance towards science, at best, or an STS consulting firm at worst. It is worth noting that the worst case scenario is unlikely to happen until social scientists and humanities scholars know scientific practice as well as its practitioners, a long shot to say the least. Nevertheless, the Ankeny and Leonelli's language is sufficiently ambiguous to allow instrumental usage, as when they define repertoires as "well-aligned or, in their earlier paper, cite some "benefit" of repertoires, or assert that repertoires are important for the "the quality of research

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[2]It's worth noting that even Becker and Faulkner's work on jazz examines repertoire in combination with the "performance situation," which helps depict demands and expectations made of the performers.

outputs" (Leonelli and Ankeny, 2015). Quality and beneficial for whom?

The concept of "trading zones" sometimes shares this perspectival ambiguity. It's not clear if the analyst is describing things from the eyes of the practitioner or from some Archimedean sociological point. In one of Galison's (2010) examples, theoretical physicists begin "trading" with their less-prestigious counterparts in engineering, and soon radar is born. Both parties, he explains, left the collaboration changed, with engineering techniques showing up in high theory. In another example, biochemistry emerges as a stable creole from its parent disciplines of chemistry and biology. Since Galison defines trade between scientific-technical cultures, it is tempting to evaluate trading zones according to the perspective of one of the participants. In the case of radar, physicists are happy (presumably) because they receive new problem-solving tools, and engineers create their desired widget. But collapsing into either perspective robs us of our critical capacity. As Galison points out, the collaboration was largely a product of the war effort. This is lost if we focus on disciplinary problem-solving or widget-making.

At the other extreme, the asymmetric connotation of repertoire might be interpreted another way, leading to an entirely different style of scholarship; the framework's emphasis on "how?" and not "why?" may encourage a form of material-social myopia, where there is little room for ideal or symbolic content. Instead of "siding with science", so to speak, a student of repertoires could ignore sides altogether. Attributions of "quality," "benefit," or "effectiveness" could then be read in a social functionalist way, with little regard for the moral or political stakes. This interpretation is not so far fetched, given that similar complaints have been directed at one actor-network theory. Jasanoff (2004) notices that "networks exercise power while displaying curiously little of the moral and political conflicts that normally accompany the creation and maintenance of systems of governance." Accordingly, if repertoire is a bullet under one of Callon's (1986) four steps of translation (1. Problematization; 2. Interessement; 3. Enrollment; 4. Mobilization), it might inherit this limitation. Repertoires might neglect the overarching struggle to imagine and realize better forms of human life or, in more trying times, efforts to empower some at the cost of others.

To sum up, I worry that the scholar of repertoires is susceptible to a couple of problems. Either she takes on the logic of actors or adopts a normatively-inert stance. Both amount to a failing to be critical. Both outcomes are incompatible with Ankeny and Leonelli's intended use cases. In their conclusion, they assert that repertoires should be used to critically examine the idea of "success" in

science and to question "what counts" as science. These aims are, in my opinion, entirely appropriate for philosophers of science and other fields in STS. But the ancestry of repertoires may have stacked the deck against them, and we should ask whether the repertoire framework adequately acknowledges the ideal, the ethical, or political. My own verdict is that it might, with some modifications. To make a case for these modifications, I'll take a brief detour of some alternative accounts of scientific change.

3. Symmetry through Imagination: Bringing Audience and Purpose Back to Repertoires

Repertoires might be partisan, pro-Science, or normatively silent, depicting the mechanistic ebb and flow of scientific research programs. But they don't have to be. There are prior frameworks that explicitly avoid either danger, so let's use one of them as an example. "Sociotechnical imaginaries," according to Jasanoff and Kim (2015), are designed to answer several questions, including: 1) what explains the stability or fragility of some sociotechnical arrangements? and 2) how do we understand the relation between individual actors and their community or culture? These questions should sound familiar. Imaginaries are intended to answer some of the same research questions cited by Ankeny and Leonelli. But in so doing, imaginaries also foreground the ethico-political trajectory of organized work, adopting a symmetrical orientation towards science and society. I suggest that repertoires can be modified to include these features.

Jasanoff (2015) defines sociotechnical imaginaries as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." Despite the name, imaginaries are not synonymous with imagined fantasies. Unlike your run of the mill fantasy, sociotechnical imaginaries must be shared between people and can be observed as they are deployed in President's speeches, on Twitter, in NSF solicitations, and in the self-proclaimed identities of scientists. Most importantly, they have concrete content that can be studied. Across the *Dreamscapes of Modernity* volume, the authors demonstrate how imaginaries provide a normative soundtrack or blueprint, so to speak, for the otherwise incomprehensible and deceptively mechanistic action of technoscience in society. Depending on the case, an imaginary might link a particular desirable future (e.g. sustainable cities), a technological intervention (e.g. renewable energy), and a

specific institutional configuration (e.g. transdisciplinarity).

As a framework, sociotechnical imaginaries pull "together the normativity of imagination with the materiality of networks" (Jasanoff 2015). They direct our attention to the ways in which collective action (e.g. scientific collaborations) requires a shared point of reference. Actors can adjust their identity to align with (or to resist) dominant imaginaries. Institutions and discourses emerge and grow around these visions of human flourishing. They can be found in science and engineering, but are not the exclusive purview of expert practitioners. To the contrary, their existence beyond the spaces of technoscience is what enables scientific practice to latch onto our pre-existing hopes and futures, worries and dystopia, and understandings of good and evil. Methodologically, this entails a thoroughgoing symmetry, between science and society, between ways of knowing and ways of living. For each dichotomy, a "symmetrical methodological approach requires us to use the same resources in explicating closure, stability and change" (Jasanoff, 1996).

Some may protest, of course, that sociotechnical imaginaries, as first proposed by Jasanoff and Kim (2009) were national in scale, while repertoires operate at the level of labs and scientific communities. However, imaginaries too can start out in the head of a few people and, in the right circumstances, gain "traction through blatant acts of power or sustained acts of coalition building" (Jasanoff, 2015). This growth doesn't happen in a normative vacuum, but rather is process of interaction with extant imaginaries. Hilgartner (2015) describes these dynamics in the case of synthetic biology: "Revolutionary sociotechnical visions develop and are re-formed through a dynamic process in which their advocates encounter other actors with different goals, engage with extant institutional machinery, and interact with established collective aspirations and imaginations of the future." The "vanguard vision" of an open, engineering-inspired biology, he asserts, is made plausible by drawing on sociotechnical visions that are already present in American discourse.

Some parts of the imaginary bear significant resemblance to repertoires. As he follows the Biobricks initiative, Hilgartner finds that the proponents of synthetic biology pitch it as a novel "open" form of science in which biological "parts" are standardized and made available for the community. Of course, this open trading comes with a set of carefully tailored social and legal platforms. The BioBricks community manage this in part by borrowing structures, strategies, and metaphors from information and computing technology. Instead of open source software and garage entrepreneurs of the 70s, the "open" vision of synthetic biology promotes open source "wetware" and biohackers. Cells are

transformed from the units of life to modular circuits, which enables the "decoupling" of complex phenomena into manageable pieces. A core BioBricks creation is an online Registry that can connect users internationally and binds them to an alternative legal regime; anyone who contributes a part to the Registry is not allowed to assert patent or property rights. I list these components of an "emerging sociotechnical imaginary" because they could easily fit within a framework of repertoires. But the story doesn't end here.

Crucially, the internal strategies and self-understandings of synthetic biology are tied—indeed they must be—into into the wider sociotechnical imaginary of "America the innovator," according to which America is defined internationally by its technoscientific prowess and the societal benefits that follow. Hilgartner describes how US policy documents present biotechnology as the key to unlocking better health care, renewable energy, and a thriving "bioeconomy." And though synthetic biology is only one brand of biotechnological development, proponents in BioBricks and elsewhere must shape their activities and speech to match—SynBio promises a healthier, wealthier America through innovation—or risk fading into obscurity. There are thus two interdependent levels for the imagining of synthetic biology; visionaries negotiate within their community to craft a vision of biotechnology that is compatible with the more stable, national sociotechnical imaginary. In my experience, this zone of overlapping imaginaries is where critical philosophy is most applicable, as actors stick their neck out, so to speak, for causes or values that exist beyond the lab or research community.

Contrast Hilgartner's account with Ankeny and Leonelli's (2016) first example of repertoires, model organism research. Applied here, the framework captures some content fitting for an imaginary. Scientists in the community developed infrastructure for breeding and standardizing specimens, advocated new conceptualizations of "model systems," and generally incentivized the use of specific organisms. In terms of value-orientation, the authors stress the importance of an "ethos of sharing" and the ability to persuade funding agencies that the research is important. But the overarching ethico-political trajectory of the practice is left entirely uninterrogated. The reader is left to wonder why the success or failure of the model organism research community matters. What desirable future does it bring about? Is that future worthy of our assent? As I will suggest in the next section, this absence starves the critical philosophical spirit; there is nothing to evaluate or reflect upon, and we are left with narrowly strategic or functionalist perspectives on science.

Admittedly, the authors point out that each of their examples are compressed in the space of a paper.

But shorthand is almost as valuable as long form for revealing the core strengths and weakness of a framework. In this case, the abundant internalist analysis of *how* to do model organism research leaves no room for *why* it is done. Even in the longer analysis in Ankeny and Leonelli (2011), the authors suggest that the long term goal of model organism research is "large-scale comparative work across these organisms." This characterization is not so much wrong as tantalizingly vague. What could such work allow humans to do? How does comparative work with model organisms actually fit in society? The authors gesture towards "socio/political commitments" and "clinical and commerical settings" but leave it at that. Could it be that repertoires are ill-equipped to deal with these aspects of practice? As they are currently pitched, I suggest the answer is "yes." The framework simply does not foreground the full range of material, social, and *imaginative* components of practice. But as I hinted above, we can use sociotechnical imaginaries as a template. Accordingly, there are two modifications that could fulfill Ankeny and Leonelli's proposal for a critical and sociologically-informed account of scientific change.

First, the definition of repertoires needs an explicit "why?"-oriented element, preferably one that does not reduce to generic scientism or an actor's rational self-interest. As with imaginaries, the framework should be able to unearth implicit (sometimes explicit) answers to classic ethical and political questions: what constitutes a just society and what forms of life are worth pursuing? One possibility, borrowing directly from imaginaries, is the idea of "desirable futures." Returning to the case of model organism research, empirical work should consciously include the futures that researchers invoke, either among themselves or in communications with the public. Another possibility: leave a place for promising. In their first repertoires paper, Ankeny and Leonelli assert that repertoires should include "promissory discourse" that make research fundable. Repertoires thus seem ready to connect with a growing literature on the "regime" and "economics" of promising in technoscience (Joly, 2010; Van Lente, 1993; Audétat, 2015). However, these authors specify that promises should be understood not as sprouting autochthonously from the ground of scientific practice. To do so would likely give practitioners too much credit for inspiring visions and too much blame for bad ones. Neither should we treat promises as impositions from outside science. Instead, promises have to be understood as a reciprocal currency, as the metaphor of economics implies. The normative give and take between science and society is a symmetrical relationship, which leads us to the second modification.

Just as significant as "why?" content, repertoires need an audience. As in jazz, repertoires are part

of a performance, and performances have at least two perspectives, player and listener.[3] Unlike jazz, critical STS scholars cannot simply sit back and enjoy the performance of science or, as performer, don their own lab coats. In keeping with an commitment to symmetrical analysis, the scholar of repertoires must keep an eye on both sides. The very concept of repertoire then becomes a function of both the scientific communities and the publics around them. Some philosophers of science will groan at this outcome, since it means doing serious empirical work on things outside of labs; they will have to remain open to ways in which law, social media, national identities, etc. all set the stage for *particular* repertoires and specific performances. But this is precisely what it means to do post-Kuhnian scholarship on scientific change. Rejecting the internalist impulse means leaving the lab and setting internal logics aside for a moment; the post-Kuhnian seeks out places where science and society blur together and, as Ankeny and Leonelli specify, rejects *a priori* boundaries of science.

To conclude, a quick redefinition may be in order. I propose the following:

> Repertoires well-aligned assemblages: of skills and behaviors; material, social, and epistemic components, *and ethico-political commitments.* Groups may use these assemblages to practice certain kinds of science, and whose enactment affects the methods and results of research, including how groups practice and manage research, train newcomers, *justify their research, and link their practice to more widely shared conceptions of human flourishing.*"

A redefinition is only a start, of course. A lazy user could still choose to ignore the "audience" of repertoires. But if propagated through the entire framework, both modifications can help better represent the ways in which society and science are mutually constitutive. In STS terms, repertoires can represent a "co-productionist" perspective, eschewing easy unidirectional stories about society constructing science or technoscience determining culture (Jasanoff, 2004). The goal here is not to be needlessly baroque or to be "accurate" per se, but to enable a certain academic form of life.

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[3]Hilgartner's *Science on Stage* employs the metaphor of drama in order to capture this dyad of performer and audience; the stage becomes a point of symmetrical focus. Perhaps then repertoires should be nested within a larger framework of "performance."

4. What Our Theories Say About Us When We're Not Around

Our choice of framework does more than just determine which questions we are equipped to answer. Framing devices, accounts, and theories also express our personal interests and affinities, for all to see.[4] For this reason, the commonly used metaphor of a theoretical toolbox is not quite right. The stakes are higher than picking between a hammer and a screwdriver. And the choice between sociotechnical imaginaries and repertoires, as it stands, is no exception. On the one hand, repertoires represent an interest in establishing stable research platforms. By uncritically taking on the perspective of the practitioner, we gain an ability to maneuver as a skilled scientist would—one can pretend to be a wheeling, dealing Craig Venter crafting the synthetic biology brand—but without a clear sense of which desirable futures are being taken for granted. The framework of imaginaries, on the other hand, grounds sociotechnical assemblages (with as much detail as you care to insert) firmly in shared understandings of the good, now made available for our evaluation.

As I suggested above, this difference need not be so extreme. Repertoires can be adapted to include the ethico-political commitments that animate scientific practice and allow it to hook into adjacent spheres of human activity. Comparative methods, too, can hone our critical capacity, by juxtaposing science in different nations or cultures.[5] But whether or not we make such an adjustment can make or break repertoires' ability to replace paradigms. For philosophers of science, the "post-Kuhnian" move is especially consequential. Philosophers are known for their normative or prescriptive tenacity, but a mechanistic or strategic sociological account of scientific communities leaves them very little with which to work. The philosopher can document a repertoire of habits, skills, technological platforms, professional ethos, and plans for coordination, but none of these things engage our normative intuitions. In my experience, learning about these characteristics practice feels orthogonal to my thoughts on democratic science or benevolent science; my own ideals are unaffected by the mere fact that scientists want to share genomic data on Drosophila or if they open a new center for fly breeding. My complaint here is analogous, I think, to Latour's (2004) lamentation that critique has "run out of steam." When all we can do is reveal the network of people and things that make up science, we replace normative critique with endless deconstruction.

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[4]Of course, if imaginaries tell us anything, it is that we often build these personal interests and goals from a shared stock of disciplinary or broadly cultural resources.

[5]This idea is not my own. Comparative methods have already become a core part of "co-productionist" scholarship in STS.

Researchers elsewhere in STS might find this philosophical hand-wringing to be a bit melodramatic. "Why should we care about philosophy's normative aspirations?" they might ask; "there are many ways to study science." Yet, the fact remains that imagination matters to human life, allowing us to evaluate states of the world and guide our actions. To deny this fact not only leaves out a large chunk of empirical data it also implicates the denier in a performative contradiction ("I imagine not"). Our very livelihoods as academics rest on sincere (at least partially sincere) commitments to a well-ordered society and to particular forms of life. So rather than let critique run out of steam, why not engage wholeheartedly and critically with the normative content of scientific practice, epistemic, ethical and political. If we maintain an awareness of the ethico-political narratives, the shared hopes and fears, that accompany "repertoires," (or "actor-networks" or "vanguard visions") then our deconstructions of knowledge practices do something very different; they show that socio-technical arrangements have a point that is bigger than the self-promotion of scientists. Sometimes we will find that a practice is animated by desirable futures that we share and applaud; other times our work inspires feelings of injustice or outrage at technological hubris. With either type of outcome, our scholarly unpacking is not for its own sake, but rather to check whether a "repertoire" is fit for the job. When we can do this, the post-Kuhnian idea starts to look like a post-Kuhnian reality.

References

Ankeny, R. A. and Leonelli, S. (2011). Whats so special about model organisms? *Studies in History and Philosophy of Science Part A*, 42(2):313–323.

Ankeny, R. A. and Leonelli, S. (2016). Repertoires: A post-kuhnian perspective on scientific change and collaborative research. *Studies in History and Philosophy of Science Part A*, 60:18–28.

Audétat, M. (2015). Why so many promises? In Wienroth, M. and Rodrigues, E., editors, *Knowing New Biotechnologies: Social Aspects of Technological Convergence*, page 29. Routledge.

Callon, M. (1986). Some elements of a sociology of translation. In Law, J., editor, *Power, Action, and Belief*, pages 1–40. Routledge, London.

Galison, P. (2010). Trading with the enemy. In Gorman, M. E., editor, *Trading zones and interactional expertise: creating new kinds of collaboration*. MIT Press, Cambridge MA.

Hilgartner, S. (2000). *Science on stage: Expert advice as public drama*. Stanford University Press.

Hilgartner, S. (2015). Capturing the imaginary: vanguards, visions and the synthetic biology revolution. In Hilgartner, S., Miller, C., and Hagendijk, R., editors, *Science and Democracy: Making Knowledge and Making Power in the Biosciences and Beyond*, page 33. Routledge.

Jasanoff, S. (1996). Beyond epistemology: relativism and engagement in the politics of science. *Social studies of science*, 26(2):393–418.

Jasanoff, S. (2004). The idiom of co-production. In *States of Knowledge: The Co-production of Science and the Social Order*, pages 1–13. Routledge, New York.

Jasanoff, S. (2015). Future imperfect: Science, technology and the imaginations of modernity. In *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, pages 1–33. University of Chicago Press, Chicago.

Jasanoff, S. and Kim, S.-H. (2009). Containing the atom: sociotechnical imaginaries and nuclear power in the united states and south korea. *Minerva*, 47(2):119–146.

Jasanoff, S. and Kim, S.-H. (2015). *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*. University of Chicago Press, Chicago.

Joly, P.-B. (2010). On the economics of techno-scientific promises. In *Débordements. Mélanges offerts à Michel Callon*, pages 203–222. Presses des Mines, Paris.

Kuhn, T. (1970). *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago.

Latour, B. (2004). Why has critique run out of steam? from matters of fact to matters of concern. *Critical Inquiry*, 30(2):225–248.

Leonelli, S. and Ankeny, R. A. (2015). Repertoires: how to transform a project into a research community. *BioScience*, 65(7):701–708.

Star, S. L. and Griesemer, J. R. (1989). Institutional ecology, translations and boundary objects: amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39. *Social studies of science*, 19(3):387–420.

Swidler, A. (1986). Culture in action: Symbols and strategies. *American sociological review*, 51(2):273–286.

Van Lente, H. (1993). *Promising Technology: the dynamics of expectations in technological development.* PhD thesis, Twente University, Delft. Eburon.