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David Peña Guzmán Date

APPROVAL SHEET

The Rational Turn In Continental Philosophy: Bachelard, Canguilhem And Foucault
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The Rational Turn In Continental Philosophy: Bachelard, Canguilhem And Foucault

By

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MA, Emory University, 2011
BA, University of Nevada, Reno, 2009

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The dissertation has a thematic and a historical component. Historically, it tries to make sense of the emergence, from the 1940s to the 1970s, of first-generation historical epistemology, the historical epistemology of Cavaillès, Bachelard, Canguilhem and Foucault. Thematically, it struggles with a question that often vexes those who study philosophical movements rather than philosophical figures: Why speak of various individuals as comprising a "movement" or a "school of thought" *per se*? What is it about the works of Cavaillès, Bachelard, Canguilhem and Foucault that allow us to group them under the auspices of a common project? In chapter one, I address the historical emergence of historical epistemology by presenting it as a twentieth century response to a nineteenth century crisis—the crisis in normativity that erupted in the late 1800s as a result of the fall of German idealism and the rise of French positivism. Then in chapters two, three and four, I direct my attention to the thematic dimension, arguing that what *collectivizes* these thinkers is that they share a common object of analysis (chapter two), a common theory of meaning that stands in opposition to phenomenology (chapter three) and a common "recurrent" methodology that rejects at every step the methodology of professional historians (chapter four). The project then concludes with a discussion of how the concepts of *rationality* and *truth* are mobilized in this intellectual tradition and how this mobilization was critical for the catalysis of what I am calling the "rational turn" in twentieth century continental discourse.

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Contents

*

INTRODUCTION

THE RATIONAL TURN IN CONTINENTAL PHILOSOPHY

The Post-Kantian and Post-Moral Pangs of Reason

After a long period of reticence, rationality has begun making noises in continental philosophy. Perhaps an inchoate murmur, perhaps a subtle hum or a whisper, these noises have not yet reached the systematic intelligibility of sensible speech. Thus, *what* they tell us is unclear, but *that* they tell us something is beyond dispute since they have rung, and continue to ring, loud and clear for those of us who, for better or worse (probably a bit of both), identify as members of a philosophical community that is dubbed "continental." By this, of course, I do not mean that only lately has rational thinking dignified the camp of continental philosophy or that only recently have rational arguments emanated from the mouths and pens of continental philosophers. No, what I mean is that over the last few decades rationality, understood as a philosophical category, has ceased being (for continental philosophers, at least) merely a problem, a crisis or an abstraction to be kept in check and has emerged, in various registers, as a vision, a promise and an aspiration to be kept alive. No longer merely the hardened excrescence of Enlightenment's pathology or a callous accretion of "old philosophy," rationality is becoming a site of contestation, a pressure point in the anatomy of contemporary thought.

But a shrewd reader might ask, "If continental philosophy has really begun the arduous process of rewriting the script of its historical relation to rationality, where are the signs of this operation found?" I invite this reader to momentarily don the lens of sociological reason and consider some emerging trends that, in my interpretation, showcase the recent investment in the category of rationality and throw the spotlight on what I call continental philosophy's "rational turn." I observe four trends that betray the extent to which, consciously or unconsciously, continental philosophy is increasingly opening itself up to questions traditionally posed outside it:

- The revival in the late twentieth and early twenty-first centuries of **modern rationalisms,**[1] especially the recovery of Spinozism in metaphysics and epistemology (Gilles Deleuze, Moira Gatens, Hasana Sharp)[2] and of Schellingianism in the philosophy of nature and the philosophy of mind (Jason Wirth, Adrian Johnston).[3]

- The resurgence of **formalist and axiomatic thinking** in the philosophy of mathematics (Alain Badiou),[4] social theory (Louis Althusser) and psychoanalysis (Jacques Lacan).

- The explosion since the 1980s and '90s of **continental engagements with the natural sciences** that precipitated different "turns" in varied sub-branches of continental philosophy, including:

  (a) What Dorothea Olkowski calls the "scientific turn"[5] in postmodern philosophy, in which continental philosophies (Gilles Deleuze, John Protevi, Manuel DeLanda)[6] have been inspired by non-linear dynamics, thermodynamics and probability theory.

  (b) What Iris van der Tuin calls the "materialist turn"[7] in feminist theory, which has led to reconsiderations of the ethical, ontological, metaphysical and epistemological underpinnings of sciences like chemistry (Ilya Priogine, Isabelle Stengers),[8] evolutionary biology (Elizabeth Grosz, Griet Vandermassen),[9] quantum physics (Karen Barad),[10] ethology (Donna Haraway)[11] and psychology (Elizabeth Wilson).[12] And,

  (c) What Dan Zahavi calls the "naturalistic turn"[13] in phenomenology, which has engendered rich dialogues between philosophical explorations of lived experience and cutting edge research in the cognitive sciences (Evan Thompson, Francisco Verela, Shaun Gallagher, Sarah Ahmed, Catherine Malabou).[14]

- The rise of **philosophical hybrids** that level out the old distinction between "analytic" and "continental" philosophy. These range from analytic uptakes of Hegel (Robert Brandom, Michael Forster, Robert Pippin)[15] to epistemological readings of Foucault (Hubert Dreyfus and Paul Rabinow, Gary Gutting, Béatrice Han-Pile),[16] from explorations of analytic philosophy's historical consciousness (Hans-Johann Glock)[17] to discussions of continental philosophy's contributions to logic and the philosophy of language (Paul Livingston),[18] and from reconsiderations of the origins of the analytic-continental divide (Thomas Friedman, C.G. Prado)[19] to pleas to abandon these time worn sectarianisms in favor of "postanalytic" and "metacontinental" philosophies that fuse the cultural, the social and the logical with the political, the epistemological and the historical (James Williams, Paul Ennis, Cornel West).[20]

Rationality has entered recent continental philosophy on the backs of these four developments. In some cases, it enters vis-à-vis projects (such as Badiou's[21]) that begin by assuming the rational status of their own point of departure. In others, it does it via projects (such as Lacan's[22] and, to a lesser degree, Grosz's[23]) that, while perhaps innocent of this assumption, nevertheless aspire to be scientific in their own right. And in others still, rationality sneaks into continental philosophy through projects that, in spite of being cautious of Enlightenment-driven teleologies of reason and antiquated ideas concerning the inherent maleness and whiteness of reason, are framed as petitions for a "new" or "qualified" rationality, for a rationality to-come (but a rationality nonetheless!). In *The Invention of Modern Science* (2010), for

instance, Isabelle Stengers demands a "new use of reason"[24] in philosophical and scientific inquiry. In *Order Out of Chaos* (1984), her colleague, Ilya Prigogine, calls upon an "open" and "Keplerian" rationality to oust the "closed" and "Copernican" rationality of classical science. In *For Marx* (1965) and *Reading Capital* (1970), Louis Althusser invites social theory to give up the nineteenth century's reverie of "the religious triumph of reason"[25] and embrace the sober "rationality of materialism."[26] And in *Difference and Repetition* (1968) and *The Logic of Sense* (1969), Deleuze combats the "insomniac rationality" of Descartes with a "primordial rationality"[27] that, rooted in the logic of sense, "is more fundamental than the commonsense dictates of 'merely' human reason."[28]

But sometimes rationality leaks into the rhetoric of continental philosophy through an even more surreptitious channel, which is the philosophical appropriation of scientific knowledge. Philosophical projects that weave the pattern of their discourse with the threads of scientific research may not presuppose the rationality of their beginning, they may not take rationality on as an ambition for thought and they may make no obvious reference to a rationality to-come. Yet even these ventures, on account of their "contact" with the first-order discourse of scientific rationality, cannot avoid at least a minimal commitment to rationality, even if only in the form of a commitment to the rationality of the very sciences they enlist for their respective ends. Feminists such as Karen Barad and Elizabeth Grosz and phenomenologists like Catharine Malabou and Evan Thompson skirt orthodox views of reason and classical theories of knowledge, and they do so not by exposing the chicanery of reason from the standpoint of reason's "outside" (as perhaps Blanchot, Valery and Adorno do), but by situating themselves within the immanent and dynamic rationality of scientific discourse; by taking the axe of a scientific conception of the rational as fallible, revisable and experimental to the root of philosophical valorizations of a fixed, moribund and static rationality. In *Meeting the Universe Halfway* (2010), Barad invokes the counter-intuitive rationality of quantum physics to overcome philosophy's separation of matter and meaning. In *The Nick of Time: Politics, Evolution, and the Untimely* (2004), Grosz "extracts" from the rational discourse of biology a new "philosophical model" for thinking about nature, materiality and the body.[29] And in *Mind in Life: Biology, Phenomenology and the Sciences of Mind* (2007),

Thompson uses phenomenology to "reclaim" what "was lost in the passage from traditional philosophy and psychology to modern-day cognitive science" while presenting this vanishing point (i.e. lived experience) "anew in light of present-day concerns in the sciences of mind."[30] In all these cases, a certain conception of rationality is posited at, and presupposed from, the start.

If we don the lens of the sociologist and take a survey of how rationality "plays itself out" in contemporary discourse, we soon realize that the countless projects that have flourished under the wings of the recent "turns" of continental thought—modern rationalisms, axiomatic formalisms, the turn to the experimental sciences and the turn away from long-standing philosophical banners—are already implicated, whether they know it or not, in debates about rationality and entangled, whether they like it or not, in controversies concerning what George Santayana calls "the life of reason."[31] And since their ploys and plots are dramatized under rationality's proscenium, it follows that the question concerning *the rational* in recent continental philosophy cannot be "to be or not to be." It can only be "how to be" or "which to be." Will we side with modernity's Man of Reason, the reason of Bacon, Galileo and Descartes? Or will we seek a new rationality that is more attuned to different frames of being, to deferent modes of belonging and to different ecologies of thought? For us post-60s philosophers, in other words, the question concerning *the rational* is not Hamlet's, but Latour's: "To Modernize or to Ecologize, That is the Question."[32]

And flippant indifference will not do. If we dismiss the rational valences of all these continental projects as insignificant nods to tradition or as surface-effects produced by the limits of language, we judge the case before the trial and lose an opportunity for theoretical reflection. Is the concept of rationality so irreversibly steeped in philosophical sin that even our leading theorists and sages cannot hope to reform it? Has the "Egyptianism"[33] of philosophy that Nietzsche so powerfully describes in *Twilight of the Idols* reached such a critical mass that aside from "mummifying" the ideas we make we now also embalm our very relation to them? Given that the theme of rationality is a dominant topic in formalism, rationalism and natural science, why shouldn't we expect those philosophies that selectively appropriate these discourses also redefine the meaning of rationality along the way?

One of the problems for us is that, although the connection between new currents in continental philosophy and the concept of rationality often pierces through the threshold of consciousness, at times this connection is entombed by layers of silence, repression and acts of forgetting that leave rationality dormant (though still active!) beneath the surface of philosophical reflexivity. When this happens, one is left with works that still posit or presuppose certain conceptions of rationality but deny that any act of positing or presupposing has taken place. In these cases, rather than speaking about continental philosophy undergoing a rational *turn* (as in philosophy's "linguistic turn") we may wish instead to speak of it suffering from rationality's *return* (as in Freud's "return of the repressed"). I use this Freudian language tongue in cheek since I am not interested in psychoanalyzing continental philosophy (or philosophers!). Still, I cannot help but wonder why the sciences of matter and life have so impressively seduced the continental imagination that, in our times, continental thinkers spill as much ink speaking about science as they do speaking through it. I also wonder why formalism and rationalism are making a comeback as theoretical heavyweights, especially amongst philosophers trained primarily in the masters of suspicion: Marx, Nietzsche and Freud. And I wonder, finally, why this interest in science, rationalism and formalism has been roughly contemporaneous with attempts to dispel that old tale according to which analytic philosophy monopolizes matters of validity, logic and truth while continental philosophy limits itself to commanding questions of culture, life and history.

Could it be that these events simply echo larger sociological patterns already underway in the academy, such as the current drift toward the "scientification"[34] of the humanities? It could be. Could it be that they enact and replicate the basic maneuver of neoliberal ideologies, which historically has been to seal the fate of humanity (and now, alas, the humanities too!) to the achievement of a techno-scientific and formal-rationalist control of nature? It also could be. But could it also be something else? Could these changes be symptomatic of a larger and deeper development, signs that a new exigency—the exigency of *the rational*—has pressed itself upon the frame of continental discourse and troubled its traditional form? Are these the noises rationality makes as it teeters on the precipice between sense and nonsense? This is the interpretation I choose. And without denying that they might also reflect the operations of extra-

philosophical determinants (corporate capitalism, globalization, technocratism, etc.), I hold that these turns mark the site of a rupture in continental philosophy's historical relationship to rationality and demand a reevaluation of its commitments and self-understanding. If, like a guilty or disturbed conscience, contemporary continental thought twists and turns, it may be because it is becoming conscious of its entanglement in the dynamics of reason, because it can no longer ignore the post-moral pangs of reason[35] or muffle the disquieting noises of rationality's susurrant voice.

In the view commanded here, the post-modern incantations of rationality that perturb contemporary continental thinking bestow upon a new generation of continental philosophers (especially those born after '68) the task of hitting the "reset" button and taking up anew the question that defined Western philosophy from Socrates to Hegel: What is the rational? In the twenty-first century, this question can no longer be answered with a refurbished *critique of reason* that engraves in philosophical stone the limits of all thought and experience or with a revamped *criticism of the rational* that exposes "reason" as epistemology's fetish. Instead, what the recrudescence of rationality requires is a novel *theory of rationality* that allows us to reclaim the meaning of the rational; a theory that allows us—"us" theoreticians—to once again entertain *dreams of objectivity* and *reveries of truth* in our post-Enlightenment and post-atomic historical moment without worrying that, at any moment, these dreams might turn into the time-worn nightmares of a sexist, racist, ableist, homophobic and imperialist "Reason" that excludes, tramples and dominates. One of the goals of this project is to articulate, with the help of French historical epistemology, what such a theory of rationality (especially *scientific* rationality) might look like in concrete form.

This dissertation is a commentary on the relationship between continental philosophy and the concept of rationality. But it is not, to be clear, a study of "continental philosophy" *as such* or about its "rational turn" *per se*. Rather, it is a case study that zooms in on a very specific (and often overlooked) province of continental philosophy in order to shed light on the bond that exists, and has always existed, between the history of continental thought, the philosophy of science and theories of rationality. Odd as it may sound to those of us who have grown accustomed to the idea that the contours of continental

philosophy are fixed by existentialist phenomenology (Husserl, Sartre, Beauvoir, Merleau-Ponty, Levinas), psychoanalysis (Freud, Fromm, Jung, Lacan, Kristeva), aesthetics and hermeneutics (Schleiermacher, Dilthey, Heidegger, Ricoeur, Gadamer), the philosophy of life (Nietzsche, Bergson, Deleuze, Jonas, Simondon), political theory (Lukács, Adorno, Horkheimer, Benjamin, Arendt) and poststructuralism (Derrida, Lyotard, Irigaray, Butler, Baudrillard), there have been entire continental legacies that, much like Descartes, have brokered interesting partnerships between philosophy, science and reason, and that have cast their lot with objectivity, truth and reason rather than with subjectivity, life and experience. One such legacy is French historical epistemology or, as it is sometimes called, the French philosophy of the concept. Like Pascal, historical epistemologists have made a rational wager insofar as they wagered on rationality itself. But, unlike him, the rationality they ventured is not the masterful reason of a knowing subject but the rationality immanent to scientific discourse. My goal in this project will be to make explicit what the stakes of this wager have been for this tradition of thought.

Epistemology Nationalized, The French Wager

> The "philosophy of the concept" was historically tied to the French tradition, ultimately traceable to Comte, of the history and philosophy of science. In the latter half of the twentieth century, this tradition was primarily represented by Gaston Bachelard and his successor as director of the Sorbonne's Institut d'Histoire des Sciences et des Techniques, Georges Canguilhem. Although the work of Bachelard and Canguilhem was scarcely known outside France, where French philosophy was simply identified with existential phenomenology, they were major influences on several generations of French philosophy students and their "philosophy of the concept" remained a significant alternative to existential philosophy.
>
> - Gary Gutting, *French Philosophy in the Twentieth Century*[36]

> It seems paradoxical to speak of 'national styles' in philosophy, and even more in the philosophy of the sciences: national frontiers do not jibe with the pursuit for the universal. And yet it appears that there are a certain number of common traits in contemporary French philosophy of the sciences. This "family air" [*air de famille*] strikes foreign observers in particular. When Gary Gutting presents the continental philosophy of science to his Anglo-Saxon readers, he evokes a French network in the philosophy the sciences, this network [*réseau*] encompassing Gaston Bachelard (1884-1962), Georges Canguilhem (1904-1995) and Michel Foucault (1926-1984).
>
> -Jean-François Braunstein, in *Les philosophes et la science*[37]

Philosophy is neither a sub-branch of political geography nor a sub-division of cartography. From this, it would seem to follow that one couldn't introduce meaningful philosophical demarcations vis-à-vis national qualifiers. What would it mean to talk about Russian logic, Mexican aesthetics or Pakistani hermeneutics? Yet, since at least the 1970s a variety of scholars have used the term "French historical epistemology" to describe a specific "approach,"[38] "style,"[39] "tradition"[40] or "school"[41] of thought that flourished in the Parisian scene of the mid-twentieth century and that is often treated as a sub-discipline of philosophy "in the geographical and temporal sense."[42] Associated with the works of Henri Poincaré (1854-1912), Alexandre Koyré (1892-1964), Jean Cavaillès (1903-1944), Gaston Bachelard (1884-1962), Georges Canguilhem (1904-1995) and Michel Foucault (1926-1984), among others, this mode of thinking was a "major force"[43] in the French milieu of the 1940s, '50s, '60s, '70s and '80s. There and then, this tradition—"French historical epistemology" or "French philosophy of the concept"—appeared as "a distinct alternative to existential phenomenology."[44]

Unlike the phenomenological writings of Edmund Husserl, Henri Bergson, Jean-Paul Sartre, Simone de Beauvoir, Martin Heidegger, Maurice Merleau-Ponty and Emmanuel Levinas, the works of these French epistemologists proceed from the double assumption that (a) the proper medium for epistemological analysis is the study of the "concepts" housed by the history of science rather than the description of the structures of lived experience, and (b) there is zero correspondence between the subjectively-objective truths of lived experience, common sense and the everyday, on the one hand, and the formal-objective truths of scientific discourse, on the other. For Koyré, Cavaillès, Bachelard, Canguilhem and Foucault, as Gary Gutting notes in *Continental Philosophy of Science* (2005), "the domain of lived experience [represents] merely a first approximation to the truth about the world, a truth toward which science moved by revising and even rejecting the concepts of everyday experience."[45]

Historical epistemologists "accepted the cognitive authority of science"[46] and sought to defend the rationality immanently secreted by science against those who would equate it with the instrumental reason discharged by the Enlightenment or with an Averroistic abstraction that estranges thought from nature and the life process. In *Twentieth-Century French Philosophy* (2007), Alain Schrift claims that by

positing themselves as "the Other[s] of existentialism" and partaking "in the ultimate unseating of existentialism as a dominant philosophical position in the second half of the century,"[47] French historical epistemologists secured for themselves a place in the annals of the history of philosophy as the rightful heirs to a long tradition of scientific and rational philosophy that extends from the antiquity of Plato and Aristotle to the modernity of Kant, Hegel and Comte.

Yet, in spite of the fact that it altered the intellectual landscape of post-1945 French thought and controverted the philosophical behemoths of the day, this tradition (especially Bachelard's[48] and Canguilhem's[49] versions of it) has received remarkably little scholarly attention in the present day and "remains little known outside France."[50] In a 1999 article published in the *European Journal of Social Theory*, Loïc Wacquant writes: "One indicator among many of the invisibility of French historical epistemology on current maps of philosophy [is that] Bachelard rates a brief one-column entry in the *Cambridge Dictionary of Philosophy* and Cavaillès, Canguilhem and Koyré are all absent from it."[51] Meanwhile, the *Stanford Encyclopedia of Philosophy* leaves out all of them, even Bachelard.

The reasons for this invisibility are not hard to discern. First, there are problems of linguistic access. Seminal books (not to mention articles, letters and papers), such as Canguilhem's influential *La formation du concept de réflexe aux XVIIe et XVIIIe siècles* (1955) and Bachelard's *Le rationalisme appliqué* (1949), are yet to be translated into English, German or Spanish. In fact, many of these works are only now being published in French (the first volume of Canguilhem's *Oeuvres complètes* was published by Vrin in 2011, the second has not yet hit the press). Second, there are also issues tied to the interdisciplinary nature of historical epistemology. At least in North America, it has been fields *other than* philosophy that have more readily opened their arms to the works of historical epistemology. The biggest impact of Foucault has arguably been in Gender Studies departments, while Canguilhem and Bachelard have been read primarily in History of Science and English programs.[52]

A third problem, intricately tied to the second, is the issue of professional labels in philosophy. In *A Parting of the Ways: Carnap, Cassirer, Heidegger* (2000), Michael Friedman states that the 1929 Davos debate between Heidegger and Cassirer over the legacy and meaning of Kant's critical philosophy

produced a split in the philosophical imaginary, which resulted in two philosophical camps or families trying to live under one roof: an "analytic" family that saw questions concerning the relationship between logic, science and reason as the proper subject matter of philosophy and a "continental" one that foregrounded questions of existence, culture and history.[53] But historical epistemology simply does not fit neatly into the dominant schemas that came to define philosophy in Europe and North America after 1929.[54] Nimbed by the aura of rationalism yet dawning a social and historical understanding of rationality, it slips through the sociological cracks of twentieth century philosophical discourse. Often dismissed by analytic philosophers as "too continental" and by continental philosophers as "too scientistic," historical epistemology is effaced and consumed by the still burning embers of an old disciplinary feud.

It is true that continental philosophers have not historically focused on the philosophy of science, which remains a largely analytic pursuit.[55] But it is also the case "that philosophy of science has never been intrinsically or essentially analytic."[56] Why then does the *Routledge Encyclopedia of Philosophy*, without explaining or justifying this move, have two separate entries for the philosophy of science: one titled "Philosophy of Science" (which is devoted the household names in analytic philosophy) and an entirely different one titled "French Philosophy of Science"[57]? In my view, this separation is not innocent and reflects a larger pattern of thinking whereby non-analytic approaches to the philosophy of science are often treated as "pre-historic in relation to the field."[58]

In *Les origins françaises de la philosophie des sciences* (2003), Anastasio Brenner argues that the link between French historical epistemology and the Vienna tradition is stronger than continental or analytic philosophers have assumed.[59] Meanwhile, in *The Present Situation in the Philosophy of Science* (2010), Thomas Uebel makes a compelling case for thinking about historical epistemology not as the Other of existentialism or as the alter ego of phenomenology, but, rather, as one of the many personifications of the philosophy of science in the twentieth century. In Uebel's interpretation, historical epistemology is just "philosophy of science by other means."[60] I, for one, take the lack of dialogue between analytic philosophy of science and French historical epistemology to be one of those "losses"

that, according to Thomas, "the philosophy of science has suffered on its way toward its analytic realization."[61]

But the eclipse of historical epistemology damns the whole house of philosophy, not just its analytic half. It seems to me that historical epistemology was occluded in the 1960s, '70s and '80s by poststructuralist critiques of reason that cast a shadow of suspicion over any philosophical effort to issue forth a normative theory of scientific rationality. Indeed, from the 1960s to the 1990s, the very concepts of "rationality" and "normativity" came to be regarded by continental philosophers as regressions to an Enlightenment philosophy of history and progress that, historically, served as a subterfuge for programs of colonial, imperialism and economic domination. In the first two thirds of the twentieth century, reason was rejected as an abstraction from lived experience by existentialists and phenomenologists and as a backsliding into the logocentric desire of modernity by deconstructionists. Even those theoretical pedigrees that managed to make a stand "for" a substantive reason, such as Frankfurt School Critical Theory, retained this category only in its political, not epistemological, form.

For much of the twentieth century, then, continental philosophy abandoned the quest that defined Western philosophy from Socrates to Schelling, i.e., the quest to furnish a substantive account of rationality that could underwrite normative content. And although this abandonment paid dividends in philosophical explorations of reason's "outside" (conceived as expression, sensibility, poiesis, difference, etc.), it also came at a great price as it atrophied continental philosophy's relationship to the sciences. In twentieth century continental discourse, scientific rationality systematically appears, alongside capitalism, as of the most dangerous and brute expressions of Hegel's bad infinity, as the offspring of "the measureless passion of the architects" says Gadamer.[62] Ultimately, this explains why critics of continental philosophy often maintain that while there have been plenty of continental *criticisms of science* (from Husserl's to Irigaray's) there has yet to be, properly speaking, a continental *philosophy of science*—that is, a serious engagement that does justice to the specificity of scientific discourse and gives a coherent account of its rational and normative force.

In this project, I disprove this charge. I show that the rational wager of French historical epistemology yields a philosophy of science that fulfills both of these functions at once. Hopefully without giving away too much too soon, I can say that one of my core claims here will be that the leading philosophies of science of the twentieth century (which, for me, include Husserlian phenomenology, Frankfurt-style Critical Theory, Carnapian logicism, Popperian falsificationism and the Sociology of Knowledge Program) have failed to reconcile two key features of scientific rationality: (a) the normativity of scientific judgments and (b) the historicity of scientific paradigms. These philosophies have failed to explain, in other words, how scientific discourses can be *normative* (and therefore necessitating) and *historicist* (and therefore contingent) at one and the same time. At best, each of these projects has managed to save one of these features at the other's expense. Phenomenologists, critical theorists and Kuhnians sacrifice the normativity of science at the shrine of history, while logical empiricists surrender the historical element in the hopes of safeguarding science's normative edge. Either way, these currents cannot seize the historical normativity proper to scientific rationality. They can only abrade it. To them, science appears as being "historical" or as having "reason," but never quite as a manifestation of "historical reason" itself.

Historical epistemology is at its best when it zeroes in on this tension between scientific history and normativity. By combining Kant's commitment to a normative epistemology, Hegel's commitment to the primacy of concepts and Nietzsche's commitment to the value of genealogical analysis, Bachelard, Canguilhem and Foucault (plus a few other "Frenchies" whose names intermittently appear in the following chapters) manage to articulate a historico-normative philosophy of science that enables us to salvage and re-imagine (dare I say redeem) "rationality" as a philosophical category. Thus, the reader should be warned that she will probably not find much by way of this work that is not already contained in its title for the main question that guides my thinking and the answer I give to it are both found therein. What is historical epistemology? It is a theory or philosophy of science that explains how science can be normative and historical at once. This is what I offer as my claim. And I claim to offer little more.

In the actual development of the argument, however, the reader will encounter concrete claims about science, history and knowledge that, if all goes as planned, will transport her all at one from the crevices and curlicues of a title to a more expansive footing. She will find herself at the heart of a nineteenth century epistemological saga, replete with scandals of philosophical fame, decline, usurpation and death; she will travel from the metaphysical depths of the Kantian "categories" to the anti-metaphysical heights of Popperian "rules of procedure," only to find on the other end the celebrated, though still metaphysically mysterious, "concepts" of historical epistemologists. She will watch as these concepts take on a life of their own and give rise to inhuman systems or networks of normativity that rival consciousness for the title of the legitimate headquarter of synthetic activity. Finally, she will follow my tracks as I struggle to process the methodological presupposition of historical epistemology and clarify the conception of "rationality" that operates through it. If by the end of the book the reader walks away with a greater understanding of the subject matter or even a newly found interest in it, I will count myself lucky for that would mean that, at the very least, the reader didn't abandon ship half way through the course. And this, as a close friend of mine once told me, "is all an author can ask for, because they rarely get anything more." And all too often, I add, not even that.

Confessions of an Undutiful Writer

As a label, "historical epistemology" conveys no clear doctrinal content. And, as a school of thought, as Cristina Chimisso has shown, it "is not a coherent whole."[63] This means that, as an object of meta-philosophical reflection, it could be said to be an example what the philosopher of law Ronald Dworkin calls a "contested concept,"[64]i.e., a *concept* that admits of many *conceptions*. For this reason, I would like to take a moment to make explicit, in the form of three "confessions," some methodological decisions I have made over the course of research that have helped crystallize my own conception of historical epistemology and that have determined the style, form and content of my research. Before all else, these confessions are admissions of the limited, finite and imperfect nature of this work.

Confession 1: My object is fabricated. In this project, I arbitrarily introduce an element of coherence into the otherwise chaotic field of "historical epistemology" by focusing on three particular thinkers: Bachelard, Canguilhem and Foucault. Even if this choice reflects scholarly convention, it remains invariably polemical. On the one hand, there is the problem of integration—i.e. the fact that there are substantial differences between the works of Bachelard, Canguilhem and Foucault that would complicate any attempt to "collectivize" them. On the other hand, there is also a problem of demarcation—i.e. the fact that there are other prominent French epistemologists besides these three that can make a claim to group membership.[65] Why, then, focus on these three? What justifies this un-natural selection?

Without denying that this decision is contentious, I defend it on two grounds. First, of all the ways one could go about gerrymandering the district of historical epistemology, this seems to be the least arbitrary one since there is a protean logic of family resemblance ("un air de famille," Braunstein says) that brings them under the same network and lends an air of legitimacy to their unification. Their works are connected by what in the *Philosophical Investigations* (1953) Wittgenstein describes as a "complicated network [of] overlapping and crisscrossing similarities."[66] Some of these similarities are relatively plain: they all believe in the importance of history for the theory of science, they all work closely with various forms of scientific "archives," and they all question progressivist narratives about scientific evolution. But some of them are less obvious: they all believe in the normative character of scientific history, in a relational theory of scientific meaning and in the importance of a "recurrent" methodology. This dissertation mentions the former at various moments and it explicitly discusses the latter.

Interestingly, the family resemblance connecting these thinkers is somewhat literal since Bachelard, Canguilhem and Foucault formed a closely-knit intellectual "family" at what Husserl once called "the most venerable abode of French science"[67]—the Sorbonne. Bachelard was a professor at the Sorbonne during Foucault's student days there and came to be a major influence on his early development.[68] "I was never directly his student," Foucault would later say, "but of all the contemporary

philosophers alive when I was a student Bachelard was the one I read most."[69] Canguilhem succeeded Bachelard as Professor of History and Philosophy of Sciences at the same institution and became the head of the *Institut d'Histoire des Sciences et Techniques* in 1955. In this function he influenced Foucault more directly. In spite of a reportedly awkward first meeting, he directed and sponsored Foucault's thesis for his *Doctorat d'État*, which was published in 1961 as *Folie et deraison: l'histoire de la folie à l'âge classique*.[70] It is no coincidence that Foucault is often described as "Bachelard's spiritual descendant"[71] and "Canguilhem's successor"[72] and that his major works—especially *HM, AK, OT* and *BT*—are, in the words of Webb (2013), "filtered through" the thinking of the men who introduced him to the very idea of historical reason.[73] It is also no coincidence that this cascading and interlocking set of biographical connections leaves behind a long paper trail: Canguilhem writes multiple essays on Bachelard;[74] Foucault pens the introduction to the English edition of Canguilhem's *NP*;[75] Canguilhem dedicates *FCR* to Bachelard and claims to have written *IR* "under the influence" of Foucault, whose own thought "was inspired" by that of Bachelard.[76]

Blood relations aside, the second reason I choose this trinity is scholarly. Currently there are virtually no interpretations of historical epistemology *as a school of thought.* "But there are millions of books about these thinkers." Yes, there are books about Bachelard,[77] about Canguilhem[78] and, of course, about Foucault.[79] But apart from a handful of articles[80] and a couple of book chapters,[81] there no extended accounts of the "network" these thinkers collectively institute. The two glaring exceptions to this otherwise inviolable rule are Dominique Lecourt's 1975 book *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: New Left Books) and Francisco Jarauta's 1979 text *La Filosofia Y Su Otro: (Cavaillès, Bachelard, Canguilhem, Foucault)* (Valencia: Pre-textos), both of which have been cornerstones for my own study. Still, neither of these works is satisfactory as an interpretation of French historical epistemology since both, perhaps inadvertently, destroy the *differentia* of this mode of thought by collapsing it under the weight of other philosophical pedigrees. Lecourt, for example, reduces historical epistemology to Marxist dialectical materialism, while Jarauta interprets it as somewhat of a precursor to Derridean deconstruction.

The overriding aim of this dissertation is to proffer an original interpretation of the French philosophy of the concept that avoids the traps Lecourt and Jarauta fall into: the trap of reductionism (in Lecourt's case) and the trap of anachronism (in Jarauta's). The questions that interest me have little to do with the debts historical epistemology might have incurred relative to other philosophical traditions and more with the advances it makes over and against them. What are this tradition's philosophical assumptions, commitments and implications? What is its object? What is its theory of meaning? What is its method? And what is its conception of truth and reason? And how does it fit into the history of Western epistemology? The novelty in my approach is that I present French historical epistemology as a philosophical adventure that troubles analytic (logical positivism, logical empiricism) and continental (phenomenology, critical theory) expectations and stands equinox between them.[82]

Confession 2: I have an agenda. I also have strategic reasons to anchor the term "historical epistemology" on the writings of Bachelard, Canguilhem and Foucault. Due to their institutional affiliations, this trio played a crucial role in the philosophical formation of many Francophone philosophers that walked through the halls of the Sorbonne and that went on to become famous theorists in their own right. Consider the following relations:

- Bachelard had a tremendous impact on the neo-formalist philosophies of Althusser, Badiou and Lacan. It was from him that Althusser, who was Bachelard's student, borrowed the concept of "epistemological obstacle" that became the signature of his scientific reading of the late Marx; that Badiou, who was Althusser's student, borrowed the idea of "technical production" that he mobilized early in his career against anti-materialist theories of formal logic;[83] and that Lacan, who references Bachelard in many of his seminars, came to appreciate the necessary "impurity" of formalization that would become one of the definitive features of his plea for a "return to Freud."[84]

- While a student at the Sorbonne in the 1940s, Deleuze studied under both Bachelard and Canguilhem.[85] Canguilhem piqued Deleuze's interest in vitalism and introduced him to the work of Gilbert Simondon, on whom Canguilhem had previously published. In *Deleuze, the Dark Precursor* (2012), Eleanor Kaufman argues that this early encounter with French epistemology shaped much of Deleuze's mature concerns. One cannot begin to grasp the seminal concept of "the fold" that grounds the Deleuzian metaphysics of immanence, Kaufman points out, if one overlooks this concept's origins in its author's relationship to Bachelard, especially his reading of the latter's *Poetics of Space* (1958).[86]

- There are also interesting connections between recent feminist projects and French historical epistemology. Hui (2011) explores the strong similarities between Bachelard's interpretation

of scientific realism and Karen Barad's quantum-inspired agential feminism.[87] And there are also strong connections between Canguilhem's work on the history of evolution and biology and both Elizabeth Grosz's Darwinian feminism and Catherine Malabou's philosophy of neuroplasticity.[88]

- Finally, Foucault's thinking has preoccupied feminist philosophers of science interested in social interpretations of scientific objectivity poststructuralist authors roused by the theoretical space where the social, the scientific and the ontological intersect. He was a Bruno Latour's most prominent teacher, Deleuze's most consistent interlocutor and one of the most notable influences on de Landa. Grosz, Barad and Haraway all reference him positively as someone who, along with Canguilhem and Bachelard, made possible a new way of thinking about science, objectivity and knowledge after Kant. It is a testament to his influence that many of these thinkers frame many of their works as responses to Foucault's project.

For me, then, historical epistemology is more than *one* example of a continental project that has wedded itself to rationality's fate. It is, in many ways, the philosophical event that, alongside the structuralist controversy of the 1960s and to the crisis of formalism that erupted before it in the 1920s, '30s and '40s, paved the way for all those theoretical ventures that at the outset I brought under the umbrella of the "rational turn."

Still, the fact remains that the methodological decision to focus on Bachelard, Foucault and Canguilhem retains a quality of capriciousness that I do not wish to conceal or disguise. The undeniable fact remains that there is no *prima facie* reason why the term "historical epistemology" should refer to these particular thinkers and to them alone. Still, scholarship demands the imposition of limits, and one of such limit comes from a tradeoff between breadth and depth—the wider the scope of a project, the weaker its depth. For the sake of breadth, I have chosen to write about three figures rather than just one. For the sake depth, I have chosen to write about three rather than four of five. But, also in the name of breadth, at different points in my argument I will incorporate references to neighboring figures, especially Jean Cavaillès, Alexandre Koyré and François Jacob (Chapter 3).

Confession 3: Cherry Picking. Bachelard, Canguilhem and Foucault were highly prolific authors who wirte about a range of topics, including metaphysics, ethics, history and even literature. How could a single author capture in a single book the whole spectrum of their works? How could she even approach the complexity of their views and apprehend their mutual relations? Even to attempt such a feat borders

on a hubristic overextension of thought. In this manuscript, however, I cope with this difficulty by tempering any fantasies of comprehensiveness and establishing clear parameters around my research question. Since my interest lies in these figures' views about the composition and physiognomy of scientific rationality and not in their total arch of their philosophies, I privilege those aspects of their works that deal directly specifically and directly with the epistemology of the sciences. I privilege Bachelard's early scientific works (especially *NSS, PN, FSM*) over his late works on poetry (*PS, PR, WD*). I privilege Canguilhem's works on the history of the life sciences (*NP, KL, IR*) over some of his early excursions into moral theory. And I privilege Foucault's early archaeological texts (*BC*, *OT, AK*) over those that came after the "ethical turn" (*UP* and *CS*). These acts of privileging, I assure the reader, spring from the prescriptions of practical necessity more than from a lack of philosophical interest and curiosity; still, the best book is a finished book.

The Project in Perspective—The Five Chapters

In **Chapter One**, I present a genealogy of French historical epistemology. *Contra* Michel Foucault and Alain Badiou, both of whom offer their own narratives about the historical origins of historical epistemology, I argue that this school of thought begins not, as Foucault claims, in the Enlightenment mythology of reason or, as Badiou insists, in the dialogue regarding the status of subjectivity first initiated by Descartes in the seventeenth century. Historical epistemology, in my view, is a reaction and a response to the crisis of normativity ushered in at the end of the nineteenth century by two historico-philosophical events: (1) the demise of idealism in Germany and (2) the subsequent rise of positivism in France. Thus, the historical transition in philosophy from "the death of the concept" to "the birth of the facts" should provide the historical and theoretical backdrop to any essay on historical epistemology since this transition frames the main problematics that excite and motivate Bachelard, Canguilhem and Foucault.

Using this historical framework as a backdrop to my own study, in the following three chapters I lay out my interpretation of historical epistemology and contend that three of its features stand out as

definitive. First, there is its object of study, which I call "scientific discourse." This object, expounded in **Chapter Two**, is a curious form of communicative action that is defined by determinate but historically variable normative schemas called "concepts." Second, there is its theory of meaning. For historical epistemologists scientific ideas, theories, models and concepts have no meaning *per se*. Instead, their meaning is a function of their mobility within a larger network of norms that provides each term in its domain with an index of determination. By putting it and network theory (broadly construed) into conversation, I show in **Chapter Three** that historical epistemology is not, technically, a "philosophy of the concept" (a misnomer) but a "philosophy of conceptual networks." The third feature of historical epistemology that matters for us is the one I take up in **Chapter Four**: its method. Bachelard, Canguilhem and Foucault adopt a "recurrent" philosophical method that introduces a normative component into the philosophical study of history. In the fourth chapter, I outline the steps of this method and make a few remarks about its relationship to other philosophical methodologies. The middle three chapters, therefore, are the theoretical core of this project; they show *that* Bachelard, Canguilhem and Foucault belong to a common tradition of thought and clarify *how* this tradition came to differentiate itself from, and rival, its contemporaries.

Finally, in **Chapter Five**, I bring this project to a conclusion by highlighting French historical epistemology's relevance to contemporary philosophical debates about science and rationality. With the hopes of substantiating Dominique Lecourt's claim in *Marxism and Epistemology* that historical epistemology is "an epistemology which has not yet taught us its last lesson,"[89] I argue that we can extract from the philosophies of Bachelard, Canguilhem and Foucault a novel theory of rationality that vindicates the rationality of scientific labor without recapitulating Enlightenment myths about the linearity of history or the inevitability of progress. This theory of rationality will deal with classical questions in the philosophy of science that are rarely taken up in continental philosophies, especially the question of truth. In finishing this project on this note, I hope to place this work in the company of those monstrous and "hybrid" philosophical projects already mentioned, which are pressuring philosophical thinking to overcome its self-generated analytic-continental divide by unceremoniously marching right through it.

[1] Danielm, Stephen. *Current Continental Theory and Modern Philosophy* (Northwestern University Press, 2005)
[2] See Deleuze, Gilles. *Spinoza: Practical Philosophy* (City Lights Books, 1988); Deleuze, Gilles. *Expressionism in philosophy: Spinoza* (New York: Zone Books, 1990); Deleuze, Gilles. "Ethology: Spinoza and Us" *Incorporations* (1992): 625-633; Moira Gatens (ed.). *Feminist Interpretations of Benedict Spinoza* (Penn State University Press, 2009); Sharp, Hasana. *Spinoza and the Politics of Renaturalization* (University of Chicago Press, 2011).
[3] Wirth, Jason. "Schelling's Contemporary Resurgence: The Dawn after the Night When All Cows Were Black." *Philosophy Compass* 6.9 (2011): 585-598; Wirth, Jason M., and Patrick Burke, eds. *The Barbarian Principle: Merleau-Ponty, Schelling, and the Question of Nature* (Suny Press, 2013); Wirth, Jason M. *The Conspiracy Of Life: Meditations On Schelling And His Time* (SUNY Press, 2012); Johnston, Adrian. "Ghosts of Substance Past: Schelling, Lacan, and the Denaturalization of Nature," In *Lacan: The Silent Partners,* ed. Slavoj Žižek (London: Verso Books, 2006), 34-55; Johnston, Adrian "The Soul of *Dasein*: Schelling's Doctrine of the Soul and Heidegger's Analytic of *Dasein*," *Philosophy Today* 47 (2003): 227-251.
[4] Badiou, Alain. *Being And Event* (London: Continuum, 2005); Badiou, Alain. *Infinite Thought* (Bloomsbury Publishing, 2005); Badiou, Alain. *Number And Numbers* (Polity, 2008); Badiou, Alain. *The Concept Of Model: An Introduction To The Materialist Epistemology Of Mathematics* (Re. Press, 2007).
[5] See Olkowski, Dorothea. *Postmodern Philosophy And The Scientific Turn* (Indiana University Press, 2012).
[6] De Landa, Manuel. *A Thousand Years Of Nonlinear History* (New York: Zone Books, 1997).
[7] der Tuin, Iris van. "New feminist materialisms." *Women's Studies International Forum* 34 (2011).
[8] Stengers, Isabelle. *Order Out Of Chaos: Man's New Dialogue With Nature* (Bantam Books, 1984); Prigogine, Ilya, and Isabelle Stengers. *La fin des certitudes: temps, chaos et les lois de la nature* (Odile Jacob, 1996); Bensaude-Vincent, Bernadette, and Isabelle Stengers. *Histoire de la chimie*. La découverte, 2013; Stengers, Isabelle. *Cosmopolitics* (Minneapolis: University of Minnesota Press, 2010).
[9] Grosz, Elizabeth. *The Nick Of Time: Politics, Evolution, And The Untimely* (Duke University Press, 2004). Grosz, Elizabeth. *Time Travels: Feminism, Nature, Power* (Durham: Duke University Press, 2005); Vandermassen, Griet. *Who's Afraid Of Charles Darwin?: Debating Feminism And Evolutionary Theory* (Rowman & Littlefield Publishers, 2005).
[10] Barad, Karen. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and* Meaning (Durham: Duke University Press, 2007).
[11] Haraway, Donna. *When Species Meet* (Indianapolis: University of Minnesota Press, 2008).
[12] Wilson, Elizabeth A. "Neurological Entanglements: The Case of Paediatric Depressions, SSRIs and Suicidal Ideation," in *Subjectivity* 4.3 (2011): 277-297.
[13] Zahavi, Dan. "Phenomenology and the project of naturalization." In *Phenomenology And The Cognitive Sciences* 3.4 (2004): 331-347.
[14] Thompson, Evan. *Mind In Life: Biology, Phenomenology, And The Sciences Of Mind* (Harvard University Press, 2007); Varela, Francisco J., Eleanor Rosch, and Evan Thompson. *The Embodied Mind: Cognitive Science And Human Experience* (MIT Press, 1992); Zahavi, Dan. "Naturalized phenomenology" In *Handbook Of Phenomenology And Cognitive Science* (Springer Netherlands, 2010), 2-19; Ahmed, Sara. *Queer Phenomenology: Orientations, Objects, Others* (Durham: Duke University Press, 2006); Malabou, Catherine. *What Should We Do With Our Brain?* (Fordham University Press, 2009).
[15] For a short introduction to the "Hegelian turn" in analytic philosophy, see Tom Rockmore's "Analytic Philosophy And The Hegelian Turn." *The Review of Metaphysics* (2001): 339-370. For a more in-depth analysis, I would recommend Paul Redding's *Analytic Philosophy And The Return Of Hegelian Thought* (Cambridge: Cambridge University Press, 2007). Or, for specific philosophical projects, the reader is directed to the following: Brandom, Robert. *Making It Explicit: Reasoning, Representing, And Discursive Commitment* (Harvard University Press, 1998); Brandom, Robert B. "Some Pragmatist Themes In Hegel's Idealism: Negotiation And Administration In Hegel's Account Of The Structure And Content Of Conceptual Norms." *European Journal of Philosophy* 7 (1999): 164-189; Forster, Michael N. *Hegel's Idea of a Phenomenology of Spirit*. Chicago: University of Chicago Press, 1998; Forster, Michael N. *Hegel and skepticism* (Harvard University Press, 1989); Pippin, Robert B. "Hegel's Practical Philosophy: Rational Agency As Ethical Life." (2008); Pippin, Robert B. *Hegel's Idealism: The Satisfactions Of Self-Consciousness* (Cambridge University Press, 1989).
[16] Dreyfus, Hubert L. *Michel Foucault, Beyond Structuralism And Hermeneutics* (University of Chicago Press, 1983); Gutting, Gary. *Michel Foucault's Archaeology of Scientific Reason: Science and the History of Reason*. (Cambridge University Press, 1989); Han, Béatrice. *Foucault's Critical Project: Between the Transcendental and the Historical* (Palo Alto: Stanford University Press, 2002).
[17] Glock, Hans-Johann. *What is Analytic Philosophy?* (Cambridge University Press, 2008).

[18] Livingston, Paul. *The Politics Of Logic: Badiou, Wittgenstein, And The Consequences Of Formalism* (Routledge, 2012).
[19] Friedman, Michael. *A Parting Of The Ways: Carnap, Cassirer, And Heidegger* (Open Court Publishing, 2000); Prado, GC. *A House Divided: Comparing Analytic and Continental Philosophy* (Humanity Books, 2003).
[20] In James Williams, Jack Reynolds, James Chase & Edwin Mares (eds.), *Postanalytic and Metacontinental: Crossing Philosophical Divides* (Continuum, 2011); Ennis, Paul. *Post-Continental Voices: Selected Interviews* (Zero Books, 2010).
[21] In *Being and Event* (1988) and *Logic of Worlds* (2006), for instance, Badiou feels comfortable equating rationality with logical and mathematical proofs and assuming the rational status of Cantorian set-theory and the Zermelo–Fraenkel axioms. "I present nothing in mathematics," he writes in the "Preface" to *Being and Event*, "which has not been established" (Badiou, *Being and Event,* xiv). See Badiou, Alain. *Being and event*. A&C Black, 2007; Badiou, Alain. *Logics of worlds: Being and event II*. Bloomsbury Publishing, 2009.
[22] In *Lacan and Science,* Jason Glynos and Yannis Stavrakakis argue that Lacan's structuralist interpretation of the psyche seeks to make of psychoanalysis a robust science. By appropriating Saussurian linguistics as well as a proto-scientific notation system, Lacanianism positions itself as an heir to Galileo. Indeed Glynos and Stavrakakis claim that Lacan's oeuvre "reflects an ardent interest to situate psychoanalysis within the Cartesian tradition of rationality which [gave] birth to modern science" (Glynos, Jason, and Yannis Stavrakakis, eds. *Lacan and science*. Karnac Books, 2002, 110)
[23] In the "Introduction" to *In the Nick of Time: Politcs, Evolution, and the Untimely* (Duke University Press, 2004), Grosz distances herself from rationalist theories of science by saying that "this book does not aim to provide a philosophy *of* science […] but rather to provide some ingredients for a philosophy of life" (Grosz, 6-70). Yet, like Lacan, who positions himself in the camp of philosophers of the rational by claiming to do good on Freud's desire that psychoanalysis become a science, Grosz makes a similar move. She argues that unlike the romantic philosophies of life that flourished in the nineteenth century, hers will have "its place alongside the empirical discoveries of the natural sciences" (Grosz, 7). If her ambition is not to write something comparable to a philosophy of science, it is because she is skipping the "philosophy *of*" part and going directly to the "science."
[24] Stengers, Isabelle. *Cosmopolitics*. Minneapolis: University of Minnesota Press, 2010, 50-55
[25] Althusser, Louis, and Etienne Balibar. *Reading capital*. London: Verso, 1997, 44
[26] Letts, Guy. "The Mystical Kernel in the Rational Shell: Althusser and the Magical Moment of Supersession in Overdetermined Contradiction." In *Studies in Social and Political Thought* 10.5 (2001): 35-49
[27] Peden, Knox. *Spinoza Contra Phenomenology: French Rationalism from Cavaillès to Deleuze*. Stanford University Press, 2014, 235
[28] Peden, *Spinoza Contra Phenomenology,* 235. Also, , Smith (2012) states that in spite of his flirtations with Hume "Deleuze remains a rationalist, but it is a modified rationalism, a rejuvenated rationalism, a rationalism unbound." (Smith, Daniel. *Essays on Deleuze*. Edinburgh University Press, 2012, 85)
[29] Grosz, *In the Nick of Time*, 7
[30] Thompson, Evan. *Mind in life: Biology, phenomenology, and the sciences of mind*. Harvard University Press, 2007, 14
[31] Santayana, George. *The Life of Reason: Reason in science*. Vol. 5. C. Scribner's Sons, 1906.
[32] Latour, Bruno. "To modernize or to ecologize? That's the question." In *Remaking Reality: Nature at the Millenium*. Ed. Braun, Bruce, and Noel Castree. Routledge, 2005, 221-242.
[33] Nietzsche, Friedrich Wilhelm. *Twilight of the Idols with the Antichrist and Ecce Homo*. Wordsworth Editions, 2001.
[34] van Peursen, W. Th, Ernst Thoutenhoofd, and Adriaan van der Weel, eds. *Text comparison and digital creativity: the production of presence and meaning in digital text scholarship*. Vol. 1. Brill, 2010.
[35] I took this phrase indirectly from Georges Santayana. In Vol.5 of *The Life of Reason,* Santayana speaks of "post-rational moralities." These refer to moral codes of conduct that acquire practical force by the fact that they implicate as motivators for action aspects of human experience that operate independently of pure reason. By inverting this term and speaking of "post-moral rationality" or "the post-moral pangs of conscience," I hope to capture systems that give reasons for belief and action without making positive claims about the nature of moral duty.
[36] Gutting, Gary. *French philosophy in the twentieth century*. Cambridge University Press, 2001*, 228*
Braunstein, Jean-Francois. "Bachelard, Canguilhem, Foucault: Le 'style français' en épistémologie." In *Les philosophes et la science*. Paru dans P. Wagner (dir.). Paris, Gallimard, 2002, 920
[38] Gingras, Yves. "Naming without necessity." *Revue de synthèse* 131.3 (2010): 439-454.
[39] Braunstein, "Bachelard, Canguilhem, Foucault"

[40] Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault*. London: NLB, 1975.
[41] Descombes, Vincent, *Le même et l'autre. Quarante-cinq ans de philosophie française (1933-1978)*, Paris, 1979
[42] Mormann, Thomas. "History of Philosophy of Science as Philosophy of Science by Other Means? Comment on Thomas Uebel." In *The present situation in the philosophy of science*. Vol. 1. Ed. Stadler, Friedrich. Springer Science & Business Media, 2010, 30
[43] Gutting, *French Philosophy*, 227
[44] Gutting, Gary, ed. *Continental philosophy of science* (John Wiley & Sons, 2008), 10-11
[45] Gutting, *Continental Philosophy of Science*, 11
[46] Gutting, *Continental Philosophy of Science*, 11
[47] Schrift, Alan D. *Twentieth-century French philosophy: Key themes and thinkers*. John Wiley & Sons, 2009, 36
[48] Gaukroger, Stephen W. "Bachelard and the problem of epistemological analysis." *Studies in History and Philosophy of Science Part A* 7.3 (1976): 189-244.
[49] Rabinow, Paul, (1994),19.
[50] Schrift, *Twentieth Century French Philosophy,* 36
[51] Wacquant, Loïc. "The Double-Edged Sword of Reason." *European Journal of Social Theory* 2.3 (1999): 275-281.
[52] As Paul Rabinow, an anthropologist at U.C. Berkeley, has pointed out, although Foucault has achieved international notoriety for his work on madness, sexuality and criminology, Bachelard and Canguilhem are barely known outside of France (Rabinow 1994, 19; Gaukroger 1976, 189). Even within France, they tend to be known either for select aspects of their work or for their contributions to fields other than philosophy of science. For instance, in spite of having written on a myriad subjects ranging from medicine to ideology critique from the early 1940s to the 1980s, Canguilhem is usually only remembered for his first work on pathology, *The Normal and the Pathological,* which was published in 1943. Although he wrote over ten books on post-Newtonian physics and Post-Lavoisian chemistry, Bachelard's oeuvre is essentially unknown in the U.S., where "his reputation is primarily as a literary critic" (Ibid. 457).
[53] Friedman, Michael. *A parting of the ways: Carnap, Cassirer, and Heidegger*. Open Court Publishing, 2000.
[54] Prado, Carlos Gonzales. *A House Divided: Comparing Analytic and Continental Philosophy*. Humanity Books, 2003.
[55] Chimisso, Cristina. "Aspects of Current History of Philosophy of Science in the French Tradition." In *The present Situation in the Philosophy of Science*. Vol. 1. Ed. Stadler, Friedrich. Springer Science & Business Media, 2010, 55
[56] Heidelberger, Michael. "Aspects of Current History of19th Century Philosophy of Science." In *The present Situation in the Philosophy of Science*. Vol. 1. Ed. Stadler, Friedrich. Springer Science & Business Media, 2010, 71
[57] Chimisso, "Aspects," 41
[58] Mormann, "History of Philosophy of Science," 31.
[59] Brenner, Anastasios. *Les origines françaises de la philosophie des sciences*. Presses Universitaires de France-PUF, 2003.
[60] Uebel, Thomas. "Some Remarks on Current History of Analytical Philosophy of Science." In *The present Situation in the Philosophy of Science*. Vol. 1. Ed. Stadler, Friedrich. Springer Science & Business Media, 2010: 13-29
[61] Mormann, "History of Philosophy of Science," 32
[62] Gadamer, Hans-Georg. *Reason in the Age of Science*. Cambridge, Mass.: MIt Press, 1982, 17.
[63] Chimisso, "Aspects," 43
[64] Dworkin, Ronald. *Taking rights seriously*. Harvard University Press, 1978.
[65] In *La filosofía y su otro: Cavaillés, Bachelard, Canguilhem, Foucault* (Pre-textos, 1979), Francisco Jarauta makes a strong case for including Jean Cavaillès (1903-1944) as a fourth pillar of historical epistemology. In his book, *On Historicizing Epistemology* (Stanford University Press, 2010), Hans-Jörg Rheinberger insists on extending this honorific not only to Cavaillés but also to the French historian of science Hélène Metzger (1889–1944), the Marxist philosopher Louis Althusser (1918-1990) and the poststructuralist Jacques Derrida (1930-2004). Other figures that also nominated for membership in various contexts include the idealist philosopher Étienne Émile Marie Boutroux (1845-1921), the physicist Pierre Duhem (1861-1916), Henri Poincaré (1854-1912), Léon Brunschvicg (1869-1944), the historian of science Abel Rey (1873-1940), the father of the "Annales School" Lucien Febvre (1878-1956), the Russian-born Alexandre Koyré (1892-1964) and, sometimes, the Polish philosopher Ludwig Fleck (1896-1961).
[66] Wittgenstein, Ludwig. "The Blue and Brown Books. Preliminary Studies for the Philosophical Investigations. References are to the Blue Book or Brown Book. 1969." (1958).
[67] Husserl, Edmund. *Cartesian Meditations: An Introduction to Phenomenology*. Springer Science & Business Media, 2012.

[68] Reflecting upon Bachelard's influence on his own thinking in a videotaped interview from 1971, Foucault praises Bachelard not only for his philosophical acumen and erudition but also for the critical undertone of his approach to the study of science. "He reminds me," Foucault claims, "of skilled chess players who manage to take the biggest pieces with pawns."
[69] Miller, Jim, and Jim Miller. *The Passion of Michel Foucault* (New York: Simon & Schuster, 1993), 60.
[70] Cantor, G. N., et al. *Companion to the history of modern science*. Routledge, 2006.
[71] Hacking, Ian. *Historical ontology*. Springer Netherlands, 2002, 45
[72] See Kolkman, Michael and Michael Vaughan. *Henri Bergson's Creative Evolution 100 Years Later* (Wisconsin: Univ of Wisconsin Press, 2010)
[73] Webb, David A. *Foucault's archaeology: science and transformation* (Oxford University Press, 2013), 45
[74] There are three essays devoted to Bachelard in *Etudes*: "L'histoire de sciences dans l'œuvre épistémologique de Gaston Bachelard," "Gaston Bachelard et les philosophes" and "Dialectique et philosophie du non chez Gaston Bachelard" (Canguilhem, *Etudes,* 173-210).
[75] Foucault, Michel. "Introduction." In *The Normal and the Pathological*, by Canguihem (New York: Zone Books, 1999), 7-24.
[76] Canguilhem, *IR,* ix
[77] See Lecourt, Dominique. *L'épistémologie historique de Gaston Bachelard*. Vrin, 2002; Chimisso, Cristina. *Gaston Bachelard: Critic of science and the imagination*. Routledge, 2013; Tiles, Mary. *Bachelard: Science and Objectivity*. Cambridge: Cambridge University Press, 1984; Jones, Mary McAllester, and Gaston Bachelard. *Gaston Bachelard, subversive humanist: texts and readings*. Univ of Wisconsin Pr, 1991.
[78] Lecourt, Dominique. *Georges Canguilhem*. Paris: Presses universitaires de France, 2008; Le Blanc, Guillaume. *Canguilhem et les normes*. Vol. 103. Presses universitaires de France, 1998; Le Blanc, Guillaume. *Canguilhem et les normes*. Vol. 103. Presses universitaires de France, 1998; Marcherey, Pierre. *De Canguilhem à Foucault la force des normes.* Paris: La Fabrique, 2009; Balibar, Étienne et al. *Georges Canguilhem: philosophe, historien des sciences*, Paris: Albin Michel, 1993.
[79] Gutting, Gary. *Michel Foucault's Archaeology of Scientific Reason*, Cambridge: Cambridge University Press, 1989. Dreyfus [1983], Deleuze [1988])
[80] Dews, Peter. "Foucault and the French tradition of historical epistemology." *History of European Ideas* 14.3 (1992): 347-363; Gingras, Yves. "Naming without necessity." *Revue de synthèse* 131.3 (2010): 439-454; Thompson, Kevin. "Historicity and transcendentality: Foucault, Cavaillès, and the phenomenology of the concept." *History and Theory* 47.1 (2008): 1-18; Hyder, David. "Foucault, Cavaillès, and Husserl on the historical epistemology of the sciences." *Perspectives on science* 11.1 (2003): 107-129.
[81] Braunstein, "Bachelard, Canguilhem, Foucault"
[82] As is well known, the first of these events (what Gary Gutting calls "the high tide of structuralism") was shepherded by the pioneering work of social scientists working in linguistics (Ferdinand de Saussure) and anthropology (Claude Lévi-Strauss), while the second (the formalist movement) was instigated primarily by the provocations of philosophically inclined mathematicians (David Hilbert and Jean Cavaillès). While dissimilar in multiple respects, both of these events contributed to the crystallization of a theoretical attitude in Europe that had major implications not only in the disciplines from which it sprouted, but also in fields as diverse as literary theory (Roman Jakobson's reading of Saussure), political theory (Louis Althusser's reading of Marx) and psychoanalysis (Jacques Lacan's reading of Freud). The core of this theoretical attitude, in a nutshell, is the idea that important elements of social life—from myth and science to the economy and the unconscious— form "complex systems" that cannot be reduced either to the elementary units that compose them or to the urges, whims and fancies of the individuals who "produce" them. For formalists and structuralists, these phenomena must be treated in terms of the "formal systems" or "modes of production" that enable individuals to produce (i.e. mythologize, rationalize, consume, desire) in the first place; that is to say, not in terms of what classical thinkers like Kant, Hegel and Husserl might take to be "the activity of the subject" but in terms of what the French philosopher Jacques-Alain Miller has dubbed "the action of the structure." (See Miller, Jacques-Alain. "Action de la structure." *Cahiers pour l'analyse* 9 [1968]: 93.)
[83] Badiou, Alain. "Mark and Lack: On Zero." *trans. ZL Fraser and R. Brassier, in P. Hallward & K. Peden (eds.), Concept and Form: The Cahiers pour l'analyse and Contemporary French Thought, London, Verso* (2010).
[84] Eyers, Tom. "Bachelard, Lacan and the Impurity of Scientific Formalization." *Paragraph* 35 (2012): 320-337,
[85] Schrift, Alan D. *Poststructuralism and Critical Theory's Second Generation*. Routledge, 2014.
[86] Kaufman, Eleanor. *Deleuze, the Dark Precursor: Dialectic, Structure, Being*. JHU Press, 2012.

[87] These connections are documented by Hui, Yuk. 2011. *On The Existence of Digital Objects*. Doctoral thesis, Goldsmiths, University of London

[88] Rand, Sebastian. "Organism, normativity, plasticity: Canguilhem, kant, malabou." *Continental Philosophy Review* 44.4 (2011): 341-357.

[89] See Dominique Lecourt's *Marxist Epistemology* (1975).

1

THE NINETEENTH CENTURY IN RUINS
THE HISTORY OF FRENCH HISTORICAL EPISTMEOLOGY

> "Lack of historical sense is the family failing of all philosophers […] There are no eternal facts, just as there are no absolute truths. Consequently what is needed from now on is *historical philosophizing*"
>
> -Nietzsche, *Human, All Too Human*[1]

The first teaching of historical epistemology, the "principle of historicity," is irreducibly Nietzschean: all knowledge, by necessity, is historical. The idea here, however, is not simply that all objects of knowledge are historical because they necessarily appear *in* the stream of historical time and must therefore be grasped in the full density of their materio-historical circumstances (although this is part of it). The idea is that all objects of knowledge appear in history *as histories*, that is, as phenomena that always speak, and necessarily so, of what was and of what has been, of eras bygone and events observed, of obstacles overcome and left behind.[2] All objects are born burdened by lineage and beckoned by pedigree; born into time-honored family trees that condition and shape them, that haunt and motivate them. To understand an object, then, it is not enough to seize it in the plenitude of its contemporaneity. It is not enough to "date" it. To be illuminated, as Nietzsche intimates in the second "Preface" to *Human, All Too Human* (1996), objects must also be "dated back" to places and times before their moment of inception. Why? Because no term in a knowledge relation, perhaps not even the knowledge relation itself, comes about in a sudden jolt of novelty that contravenes the commandeering logic of time like a thunderous Badiouian "event." Each event is a history within a history, a history whose meaning and force are to a large tied to its memories, the memories it embodies, the memories it acknowledges and the memories that it so mightily tries to forget. "We require history," Nietzsche says, "for the past continues to flow within us in a hundred waves."[3]

As a philosophical tradition, French historical epistemology is not an exception to this rule. It is historical insofar as it is born into a historically determinate context that embeds it, but also insofar as its very existence speaks of what was and what has been, of philosophical systems built and demolished, of scientific problems posed and deposed, of epistemic battles won and lost, fought and suffered. Driven by this conviction, this chapter nose-dives into the history of this tradition in the hopes of articulating something like a *historical epistemology of historical epistemology.* This school first appears during the tumultuous decades of the 1930s and '40s, in the years leading up to the rise of the Vichy regime in France. And we know that its root in that "most venerable abode of French science,"[4] the Sorbonne. But *why* does it appear at this time? What questions, crises and polemics preoccupy thinking and structure theoretical production in Europe around this time? What is the intellectual landscape and the historical backdrop against which this discourse takes form and comes to matter? What, in other words, are its historical conditions of emergence? What are the forces, energies and incidents that contribute to its genesis? What are, to quote Foucault's "Nietzsche, Genealogy, History," "the myriad events through—thanks to which, against which—[it is] formed"[5]? In a polemic against Michel Foucault and Alain Badiou, this chapter locates the most important of these events in the nineteenth rather than the eighteenth or seventeenth centuries.

In the second half of the nineteenth century, sometime between Hegel's death in 1831 and Ricoeur's birth in 1913, a handful of events erupt on the continent that bring about a drastic failure in philosophical reason and uproot philosophy (especially in its guise as epistemology) from its historical self-understanding as a normative discipline: (1) German idealism dies, (2) French positivism is born, and (3) science is emancipated from philosophy. These events, which I describe in fuller detail below, call into question the traditionally normative character of philosophy's determinations and dissolve the "right" that philosophy had historically arrogated for itself: the right to legislate, vis-à-vis a philosophical meta-language, universal norms for rational thought. When philosophy loses its right to lay down norms that science must obey, two things occur. First, philosophy is dethroned as the queen of the sciences and is left a bereaved and derelict state in which it becomes the consciousness of its own deposition. Philosophy

becomes a problem onto itself. And second, the epistemic standing of scientific rationality becomes ambiguous. By the end of the nineteenth century, it is clear that scientific knowledge is both normative and historical. How is its historical normativity to be explained or justified, especially now that philosophy has lost its norming function?

My thesis is that French historical epistemology asserts against the background of these predicaments concerning philosophy, science and historical normativity that leave the nineteenth century in ruins. In a nutshell, the predicaments boil down to a single problem: How can reason (especially scientific reason) be normative *and* historical at one and the same time? And how can we make sense of this duality?

Foucault and Badiou: Genealogies of Kant and Descartes

In contemporary philosophy, there are two dominant stories about the origins of historical epistemology. There is the genealogical account Michel Foucault presents in his "Introduction" to the 1991 English edition of Georges Canguilhem's *The Normal and the Pathological.* And there is the historical, and proto-metaphysical, narrative provided by Alain Badiou in *The Adventure of French Philosophy* (2012). Since my genealogical account will take a very different form, I begin by reconstructing these other genealogies so as to clarify where and how I depart from them, and why.

In the frequently cited "Introduction" to George Canguilhem's *The Normal and the Pathological*, Foucault introduces the Anglophone world to the theoretical project of his mentor, the "historian of rationalities," Georges Canguilhem. After noting in the opening paragraphs that Canguilhem occupies a considerable position within the French intellectual establishment, Foucault argues that all the major thinkers that English-speaking readers associate with "French philosophy"—the Marxists, linguists, the psychoanalysis, etc.—have had to, at one point or another, "come to terms with" Canguilhem's brand of vitalism.[6] Take away Canguilhem, he says, "and you will no longer understand much about Althusser […] you will no longer grasp what is specific to sociologists such as Bourdieu [and…] you will miss an entire aspect of the theoretical work done by psychoanalysts, particularly by the followers of Lacan." Take away

Canguilhem, I would add, and you would also struggle to comprehend Merleau-Ponty, Deleuze, Badiou and, of course, Foucault himself.

In this panegyric, Foucault uses the opportunity of paying homage to his teacher to also reflect on origins of the tradition the latter helped inaugurate—the tradition of historical epistemology. In Foucault's brief narrative (the whole piece is less than 20 pages), historical epistemology is presented as a form of phenomenology. According to Foucault, the introduction of phenomenology to French intellectual culture in 1929—the year Husserl delivers his famous "Paris Lectures" on transcendental phenomenology at the Descartes Amphitheater of the Sorbonne—marks a watershed event in the history of ideas.[7] In these two two-hour long speeches, Husserl expands the repertoire of French theory by acquainting a whole generation of Parisian thinkers (including Emmanuel Levinas, Jean Cavaillès, Alexandre Koyré and Maurice Merleau-Ponty, all of whom were in attendance) with a new philosophical method that believes itself to be descriptive rather than prescriptive, presupposition-less rather than prejudiced and scientific rather than speculative.

This method does more than enlarge the possibilities for thinking in France. It also reacts back upon French thought as a whole, splitting it into two opposing camps, each a different uptake of the original Husserlian position.[8] The first of these camps is comprised of existentialist phenomenologists such as Heidegger, Sartre, Merleau-Ponty and Levinas, whose *subjectivist* reading of Husserl foregrounds his interest in the primacy of lived experience and his emphasis on the importance of consciousness and intentionality. The second camp is the less popular and more recondite *anti-subjectivist* reading voiced primarily by French historians and philosophers of science such as Jean Cavaillès, Gaston Bachelard and Georges Canguilhem, whose thinking showcases a different aspect of Husserl's work—his attraction to the philosophy of logic and his attentiveness to questions of concept-formation and epistemic objectivity. Foucault writes:

> Without ignoring the cleavages which, during these last years after the end of the war, were able to oppose Marxists and non-Marxists, Freudians and non-Freudians, specialists in a single discipline and philosophers, academics and non-academics, theorists and politicians, it does seem to me that one could find another dividing line which cuts through all these oppositions. It is the line that

> separates a philosophy of experience, of sense and of subject and a philosophy of knowledge, of rationality and of concept. On the one hand, one network is that of Sartre and Merleau-Ponty; and then another is that of Cavaillès, Bachelard and Canguilhem. In other words, we are dealing with two modalities according to which phenomenology was taken up in France, when quite late—around 1930—it finally began to be, if not known, at least recognized. Contemporary philosophy in France began in those years.[9]

What is striking about this Foucauldian account, aside from the intricate bond it posits between French epistemology and German phenomenology, is that it treats the appearance of French epistemology not as a novel event in the history of philosophical discourse but as one "moment" of a larger dialectic of history whose logic is operative well before Husserl's visit to Paris in 1929. This larger dialectic, which contains historical epistemology as one of its stages, is the dialectic of Enlightenment rationality that is born in the 18th century, when "Mendelssohn and then Kant tried to answer in 1784 in the *Berlinische Monatschrift* [the question]: Was is Aufklärung? (What is Enlightenment?)."[10]

The Enlightenment project, that splendid escape to freedom that is definitive of European modernity and claims to epitomize reason's triumphant power, sets in motion a historical movement that reaches "different destinies"[11] in the twentieth century. In Germany, the materialist spirit and social mission of the Enlightenment project stand out as its two most significant motifs and, so, its legacy is carried on in the form of a "historical and political reflection on society"[12] that extends "from the Hegelians to the Frankfurt School and to Lukács, Feuerbach, Marx, Nietzsche and Max Weber."[13] In France, however, it is not the social interest of Enlightenment thinking but its rationalist-scientific alignment that comes to the fore as its most important attribute. Therefore there is a second Enlightenment destiny that unravels through the philosophically modulated approach to the "history of science" one detects in "works such as those of Koyré, Bachelard [and] Canguilhem."[14] For Foucault, then, French historical epistemology is a neo-rationalism with roots in Mendelssohn and Kant as much as it is an anti-subjectivism anchored in a particular interpretation of Husserl's work. But, in the end, it is the deep history of Enlightenment rationality and not simply the intervention of phenomenology that explains the emergence, from the 1930s to the 1960s, of a characteristically "French" approach to epistemology.

Husserl's visit in 1929 is merely the event that precipitates the Enlightenment's realization of its "French" destiny.

In *The Adventure of French Philosophy* (2012), Foucault's friend and interlocutor, Alain Badiou, gives us an account of French epistemology that locates its origins not in the tension between "two modalities" of phenomenological thinking that surface in Paris after 1929 but in the tension between "two contrasting currents" that come to dominate French thought during the first two decades of the twentieth century. According to Badiou, a "fundamental division […] occurred within French philosophy at the beginning of the 20th century,"[15] a division that left philosophy torn between "the philosophy of vital interiority" founded in 1911 by Henri Bergson and the "philosophy of the mathematically-based concept" formulated by Léon Brunschvicg in 1912.

> From the start of the century, French philosophy presents a divided and dialectical character. On one side, a philosophy of life; on the other, a philosophy of the concept. This debate between life and concept will be absolutely central to the period that follows. At stake in any such discussion is the question of the human subject, for it is here that the two orientations coincide. At once a living organism and a creator of concepts, the subject is interrogated both with regard to its interior, animal, organic life, and in terms of its thought, its capacity for creativity and abstraction. The relationship between body and idea, or life and concept, formulated around the question of the subject, thus structures the whole development of 20th-century French philosophy from the initial opposition between Bergson and Brunschvicg onwards.[16]

At its core, this "debate between life and concept" is a dispute about epistemology. For Bergson, the foundation of epistemology is subjectivity because our faculty of intuition (dislodged from the Kantian frame it acquires in the "Transcendental Aesthetic") gives us access to duration as the ultimate ground of concept formation. In *Matter and Memory* (1911), *Creative Evolution* (1911), and *The Creative Mind: An Introduction to Metaphysics* (1946), Bergson contends that through a proto-Cartesian exercise of introspective reflection, the human mind can reach the fundamental truth of its own existence—namely, the fact that the essence of mind is pure temporality, that mind exists and subsists as pure duration (French, *durée*) in time. By tapping into this sphere of lived time, Bergson argues, the intellect "touches something of the absolute"[17] in the form of the *élan vital* of life. This vital energy or impulse is the engine of all concept-formation, the horse that pulls the cart of human knowledge. For Brunschvicg,

on the contrary, subjectivity cannot be the real founding term in epistemological inquiry because the knowledge relation is not completed or actuated by the subjective faculties, such as intuition. Rather, it is the objective historical development of scientific discourse, what in *Les étapes de la philosophie mathématique* (1912) Brunschvicg dubs "the history of scientific thought" and its "conditions of formation and development"[18] that ground the genesis of ideas and serve as epistemology's starting point. Here, epistemology is not pulled from the front by the metaphysical vigor of a conquering subject that manages to make contact with a new version of the absolute, but from the back by the compelling force of science's byzantine past.

According to Badiou, Brunschvicg's intervention "on the eve of the Great War" makes possible a new way of thinking in the Third Republic that lays out in the open the meta-epistemological foundations upon which Bachelard, Canguilhem and Foucault build the apparatus that today goes by the name of "historical epistemology." By relinquishing the Bergsonian commitment to the primacy of lived experience and replacing it with the affirmation of the historicism of knowledge (especially scientific knowledge), Brunschvicg disseminates a view of history, conceptuality and objectivity that, under the influence of a new generation of thinkers, morphs into the philosophy of the concept. So, it is not the man who spearheads phenomenology's debut in France in 1929 (Husserl), but the man who officially invites him to the Sorbonne (Brunschvicg) that throws the gate open for the emergence of historical epistemology in France.[19]

But after outlining this micro-history of historical epistemology and, as Bruno Bosteels puts it, "generalizing [the] great dividing line" of French philosophy already instituted by Foucault in the "Introduction" to Canguilhem's *NP*, Badiou, echoing Foucault's strategy once more, jams this micro-history into a larger historical dialectic that pre-dates the twentieth century—not the dialectic of Enlightenment rationality, but the dialectical tension between the philosophy of life and the philosophy of number that erupts in Europe first in antiquity (in the period extending from Parmenedes to Aristotle) and then again in modernity (in the wake of Descartes's philosophy of subjective immanence). In the same way that Foucault begins by tracing the origins of historical epistemology to the early twentieth century

and concludes by pushing the chain of historical causality back to the German setting of 1784, Badiou first pinpoints the origins of this tradition to the years leading up to the irruption of WWI and then pushes his causal account back in time, all the way back to 1637, the year Descartes's *Discourse de la method* hit the press. "We could," Badiou writes "take the quest for origins further back and describe the division of French philosophy as a split over the Cartesian heritage. In one sense, the postwar philosophical moment can be read as an epic discussion about the ideas and significance of Descartes, as the philosophical inventor of the category of the subject. Descartes was a theoretician both of the physical body—of the animal-machine—and of pure reflection."[20] Perhaps unbeknownst to him, Descartes's writings were as divided as the metaphysical substances mentioned in them for they imagined the subject as both animal (life) and thinking substance (number).[21]

Although Badiou does not explain his position in great detail, his point seems to be that Descartes raises, but leaves unresolved, the status of subjectivity. Surely, the *res cogitans* stands as a thinking substance that reaches, vis-à-vis the method of doubt, the indubitable conclusion that "I think, therefore, I am." But, Badiou asks, in precisely what sense is the "I am" elocution to be interpreted? Is the "I am" a testament to the fact that "I live"? Or is it an indicator that "I conceive"? What is the essence of the meditative cogito that represents, for Descartes, the most simple of natures? And what is the meaning of the verb *to be* within the framework of radical doubt? That Descartes, whom Badiou elsewhere describes as the "master of all French philosophers,"[22] fails to deal with the question of what the cogito *is* at the very moment it asserts its existence as a necessity that follows from the fact of thinking—that Descartes fails in this regard suggests that the first "clear and distinct idea" of the Cartesian enterprise is actually rather *un*clear and *in*distinct. This drastic imprecision, according to Badiou, introduces a scission into modern philosophy between philosophies of life (living) and philosophies of number (conceiving) that climaxes in the opposition, circa the 1920's and '30s, between Bergson's philosophy of interiority and Brunschvicg's philosophy of conceptuality. And it is around this opposition that all twentieth century philosophical discourse, including French historical epistemology, organizes itself. "To deploy Kant's metaphor of philosophy as a battleground on which we are all the more or less exhausted combatants:

during the second half of the 20th century, the lines of battle were still essentially constituted around the question of the subject," Badiou states.[23]

A Wrong Turn From History to Mega-History

Foucault's and Badiou's genealogies are illuminating reports about the rise of the philosophy of the concept. But they suffer from an intolerable shortcoming. Both figures formally take note of the fact *that* circa the 1930s a new way of doing epistemology is born in France (thanks to the French uptake of Husserl's phenomenology the case of Foucault, and as a consequence of Brunschvicg's objectivist philosophy of knowledge in the case of Badiou). Yet, neither explains *why* this style of epistemological inquiry appears at this precise historical moment. Why do the writings of the most famous French epistemologists from this period (Cavaillès, Bachelard and Canguilhem) surface in the Parisian atmosphere of the 1930s, '40s and 50's, roughly at the same time as the formalist revolution in logic and mathematics (Hilbert) and the turn to structuralism in linguistics and anthropology (Saussure, Lévi Strauss) rather than, say, in the 50's and '60s alongside the existentialist movement (Sartre, Beauvoir, Levinas) or in the '70s, '80s and '90s apace with Yale-style literary theory (Derrida, Barthes, Lyotard)? Why, in other terms, does the "philosophy of the concept" begin oozing out of the walls of the Sorbonne at the exact moment that philosophical reason is fighting to come to terms with it transition from a nineteenth- to its twentieth-century cast?

Surely Foucault will answer "Kant's Enlightenment!" much like Badiou will answer "Descartes's Cogito!" But here I worry that by subsuming the history of historical epistemology under such massive, trans-centurial meta-narratives that reach back to Kant and Descartes, Foucault and Badiou lose sight of the temporal specificity of their object and end up obscuring what they hope to elucidate. Notice that both make the same encyclopedic maneuver. They first craft a micro-history of the philosophy of the concept that (correctly) "dates" it to the 1930s. And then, *bam!*, they cram this micro-history into a long and protracted logic or dialectic of history that contains it as one of its "moments" or "stages." In so doing,

they purge historical epistemology of all historical specificity and of any sense of urgency and reduce it, whether intentionally or not, to a moment of historical *déjà vu*.

Now, I do not deny that the refrain of Enlightenment rationality and the status of subjectivity are important themes for Bachelard, Canguilhem and Foucault. Indeed, I see these as all-important. (In Chapter Three, I explore these thinkers' understanding of the relationship between subjectivity and synthesis and Chapter Five lay out their shared theory of rationality.) Nevertheless, it is erroneous to assume, as Badiou and Foucault both do, that historical epistemology has no goal or mission other than that of reciting, in a new voice, the lines of an old argument or reenacting, in a new stage, the scenes of an old philosophical feud. Surely, historical epistemology is a response to a "crisis." And surely, this crisis is tied to an unresolved tension or dilemma, as Badiou affirms. But this crisis and this tension are not the ones precipitated by Descartes's life/number dualism or by Kant's injunction against self-incurred tutelage. The crisis and the tension that set the stage for the birth of historical epistemology in the middle of the twentieth century are *the crisis in the theory of knowledge* and *the tension between scientific and philosophical reason* that erupted in Europe at the end of the nineteenth century.

This crisis and this tension, as I show below, revolved around two predicaments: (1) how to understand the explosion, from the 1830s onward, of positive (i.e. scientific) knowledge and (2) how to understand philosophy's relationship to both history and science. By time Bergson and Brunschvicg are penning their famous works on the eve of the Great War and by the time Husserl is speaking to a captivated French audience at the Sorbonne almost two decades later, these predicaments have already saturated the philosophical imaginary and determined, to a large degree, the direction and orientation of thought in the twentieth century. Historical epistemology must be interpreted as a reaction and response to this development. Its historical sense of urgency and its historical specificity are both tied to it.

The Nineteenth Century in Ruins

In *Knowledge and Human Interests* (1968), Habermas argues that the life of modern philosophy from Kant to Hegel hinges on the theory of knowledge. Modern philosophy, in other words, consumes itself in the task of elaborating a theory of knowledge that satisfies three fundamental demands:

1. *The demand for comprehensive unity*. Against the ancient position that philosophy concerns itself primarily only with a specific kind of knowledge (knowledge of first principles), modern epistemology sets for itself the resplendent goal of explicating the formation and constitution of all possible knowledge, including knowledge accessed through pure, practical and reflective judgment. In the modern period, knowledge is one in the sense that all knowledge claims can be accommodated into a catholic theory of knowledge that leaves sphere of human life outside its dominion.

2. *The demand that scientific knowledge be included in philosophy's object-domain*. Although philosophy understands itself to be "science" throughout much of the seventeenth and eighteenth centuries, it nonetheless posits a difference between the knowledge it creates and the knowledge produced by the positive sciences. More than simply marking the site of a dissimilitude, this difference marks the site of a bifurcation insofar as modern philosophy treats science (as much as morality, aesthetics and even politics) as provincial and derivative modes of reasoning that are explained and justified only by the unconditioned reasoning of philosophy. Philosophy is to science as *explanans* to *explanandum*.

3. *The demand that philosophy be both sovereign and legislative relative to its objects*. From Descartes to Kant to Hegel, the idea that philosophy commissions philosophical truths that cannot be refuted or contradicted by non-philosophical knowledge is prevalent, and so is the notion that non-philosophical disciplines receive these truths not actively (as equals in a bidirectional dialogue) but passively (as subordinates in a medieval adoubement). As the queen of the sciences, modern philosophy decrees norms to which the sciences can only conform and through which alone they can exist.

Modern philosophy up to Hegel's time, therefore, is essentially circular. It defends its right to be sovereign on the grounds that knowledge is one and that only philosophical reason can explain all its manifestations, and it defends its claim that knowledge is one and that philosophy explains it on the grounds that knowledge can be unified through a normative meta-language that philosophy itself commissions. But this circularity is broken in the late nineteenth century. The spirit of positive philosophy promulgated first by August Comte and later by Ernst Mach "liquidates," according to Habermas, epistemology as a theory of knowledge a la Hegel. With its turn away from classical epistemology to positivism, philosophy "leaps" over the requirements of a robust theory of knowledge

and cedes the very right that, from 1781 to 1867 or so, it has majestically arrogated for itself with the help of transcendental inquiry. Under the weight of the positive, philosophical discourse is displaced from its legislative and normative role and recast as what Habermas can only describe as a "pseudo-normative regulation of established research."[24] Whereas before its purpose was to generate the highest form of knowledge available to the human species, under the positivist revolution philosophy restricts itself to the menial function of describing, organizing and systematizing the factual-empirical knowledge secreted by the natural sciences.

> Positivism marks the end of the theory of knowledge. In its place emerges the philosophy of science. Transcendental-logical inquiry into the conditions of possible knowledge aims as well at explicating the meaning of knowledge as such. Positivism cuts off this inquiry, which it conceives as having become meaningless in virtue of the fact of the modern sciences. Knowledge is implicitly defined by the achievement of the sciences. Hence, transcendental inquiry into the conditions of possible knowledge can be meaningfully pursued only in the form of methodological inquiry into the rules for the construction and corroboration of scientific theories.[25]

Comte's claims in Volume One of the *Course on Positive Philosophy* (translated by Harriet Martineau as *The Positive Philosophy of Auguste Comte*) that metaphysics is an "absurd" fancy that adds nothing to our stock of knowledge and that "it is only by the thorough observation of facts that we can arrive at the knowledge of logical laws"[26] represent clear evidence that positivism is bent on replacing the epistemological self-understanding of modern philosophy with a gaunt philosophy of science in which the meaning of knowledge is reduced to "what the sciences do."[27] In this framework, any inquiry into the faculties and capacities of the knowing subject—which, for the moderns, secure the universal genesis of the knowledge relation—is replaced by a social-scientific reflection on the process of research itself.

> The [positivist] philosophy of science renounces inquiry into the knowing subject. It orients itself directly toward the sciences, which are given as systems of propositions and procedures, that is, as a complex of rules according to which theories are constructed and corroborated. For an epistemology restricted to methodology, the subjects who proceed according to these rules lose their significance. Their deeds and destinies belong at best to the psychology of the empirical persons to whom the subjects of knowledge have been reduced. The latter have no import for the immanent elucidation of the cognitive process. The obverse of this restriction is the development through which logic and mathematics become independent, self-sufficient formal sciences, so that henceforth the problems of their foundations are no longer discussed in connection with the problem of knowledge.[28]

The effects of positivism's usurpation of the place once occupied by the idealist theory of knowledge are that the sciences become "immunized" against the critical and phenomenological prescriptions of philosophy and that epistemology, once the bastion of modernity, is reduced to an empty objectivism that says nothing of value about how knowledge is possible in the first place. In Comte's "ontology of the factual," where facts reign supreme, the one fact left unexplained is paradoxically the fact of knowledge itself, the fact that knowledge *is*. In the aftermath of the positivist eruption, once positivism "knocks the bottom out of [metaphysics],"[29] there is only one outcome of philosophical concern: "the meaning of knowledge itself becomes irrational."[30]

While I take Habermas's historically oriented diagnosis of modernity as conclusive, I would like to controvert it on two points. First, as a point of clarification, one should be aware that the legislative function of modern epistemology is executed through a very specific philosophical maneuver—the construction of a second-order meta-language that issues, through logico-transcendental analysis, the philosophical norms that regulate our first-order judgments about the sensible world. And it is conformity or unconformity with these philosophical norms—which, according to Webb (2013), always come "from above"[31]—that determines the firmity or infirmity of non-philosophical knowledge, especially scientific knowledge. If after Hegel the theory of knowledge is annihilated in favor of a philosophy of science guided by positivist dogma, this is because post-Hegelian developments make unthinkable what since Kant had been the linchpin to the philosopher's self-understanding, i.e., the enunciation of such a normative meta-language upon which both the philosopher's unifying function and legislative resolve depend.

In Kant's critical philosophy, for instance, the justifiability of science depends not on whether or not our representations conform to the objects posited by science, but—and I take this to be pivot point of the Copernican Revolution—on whether the objects posited in scientific judgment conform to our way of representing them. In *Kant and the Philosophy of Science Today* (2009), Michela Massimi explains: "from a Kantian perspective, we gain scientific knowledge of nature by subsuming appearances under the

a priori concepts of the understanding. Our scientific knowledge of nature is then confined to phenomena intended as objects of experience, i.e. as conceptually-determined appearances."[32] True, Kant brings about this upheaval in epistemology by extracting or distilling *from* the sciences (especially Newtonian mechanics) certain suppositions that are then re-casted as the necessary and universal conditions for the constitution of all possible objects of experience and, therefore, of experience itself. In this regard, one could well say that Kant begins not by legislating philosophical truths *to* the sciences, but by presupposing the legitimacy of scientific judgments and then building an edifice from them. But there is a real sense, already in the Kantian text, that this operation of extraction that founds reason's architectonic is more than just an audit of science's conceptual assets. Above all, the Kantian extraction is an anointment that sanctions and codifies as statutory that which, for the sciences, only exists by force of fact. Where science finds only fact, philosophy gives norms. Once scientific suppositions are reinvented as philosophical norms, they acquire an extra-scientific aura that no science (even the Newtonian physics that inspired them) can disengage. Should science ever contravene the norms laid out in a philosophical meta-language, Kant would most certainly say, then all the worse for science! In the "Preface" to the second edition of the *Critique of Pure Reason* (1781), Kant argues that if human reason wants to be taught by nature, it must first be taught by the queen of the sciences and learn from it how to approach nature with an armature of "principles" that the queen herself makes available for reason. "This," Kant writes, "is how natural science was first bought to the secure course of a science after groping about for so many centuries."

The birth of a new historical consciousness in the nineteenth century complicates this Kantian theory of knowledge without, however, upsetting its most fundamental intent. Hegel, that imponderable German philosopher who claims to be historical consciousness as such, worries that the norms of the Kantian theory of knowledge bears, all too visibly, the a-historical sensibilities of its eighteenth century origins and needs to be surpassed by a new theory that opens itself up to the provocation of history and time. In *Kant and the Nineteenth Century* (1975), W. T. Jones and Robert J. Fogelin argue that, for Hegel, the torpidity of Kant's "synoptic table" threatened to bring about the dissolution of the theory of

knowledge because the categories laid out on it are incapable of change and thus inadaptable to the needs of each historical moment. Being indistinguishable from "the pigeon-holes into which the postman tosses each day's accumulation of letters and packages,"[33] the norms of the Kantian meta-language are simultaneously too abstract (not concrete) and too concretized (intractable). And even if they, for the pure sake of argument, justified the rational status of scientific knowledge *at the level of its possibility*, they failed to do so *at the level of its actuality*. Actual knowledge grows. It changes and expands with the ebb and flow of phenomenal and historical time, and any theory of knowledge that wants to hold on to its legislative rights must be able to accommodate, from within itself, this historicity. With its adamant inflexibility, Kant's theory might succeed at denying knowledge "in order to make room for faith." But it fails horribly at making room for history. And this radical failure forecloses more than the relationship between philosophy and history; it forecloses also the very possibility upon which epistemology itself depends—the possibility of education. In the first *Critique*, and this is Hegel's charge in the *Phenomenology of Mind*, there is nothing new under the sun; what has been will be again, what has been done will be done again. And this means that, in the critical philosophy, there is no avenue for the education of consciousness since consciousness will find nothing in the realm of experience other than what it itself has put into it. This suppression of the shock of the new robs experience of the right to surprise reason and renders the content of experience constitutionally incapable of shaking up the formalism of *raisonnement.*

In spite of his anti-Kantian approach to epistemology, however, Hegel leaves intact the kernel of the Kantian project. He agrees with Kant that philosophy's mission is to construct, guided by metaphysics, a normative meta-language to which all forms of knowledge, including scientific knowledge, are beholden. The only difference is that the subject of knowledge (now conceived as "Spirit") is regarded as capable of changing the categories of thought through experience. Yet, in Hegel's work the "moments" in which Kantian categories are subjected dialectical overturns themselves become the philosophical norms or "rules for thinking"[34] over and against which scientific knowledge and scientific history are measured. Indeed, the advancement of consciousness through these ideal moments

or stages becomes a meta-norm or meta-directive that Hegel depicts as the logical development of "the Concept" (das Begriff). The logic of experience outlined in the *Phenomenology of Spirit* and the logic of logic drawn in the *Logic* act as normative horizons within which scientific ideas, judgments, theories and discoveries are to be evaluated. Particular sciences are "rational" only to the extent that their concepts and attitude reflect this directive's mode of coming to terms with itself.

The Kantian legalism of the Hegelian standpoint is evident in Hegel's philosophy of nature. Posch (2004) states that Hegel's position concerning the acquisition of knowledge of nature is that only philosophy, interpreted as the act of witnessing the dialectical movement of what is (i.e. "the Concept"), can truly comprehend nature and, for this reason, only it can legislate norms for knowledge. Similarly, in his 2010 "Introduction" to Hegel's *Philosophy of Nature* (1817), M.J. Petry contends that Hegel's *Naturphilosophie* bands together the descriptive methodology of phenomenological discourse and the normative edge of a catholic theory of knowledge in order to give a notional or conceptual account of the phenomena and show that the history of science must be interpreted as the development of the Concept in its external garb as nature. Thus, the normative meta-language that Kant articulates in terms of categories and congeals into the unity of a table, Hegel articulates in terms of conceptual moments (Terry Pinkard calls them "essential moments") and congeals into the unity of a teleology. In both cases, the modernist desire to unify all knowledge under a normative discourse furnished by metaphysics rules the scene.

But with Hegel's philosophy of the concept the theory of knowledge makes its last stand. In *Reason in the Age of Science* (1979), Georg-Hans Gadamer argues that "Hegel was the very last to dare to defend in his thinking the proud claim of philosophy to be the framework and comprehensive totality for all possible human knowing. To the extent that this was attempted after Hegel, it occurred within the academic horizon of the schools on the part of professors of philosophy and was no longer world historical reality it had been in the visage of professor Hegel of Berlin."[35] The crisis that erupts in epistemology on account of Comte's positivism and leaves the nineteenth century in ruins is that positive doctrine bars philosophy's normative motivation and makes obsolete the philosophical norms previously commanded by the thrust of critique and the movement of phenomenological description. The only norms

recognized as legitimate by the age of positivism are the non-philosophical norms of scientific research and procedure, those rules for the regulation of feedback-controlled action that would reach a climatic point in Karl Popper's *The Logic of Scientific Discovery* (1934). All other norms disappear from the philosopher's vocabulary as elapsed remnants of a bygone stage of human history, the stage that Comte describes as "metaphysical."

I emphasize the role second-order, philosophical meta-languages play in the liquidation of the theory of knowledge because this way of framing the event of "the death of German idealism" allows us to better understand the transition from 19th to 20th century philosophy and, concomitantly, the rise of French historical epistemology circa the 1930s. But before I turn to this transition, I would like to add a slight corrective to the Habermasian account of how this liquidation came about. According to Habermas, the crisis in the theory of knowledge was a solely intra-philosophical affair. "Philosophy was dislodged from [its] position by philosophy," he writes. On this point, I contend, Habermas is mistaken. Surely, the historical transition from Kant to Hegel to Comte is affected by developments internal to philosophy, especially the rise of post-Hegelian modes of thought such as the materialism of Feuerbach, Marx and Engels, the *naturphilosophie* of Schelling, the philosophy of existence of Kierkegaard and Schopenhauer's philosophy of the will. But philosophers alone do not determine the future of philosophy. Extra-philosophical factors—sometimes political, sometimes anthropological, sometimes economic—act upon philosophy. Sometimes they help form it. But sometimes they reform and deform it as well.

The liquidation of the theory of knowledge is an example of a philosophical development that does not come about by philosophical causes alone. Two extra-philosophical that contribute to it and that are completely overlooked by Habermas's philio-sophical account are the compartmentalization of knowledge brought about by the birth of the German university system and the explosion, from the 1840s to the 1920s, of a series of scientific revolutions whose empirical consequences outstripped philosophical conceptions of the bounds of "possible" knowledge. Both of these sociological events conspire with changes in philosophical outlook to barricade the dreams of classical epistemology and disengage its theory of knowledge.

The Sociological Scaffolding of the Crisis: The German University

In an entry for the third volume of Walter Ruegg's *History of the University in Europe* (2004), Christophe Charle argues that the logic of professionalization and specialization that has come to dominate the academic system in the 20th and 21st centuries is merely the long-drawn consequence of the Prussian education model promoted in the early-to-mid 1800s by the philosopher and state functionary Wilhelm von Humboldt, brother to the famous naturalist Alexander. According to Humboldt, whose philosophy of education is built on the Enlightenment philosophy of Friedrich Schleiermacher and the humanist ideal of self-formation (*Buildung*), universities should be sites for the cultivation of free, critical thought. They should be subjected only to the most minimal level of state intervention and their structure should be modeled after the classical image of the tree of knowledge, with Aristotle's idea of humans' nature desire for knowledge as the core and a series of specialized branches of scientific inquiry emanating from it. This approach is first embodied in the governance system and structure of the University of Berlin.

Although at the start of the nineteenth century Humboldt's approach is only popular within the German context and appears to be overshadowed outside this context by the Napoleonic model of education born out of the First French Republic, by the last third of the nineteenth century this model overtakes the French one as the preeminent standard for learning on the continent. Perhaps on account of its less militaristic and interventionist philosophy or perhaps because of its more liberal policies, by the middle of the nineteenth century the Humboldtian approach "bore fruit" and took root in western Europe. In the "Introduction" to the aforementioned text, Walter Rüegg writes:

> While, at the beginning of the century, Paris had been a Mecca for scholars and scientists from all over the world, from the 1830s the French Government sent representatives to Germany to enquire about progress in higher education. In the same way, young French people, as well as Americans later on, trained at German universities in the new scientific methods. From the end of the nineteenth century, the German model represented the modern university not only in Europe, but also in the United States and Japan.[36]

This shift from Napoleon's France to Friedrich Wilhelm IV's Prussia has significant consequences. It makes Berlin rather than Paris the epicenter of intellectual life in Europe and facilitates the spread of German philosophy and literature throughout the continent. It enables, in other words, the Germanization of European thought. At the time, it ramps up cultural production within Germany, setting the stage for what historians of ideas call "the Golden Age" of German philosophy and literature—the age of Novalis, Rilke and Schopenhauer.

But this shift, which is as much about the Germanization of Europe as it is about the institutionalization of philosophy, also alters in radical ways the conditions for philosophical thought. And many philosophers experience it rather negatively, as an assault on their life activity. For post-Kantian philosophers, philosophy is the very consecration of human thought, and its splendor emanates from the fact that, unlike the other sciences, it does not deal with objects but is the science of knowledge itself (*Wissenschaftslehre*). The rise of the university system, which subsumes philosophy under it as one of its "discipline," changes the meaning of philosophy and lacerates the philosopher's inflated sense of self-importance. With the march of the new university, what had once been the world-historical mission of the philosopher (or, perhaps more accurately, the self-understanding of the philosopher as a world-historical figure) turns into a practical occupation that unfolds within a pre-established institutional infrastructure, under the auspices of the state. No longer the *daimonic* "Wise Man" referenced by Hegel in *The Philosophy of Right* (1821)—i.e., no longer that prophetic silhouette that, perched at the zenith of history, stands proudly akimbo—the philosopher is now a mere employee, a worker whose most pressing duties are no longer to Spirit, Nature or Being but to the institution that houses him, its students and his research agenda. This is why Gadamer contends that "to the extent" that philosophers in the second half of the nineteenth century still take up the perennial philosophical questions—such as the problem of the possibility of knowledge—, this is done from "within the academic horizon of the schools on the part of professors of philosophy." In this sense, it really is Hegel, rather than Nietzsche, who is the "last metaphysician" since after his death one can no longer speak of "philosophers," one can only speak of professors of philosophy. In 1895, the philosopher Friedrich Paulsen voices this fear by lamenting that at

the close of the nineteenth century in Germany, the "age of absolute philosophy has been followed by an age of absolute unphilosophy."[37]

But it is not only the philosopher's grandiose *imago* that is put under pressure by the institutionalization of knowledge. The philosopher's vocation also suffers a blow. By separating various types of inquiry into different fields, departments, disciplines and areas of specialization, the university system promotes a sense of "particularism" that calls into question philosophy's bid to unify all possible human knowledge under the auspices of a complete epistemological framework. By the late 1800s, the compartmentalization of knowledge has set in motion a process of epistemic balkanization that signals the fundamental dis-unity of knowledge and broadcasts the end of idealist epistemology. As new disciplines are born and as existing ones make more and more sophisticated claims to methodological and conceptual autonomy, questions begin to surface about whether knowledge is, in fact, a "unity" (as philosophers historically assumed) and whether it can be "unified" under a totalizing, genetic theory of the Kantian and Hegelian varieties. Even under the assumption that some form of unity remains within the reach of the thought process, it is unclear whether the philosopher is, so to speak, the right person for job since the philosopher, qua professor, has become just one scientist among many. And how could the whole be unified from the standpoint of one of its parts? Previously philosophy's doing, mereology (the study of wholes and parts) becomes philosophy's undoing.

The politics of the university do not bring about the dethroning of epistemology by themselves. What historians call the "Second Scientific Revolution" is also a factor to consider. The second scientific revolution is a period of European history, spanning roughly from the 1830s to the 1920s, in which science acquires unparalleled cultural capital and becomes a central determinant of the human condition, affecting every major aspect of social life from agriculture, technology and law to religion, medicine and communication. In *Science and Industry in the Nineteenth Century* (2005), John Bernal shows that during this historical period science acquires so much social relevance that is becomes difficult, if not impossible, to "disentangle science from the social and economic factors with which it is entwined."[38]

More than a "part" of the social totality, science comes into its own as the dominant thread by which the whole social fabric of nineteenth century life hangs.

The Scientific Scaffolding of the Crisis: Science's Revolt

> "The development of the sciences is as the same time their separation from philosophy and the establishment of their independence"
>
> -Martin Heidegger[39]

More than anything else, however, what makes this epoch stand out as "the age of science"[40] is that it bears witness to a succession of revolutions that shatter the classical frame of almost every branch of positive science, from mathematics, biology and chemistry to geology, physics and logic.[41] In 1830, for instance, Nikolai Lobachevsky sets the world of pure mathematics on fire by inventing non-Euclidean geometry through the axiomatic suspension of Euclid's famous "fifth postulate." And a year later, with his discovery of electromagnetic induction, Michael Faraday sets the groundwork for the birth of the science of electromagnetism, which overturns the strictly mechanical view of the world that prevailed in physics since the time of Gassendi, Newton and Galileo. Similar changes follow Darwin's articulation of the theory of evolution through natural selection, the birth of statistics, the creation of non-Aristotelian logics, the rise of post-Lavoisian chemistry and the emergence of Louis Pasteur's germ theory of disease. Much like the university system's rhetoric of specialization and research that made them possible, these revolutions destabilize philosophy from without and call into question one of the central tenets of modern epistemology—the idea that epistemology's business is to adopt a legislative attitude toward the sciences.

These discoveries bulldoze over many of the epistemological norms decreed by philosophical meta-languages. In direct defiance of philosophy's self-appointed legislative authority, new scientific discoveries disfigure philosophical conceptions of "time," "space," "substance," and "causality"[42] and show speculative thought to be incapable of accommodating the latest achievements of the positive sciences. Kant's contention in the "Transcendental Aesthetic" that time are space distinct forms of intuition, for instance, breaks down in the face of Einstein's theory of special relativity, and the necessity

of his categories (especially the category of substance) degenerates under the pressure of new chemical knowledge.[43] Similarly, Hegel's account of the ideal progression of mind in the *Phenomenology* is out of joint with the actual historical development of science and his understanding of scientific concepts such as "number" and "matter" in the *Logic* puts his philosophy at odds with what the Neo-Kantian philosopher Ernst Cassirer calls "the immanent progress of the sciences."[44] In "The Heritage of Hegel," Gadamer argues that, much like the Kantian architectonic, the Hegelian dialectic, amenable as it is to the idea of historical change, "had little chance of escaping the resistance of historical research."[45]

And it is not only particular philosophical norms that are breached by the steady march of positive knowledge. It is the whole character of philosophy that is put on trial. The upheavals in scientific knowledge that appear during the age of science instigate a wholesale Copernican revolution in thought comparable to those of Copernicus in astronomy and Kant in epistemology. In the sixteenth century, Copernicus showed that it is not the heavenly bodies that revolve around the spectator but the spectator who revolves around the stars. Two centuries later, the epistemologist from Königsberg tried to show that it is not our intuition that revolves around objects but objects that revolve around our intuition. In a similar way, what the second scientific revolution of the nineteenth century tells us is that it is not scientific progress that revolves around philosophical norms but philosophical norms that must revolve around the fact of scientific progress. Epistemological normativity is a byproduct of scientific not philosophical reason. And this means that philosophers have to fit their *de jure* judgments about the nature and limits of knowledge to the *de facto* advancements of scientific discourse and justify themselves before the bar of science, rather than the other way around. By the time the nineteenth century comes to a close, Gadamer writes, philosophy has lost its status as the source of legitimation and "has come to need legitimation in the face of science in a way that had never been true before."[46] With this emancipation of science from philosophy, the latter loses its legislative identity and abandons the project ascribed to it by the theory of knowledge—the project of unifying all possible knowledge through the erection of a normative meta-language. Philosophy then flees from an epistemology firmly rooted in idealism and rushes headfirst into a philosophy of science acquiescent to positivism.

We see, then, that Habermas is right in thinking that modern epistemology meets its end after Hegel's death in 1831 and in asserting that this event is precipitated by the rise of positivism in France. But he is off-target in attributing this event to philosophical causes alone. Yes, modern epistemology runs into a wall with positive philosophy. But this is only one of the factors that spawn the crisis in the theory of knowledge and cause the siege of epistemology by the philosophy of science at the start of the twentieth century. I argue that two other factors bring the nineteenth century to this impasse: 1) the dis-unification of knowledge produced by the structure of the German university and 2) the onslaught of scientific revolutions that, from the 1840s to the 1920s, flout the most basic categories of traditional epistemology and that in course of a few decades turn topsy-turvy philosophy's place in the world and leave the philosopher on unfamiliar terrain. These events, in turn, impact the self-understanding of philosophy as it gears up to transition from the nineteenth to the twentieth century.

Philosophy's Entry into the Twentieth Century—An Infelicitous Start

> "The crisis of idealism comes at the same time as a crisis in philosophy's pretensions to totality"
> -Theodor Adorno[47]

In my interpretation, what Köhnke (1991) calls "the death of German idealism"[48] is caused by three equiprimordial factors: the birth of Comtean positivism, the spread throughout the European continent of the German university model of education and the eruption of the second scientific revolution. These factors, which are intricately inter-connected, problematize what Theodor Adorno calls "philosophy's pretentions to totality" and bring about the "decapitation"[49] of philosophy and the "liquidation"[50] of the philosophical concept of knowledge. While I contend that it is more accurate to think of this as the death of the philosophical norm (or the "death of the concept"), what matters is that this historical event be grasped in its full significance as the moment philosophy relinquishes its post as the source of normativity and clears the way for the positive sciences to ascend to a position of self-determination. What matters, in other words, is that the death of German idealism be recognized as the

site of a Second Enlightenment—the epoch in which science releases itself from its self-incurred philosophical tutelage and gives itself the norm.

Unfortunately, while this Second Enlightenment infuses science with an intoxicating feeling of freedom and boundlessness, it leaves philosophy in an abject state of privation in which all the latter can do is ponder the infelicitous question of its own existence. The almost incredible success of the sciences—i.e., the rapidity of their growth, the verifiability of their results and the success of their methods—is so significant that, as Gutting (2005) points out, "the question gradually [arises] of what, if anything, there remain[s] for philosophy to do."[51] If it cannot unify or legislate, what can philosophy do? How might it justify itself? In the late 1800s, while still processing the improbable fact of its own abrogation, philosophy has no yet developed the theoretical resources needed to think through the question of its own justification, of its *raison d'être*. Dejected and crestfallen, all it can when called upon to defend its status as a discipline is lower its previously willful gaze and watch helplessly as the spectacle of history washes over the memories of its once illustrious past.

But if in acknowledging science's capacity for epistemic self-rule this second Enlightenment brings about the crisis of idealism that strips philosophy of legislative attitude, in exposing the profoundly historical nature of scientific rationality it brings about an even more acute crisis in positivism that denies the latter the internal consistency it claimed for itself. What the many scientific discoveries and revolutions of the late nineteenth and early twentieth centuries reveal is that at the same time as the research process occasions the genesis of its own normative concepts, it catalyzes the conditions for their very transformation. What science enacts, science can also revoke. This raises serious questions about how scientific normativity and the history of science are to interact. How can scientific judgments be normative (and therefore necessitating) and historicist (and therefore contingent) at the same time? How can the norms science gives itself possess genuine normative content if science overturns itself in sudden, revolutionary jolts? This is the crisis in the theory of science that, in my view, *follows* the crisis in the theory of knowledge. It revolves not around the question of (all) knowledge and its (subjective) genesis, but around the issue of normativity and its place in (scientific) history. Thus, I agree with Habermas that

the death of idealism begets a severe crisis in the theory of knowledge. And I agree with him that this crisis results in a plateaued objectivism that measures the category of knowledge solely by the achievements of the sciences. But I add that this objectivism, the staple of the positive philosophy, undergoes a crisis of its own as it cannot explain the two historical facts upon which its own theory of science depends: (1) the fact that science exhibits the characteristics of a normative dialogue and (2) the fact that it also succumbs to revolutionary change.

The end of the long nineteenth century brings philosophy into a new "situation" in which the latter is transformed. Philosophy no longer stands at the pinnacle of human history, surveying the totality of human life from that impossible perspective that Plato calls "a place beyond heaven."[52] Historical forces pull philosophy down from the lofty heights of its idealist self-understanding (where it exists as a theory of all possible knowledge) and into the trenches of social life (where it can only exist as one discipline among many, as one practice among others). In this new world, the surest sign that an entire age of philosophy has come to pass is the fact that philosophy's most pressing concerns shift and that the problems that once served as its core points of reference give way to a new set of problems that more accurately reflect its new social and historical conditions of actuality.

If the two fundamental questions that vex the philosophical mind in the modern period are "What is knowledge?" and "How is it possible?," the two questions that completely engulf it at the end of the nineteenth century are "What is scientific rationality?" and "What is philosophy's relationship to it?" In their proper form, they can be articulated thus:

(1) The question of scientific rationality: How can scientific rationality be simultaneously normative and historical? And,

(2) The question of philosophy's relationship to it: What should philosophy's duties to, and expectations from, the positive sciences be?

It is through these two questions that philosophy first enters the twentieth century. It is through them that it becomes aware of the need to re-invent itself. And it is through them that all of its new 20th century beginnings are framed. These two questions form the unconscious underbelly of the new age and

constitute the primal scene from which all philosophical thought in the 20th century is born. Again, my suspicion is that these questions—even more than questions about Kant's enlightenment or Descartes's cogito—shape the philosophical, historical and epistemological content of French historical epistemology.

The Seventh Frame—French Historical Epistemology

In the first half of the twentieth century there are seven major philosophical projects, or "frames," that try to address the enigma of how *the normative* and *the historical* collide in *the scientific* and promise philosophy the chance of a new beginning after Comte. These are:

1. Neo-Kantianism (especially the "Marburg School")
2. Phenomenology (Husserl)
3. Logical Positivism (Carnap)
4. Logical Empiricism (Popper)
5. Critical Theory (the "Frankfurt School"), and
6. The Sociology of Knowledge Program (the "Edinburgh School")
7. Historical Epistemology (Bachelard, Canguilhem and Foucault)

Although by no means exhaustive of the intellectual arena at the turn of the century,[53] these schools represent different rejoinders to philosophy's abject condition at the end of the age of science that try to overcome, in diverse ways, the crisis in the theory of science that constitutes the long century's true epistemological legacy. Sadly, the first six of these projects fail to resolve the crisis that provokes and motivates them. Instead of reconciling the unmistakable normativity of scientific judgments and the undeniable historicity of scientific paradigms, which is the most pressing task of thinking after the Great War, these six discourses invent new futures for philosophy by repressing one or another horn of this controversy. Some of them, such as logical positivism, repress the historicity of science for the sake of buttressing its normative claims. Others, such as the sociology of knowledge program, repress its normativity so as to accommodate its historicity. Others still, neo-Kantianism and phenomenology, succeed at the formidable task of repressing both. Either way, most philosophies born in the late nineteenth and early twentieth century prove incapable of resolving the crisis concerning science, history

and normativity that stun the nineteenth century. Most of them these philosophical positions are overwhelmed before this crisis and splintered up by it too. Only historical epistemology, I argue, manages to articulate a theory of scientific rationality in the twentieth century that (i) does not vitiate the rationality immanent to science and (ii) refuses to "save" the historico-normative enterprise of scientific discourse by sacrificing its historical or normative content. Only historical epistemology, in other words, builds a new frame for thought that accommodates the lessons of the long century. (For a closer analysis of the failures of these other six projects, I refer the reader to "Appendix 1—A Century in Frames.")

Like neo-Kantians, phenomenologists and logical positivists, historical epistemologists retain the notion of the *a priori*. Before an epistemic agent can be "constituted in rationality," as Bachelard argues in *AR*, he or she must accede to various "principles of necessity" that give scientific experience its "apodictic character."[54] These principles, however, appear in the works of Bachelard, Canguilhem and Foucault not as subjective categories (neo-Kantians), structures of lived experience (phenomenologists) or relations of logical necessity (logical positivism), but as scientific *concepts* that condition scientific experience and govern the production of scientific knowledge. These "concepts"—not to be confused with subjective "ideas" or "beliefs"—are legislative and epistemological in content and thus, as Bachelard makes clear, exist "above facts."[55] They are epistemic values or norms that help epistemologists evade the glorification of the factual that defines the positive philosophy.

Where historical epistemologists end their alliance with other theorists that also incorporate the notion of the *a priori* into their theories of science is that they (the former) have a curious understanding that does not require (indeed forbids!) the *a priori* from being understood as a-temporal. In French epistemology, the *a priori* is "historical" rather than "synthetic" or "formal"—as in Foucault's famous "historical *a priori*."[56] The principles that ensure the apodicticity of scientific knowledge in Bachelard's, Canguilhem's and Foucault's thinking, in other words, are not transcendental rules of subjective synthesis or properties of solely analytic statements. They are historically variable concepts that regulate what it means to know [Fr. *savoir*] at particular historical periods and under particular scientific domains.

Concepts are only *a priori* when considered from the perspective of the individuals whose thinking and discourse are regulated by them. For these individuals, these concepts are *a priori* insofar as they are not objects of experience or abstractions from particulars given in experience. But these concepts are not *a priori*, but *a posteriori*, when considered in themselves since they are products of scientific discourse. Science, an empirical activity, generates these concepts in historical time—we can locate, for instance, the origin of the concept of *the reflex* in history. As such they form what Foucault calls a "historical *a priori.*" But since these concepts, being epistemological principles with normative power, are not just conventions or cultural facts, they help historical epistemologists also take a stand against those who seek to reduce the rationality and normativity of the research process to social and political forces (Critical Theory, SSK).

In *Historical Ontology* (2004), Ian Hacking explains the historical nature of the French *a priori* by saying that it is as "inexorable" as Kant's synthetic *a priori in its time and place,* but in relation to other historical life-worlds it retails a contingent character.[57] In "Foucault and the French Tradition of Historical Epistemology," Peter Dews makes a similar claim, focusing this time on Bachelard's and Canguilhem's work. These two thinkers have to fight on two opposing fronts. On the one hand, they have to fight against eternal conceptions of the *a priori* conditions that enable and constrain scientific experience (Kant) and scientific discovery (Popper). On the other, they have to also fight against relativistic historicisms that would rather do without the notion of the *a priori* altogether. They have to fight the fight against "pure reason" and "pure method" while abstaining from the supposition that, in the absence of this purity, "the enterprise of science as a whole can [or must] be explained by irrational determinants."[58] It is fair to say that Bachelard, Canguilhem and Foucault partake in this taxing battle for the sake of defending the integrity of what Bachelard dubs "the scientific city," a city that guarantees apodictic truths that do not hold for people of all times and countries. This city, Dews quotes Canguilhem as saying, represents the "effectuation of a project which is internally normed, but traversed by accidents, delayed or side-tracked by obstacles, interrupted by crises, that is to say, moments of judgment and of truth."[59]

The theory that the *a priori* has normative and historical content gives French philosophers of the concept their first weapon for overcoming the crisis in the theory of science that takes Europe by storm after 1911. Their second, and no less potent, weapon comes from their celebration of the effects of the Second Enlightenment. Recall that scientific revolutions in physics, chemistry and biology shifted the center of legislative gravity from philosophy to science and that multiple schools in the twentieth century made their claim to fame by trying to shift the center back onto philosophy. But, much like admirers of SSK, French historical epistemologists celebrate the fact that science has released itself from the yoke of the philosopher, and they essentially create a proclamation of epistemic emancipation by vociferously stressing the point that the *concepts* that make of epistemology a viable vocation are achieved by science rather than philosophy. The first-order language of science does not wait around patiently for a second-order, philosophical meta-language to normalize it. This first-order language norms itself and "creates its own norms" without waiting for philosophy's Godot.[60] Once time reveals the generative power of scientific rationality and the relative sluggishness of philosophical discourse (relative to this power), philosophers must ditch their historical will to master science. They must recognize that philosophy, that old queen of the science, can no longer role-play as the "super-ego"[61] of the scientific mind—not, at least, without making a mockery out of itself. Science has cast off the fetters of philosophy and established itself as a genuinely *auto-nomos* agent.[62]

This emancipation of science leads to a re-description of the philosopher's job. Remember that in the eighteenth and nineteenth centuries, the philosopher's job was to attend to the present state of scientific knowledge, analyze it, and then craft an ideal and normative meta-language for it. The presupposition here being, of course, that there exist universal rules or norms for rational thinking, that these are operative in the function of scientific judgment and that only philosophy can grab a hold of them. But when the news spread that, from now on, the job of norming scientific knowledge is to be performed by science in-house, the philosopher finds himself or herself without a post. What is philosophy to do? Philosophers of the concept give philosophy an option. Philosophy can be in charge of articulating *genealogies of systems of knowledge* that "justify" scientific knowledge by showing it to be a

rational consequent of its own past, as long as it is understood that these genealogies are not normative meta-languages that philosophy mysteriously spits out from within itself. Since neither logical nor transcendental analysis will return philosophy to the throne, philosophy must find a new way to adapt to its post-patrician conditions of existence. And this adaptation, historical epistemologists clarify, must be Nietzschean in form. It must turn all philosophizing into "historical philosophizing."

But the commemoration of the newly found epistemic freedom of the sciences does more than steer the epistemologist in the direction of the genealogical method. It actually revolutionizes the very meaning of epistemology, severing all of its ties to the theory of knowledge. Here, we must emphasize that French epistemologists do not simply believe that epistemology must become more sensitive, or more respectful, to scientific knowledge. They take a much more radical position, insisting that scientific knowledge must indeed become epistemology's sole possibility. The French philosopher François Regnault has explained the severity of this claim by stating that Bachelard and Canguilhem define epistemology "as relative to science or to the sciences."[63] Epistemology ceases being coextensive with an *a priori* theory of knowledge in the tradition of Kant and becomes an *a posteriori* reflection on the history of the sciences in the tradition of Comte. The Spanish philosopher Francisco Jarauta observes in *La filosofía y su otro (Bachelard, Cavaillès, Canguilhem, Foucault)* that the penetrating analyses of knowledge, reason and truth that emanate from the Sorbonne from 1940 to 1980 are always grounded not on the philosophical cannon but on "the Other of philosophy," the history of the sciences. And the reason, I hold, is because for them this is the only opening onto epistemology left to philosophy in the twentieth century. All else is regression. Drawing a comparison, one could say that in the same way that Kant appeals to practical reason as the norm-testing court of appeal for questions of morality, French philosophers of the concept appeal to the history of the sciences as the norm-testing court of appeal for questions of epistemology. In the depths of this "Other," the philosophy of the concept finds its sustenance, its life-source, and its point of departure.

This amputation of the theory of knowledge has two side-effects. First, it denies philosophy *generative* access to the epistemological *a priori*. Certainly, there is a link between philosophy and the *a*

priori of knowledge. But this link is one of founding. Philosophy looks for *a priori* by surveying the historical landscapes of scientific rationality. It seeks it and, sometimes, finds it. In those cases, it also describes it. But philosophy never *gives* it. Science creates it and philosophy receives it. Second, in the same way that the amputation of a limb, according to Maurice Merleau-Ponty, creates a new sense of lived time in the subject who undergoes tragedy so, too, the amputation of the theory of knowledge from the philosophical body readjusts philosophy's clock and situates it in a new temporal register. One of the functions of the classical theory of knowledge that we learn from Habermas's work in *Knowledge and Human Interest* was to explain the origins of knowledge (in subjective synthesis).

Another function of the theory of knowledge not discussed by Habermas is to provide a temporal order to house this logic of generation and explain what temporal sphere objects of knowledge are born *into*. Modern philosophy from Kant to Hegel, in fixing the meaning of epistemology via the theory of knowledge, gives the impression that the only temporality that can sustain the knowledge relation is the temporality of the thinking subject, the temporal register that at some point Husserl describes as "the internal time of consciousness." But when theorists of historical reason leave the theory of knowledge behind like a dead appendage and bring to light instead epistemology's constitutive bond to the sciences, they transpose epistemology from the subjective time of the cogito to the non-subjective time of the history of science or, to be more exact, the *temporality of the scientific archive.* It is this time that grounds the appearance of scientific concept and that is systematized into a genealogical narrative by the new philosopher-figure. In the Parisian scene of the mid-twentieth century, then, epistemology becomes a historical discipline divorced from the *a priori* suppositions of Kantian and post-Kantian German idealism. It acquires a new identity, new obligations and a new temporality that it then uses to project itself into the European context of the twentieth century *as* the philosophy of the concept.

But perhaps this is too fast. If so, the reader should keep in mind that this is meant only as preview of what is to come. That said, these aspects of French historical epistemology allows us to interpret it as a theory of historical rationality that comes to rest on three fundamental commitments: (1) a commitment to epistemological normativity in scientific experience, which takes the form of a

commitment to the existence of normative "concepts," (2) a commitment to the mutability of these concepts, and (3) a commitment to a genealogical, rather than logical or transcendental, approach to the study of these concepts and their transformations. Another way of framing these commitments is by identifying them with the various philosophical lineages that historical epistemologists pay tribute to in their writings: (1) a commitment to the fundamentally Kantian insight that scientific knowledge is a form of *judgment* and is thus normative, (2) a commitment to the loosely Hegelian position that norms of knowledge must be *temporalized*, and finally (3) a commitment to the Nietzschean intuition the best way to explain present states of knowledge is by crafting genealogical accounts that show these states to be the rational thought not logically necessary *denouement* of their own past (as Nietzsche does with the state of Christian morality in *On the Genealogy of Morals*).

Each of the following chapters maps onto one of these commitments. Chapter 2 focuses on the problem of normativity and present a theory of those infamous "concepts" that French historical epistemology claims to be the philosophy of. Chapter 3 is a study of their theory of meaning and theory of scientific change. And Chapter 4 deals with their appropriation of the genealogical method. Then, I try to bring my interpretation of historical epistemology as a whole to a close by trying to articulate the notion of *rationality* that emerges from these three commitments in Chapter 5.

[1] Nietzsche, Friedrich. *Human All Too Human: A Book For Free Spirits* (Cambridge: Cambridge University Press, 1996), 13
[2] Nietzsche, *Human All Too Human*, 209
[3] Nietzsche, *Human All Too Human*, 267-8
[4] Husserl, Edmund. *Cartesian Meditations: An Introduction to Phenomenology*. Trans Dorion Cairns (The Hage: Martinus Nijhoff Publishers, 1960).
[5] Foucault, Michel. "Nietzsche, Genealogy, History." *Semiotexte* 3 (1978): 78-94.
[6] Foucault, Michel. "Introduction." In *The Normal and the Pathological*, by Canguihem (New York: Zone Books, 1999), 7
[7] Foucault, "Introduction," 8
[8] Foucault, "Introduction," 8-9
[9] Foucault, "Introduction," 8
[10] Foucault, "Introduction," 9
[11] Foucault, "Introduction," 10
[12] Foucault, "Introduction," 10
[13] Foucault, "Introduction," 10
[14] Foucault, "Introduction," 11
[15] Badiou, Alain. *The Adventure of French Philosophy* (London and New York: Verso, 2012), lii-liii
[16] Badiou, *Adventure,* liii
[17] Bergson, Henri. *Creative Evolution* (New York: Dover Publications, 1998), xi
[18] Brunschvicg, Léon. *Les Étapes de la philosophie matematique* (Paris: F. Alcan, 1912), vi
[19] Peden, Knox. *Spinoza Contra Phenomenology: French Rationalism from Cavaillès to Deleuze* (Palo Alto: Stanford University Press, 2014), 25
[20] Badiou, *Adventure,* liv
[21] In some ways, Badiou seems to take an almost a-historicist approach since at times he claims that the tension in philosophy between life and number is as old as Western philosophy itself. According to him, there have been several periods in the history of Western philosophy in which philosophy finds itself in a condition similar to that of the Hegelian "concrete universal," i.e. torn between the lofty heights of university but mired in the signature of the particular. "There are what we might call moments of philosophy, in space and in time. Philosophy is thus both a universal aim of reason and, simultaneously, one that manifests itself in completely specific moments." In these moments, Badiou claims, philosophy vascillates between the universality of its claims and the particularity of its historical conditions of actuality as it sees itself as a universalizing discourse that can only realize itself under particular geographic and national circumstances. Two examples of these "moments" are the period of Greek philosophy from Parmenedes to Aristotle and the age of German idealism from Kant to Hegel. In both cases, philosophy was unlimited in its ambitions, yet bound to a particular locality. And in both cases, there was always a tension internal to the period between philosophies of life and philosophies of number. Badiou's central thesis in *The Adventure of French Philosophy* is that "contemporary French philosophy"—i.e. the philosophy that was produced in France in the 20th century—is another philosophical moment, another concrete universal. "I propose to defend a further national and historical thesis: there was—or there is, depending where I put myself—a French philosophical moment of the second half of the 20th century which, *toute proportion gardée*, bears comparison to the examples of classical Greece and enlightenment Germany" (Badiou, *Adventure*, li). This "creative" period extended from the 1940s to the 1990s, beginning with the publication of Sartre's *Being and Nothingness* in 1943 and coming to a closure in the early 1990s with the appearance of "the last writings of Deleuze" (Badiou, lii). During this span of time, Badiou claims, philosophy in France was "both particular and universal"—i.e. it was particular to France and universal in the scope of its affirmations.
[22] Badiou, Alain. "A History of Finitude and Infinity: Classicism." The European Graduate School. Released 2011. Last accessed February 2014. www.egs.edu/faculty/alain-badiou/articles/a-history-of-finitude-and-infinity
[23] Badiou *Adventure,* liii
[24] Habermas, Jürgen. *Knowledge and Human Interests* (Boston: Beacon Press, 1972), 4
[25] Habermas, *Knowledge and Human Interests*, 67
[26] Comte, Auguste. *The Postive Philosophy of Auguste Comte, Volume 1.* Trans. Harriet Martineau (London: Batoche Books, 2000), 36.
[27] Habermas, *Knowledge and Human Interests*, 67
[28] Habermas, *Knowledge and Human Interests*, 68
[29] abbermas 81

[30] Habermas, *Knowledge and Human Interests*, 69
[31] Webb, David A. *Foucault's archaeology: science and transformation* (Oxford University Press, 2013), 24
[32] Massimi, Michela. *Kant And Philosophy Of Science Today* (Cambridge: Cambridge University Press, 2008), 11
[33] Jones, W. T. *Kant and the Nineteenth Century* (Fort Worth: Harcourt Brace Jovanovich, 1975), 115
[34] Daniel O. Dahlstrom, *Philosophical Legacies: Essays on the Thought of Kant, Hegel, and Their Contemporaries* (Catholic University of America Press, 2008)
[35] Gadamer, Hans-Georg. *Reason in the Age of Science* (Cambridge: MIT Press, 1982), 24
[36] Rüegg, W. (ed.) *A History Of The University In Europe. Vol. I Universities In The Middle Ages* (Cambridge: Cambridge University Press, 1992).
[37]Quoted in Ruegg, *History Of The University In Europe,* 453-4
[38] Bernal, John Desmond. *Science and Industry in the Nineteenth Century* (Taylor & Francis, 2005), 3.
[39] Heidegger, Martin. "Time and Being." In Gary Gutting's *Continental Philosophy Of Science* (John Wiley & Sons, 2008), 143.
[40] Knight, David. *The Age Of Science: The Scientific World-View In The Nineteenth Century* (Oxford: Basil Blackwell), 1986.
[41] Bernal, *Science and Industry,* 5.
[42] See Werner Heisenberg's *Encounters With Einstein: And Other Essays on People, Places, and Particles* (Princeton, New Jersey: Princeton University Press, 1983). See also Cassirer, Ernst. *Substance And Function And Einstein's Theory Of Relativity* (Courier Dover Publications, 2004).
[43] See Bachelard's *PN*
[44] Cassirer, Ernst. *The Philosophy Of Symbolic Forms: The Phenomenology Of Knowledge. Vol. 3* (Yale University Press, 1957), 20
[45] Gadamer, *Reason in the Age of Science,* 39
[46] Gadamer, *Reason in the Age of Science,* 6
[47] Adorno Theodor. "The Actuality of Philosophy" In *The Adorno Reader*, ed. Brian O'Connor (Oxford: Blackwell, 2000), 25
[48] Köhnke, Klaus Christian. *The Rise Of Neo-Kantianism : German Academic Philosophy Between Idealism And Positiism* (Cambridge: Cambridge University PPress, 1991)
[49] See Husserl's *The Crisis Of European Sciences And Transcendental Phenomenology: An Introduction To Phenomenological Philosophy* (Northwestern University Press, 1970).
[50] Habermas, *Knowledge and Human Interests*
[51] Gutting, Gary. *Continental Philosophy Of Science* (John Wiley & Sons, 2008), 1
[52] Plato. "Phaedrus" In *Plato: Complete Works* (Indianapolis: Hackett Publishing Co., 1997). 247c.
[53] Think, for instance, of the "Southwest School" of Neo-Kantianism, of the "Historical School" of hermeneutics of Dilthey and Gadamer, of the *lebensphilosophie* of Nietzsche, Simmel and Bergson, and of the pragmatist tradition of Dewey, Pierce and James.
[54] Bachelard, AR, 25
[55] Bachelard, AR, 25
[56] This term is found in the writings of Husserl. But its meaning in the phenomenological philosophy is different from the meaning it acquires in the network of French historical epistemology.
[57] Hacking, Ian. *Historical Ontology* (Cambridge: Harvard University Press, 2002), 5
[58] Dews, Peter. "Foucault and the French tradition of historical epistemology." *History of European Ideas* 14.3 (1992): 347-363, 357
[59] Dews, "Foucault and the French Tradition," 58
[60] Foucault, *AK*, 46; Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: NLB, 1975), 165
[61] Bachelard, *AR,* 11
[62] In *MR*, Bachelard speaks of a scientific will to power [Fr., *volonté de puissance*] that differs from the philosophical will to master and that turns the scientist not into a despotic monster that controls what is, but into a "truthful magician" or "positive demon" (a play on Descartes's evil genius) that creates new truths.
[63] Hallward, Peter and Knox Peden. *Concept and Form: Volume 1, Selections from the Cahiers pour l'analyse* (Paris: Verso, 2012)*,* 119

2

WHAT IS A CONCEPT?

AN ONTOLOGY BEYOND THE SUBJECT BUT BENEATH SPIRIT

> "[Concerning the genre of the history of science], it is certain that several questions have long been raised and continue to be. These questions are those of *Who? Why? How*? But there is a principal question that should be posed and almost never is, that's the question of *What?* What is the history of science a history *of*? [*De quoi* l'histoire des sciences est-elle l'histoire?] That this question is not posed has to do with the fact that we generally believe the answer to be given in the expression itself of the history of *the sciences* or of *science*."
>
> -Georges Canguilhem[1]

Doubts about the coherence of French historical epistemology as a philosophical enterprise tend to manifest themselves as concerns regarding the stability and specificity of its object.[2] What exactly do French philosophers of historical reason philosophize about? What is their object of analysis? And what, in turn, guarantees the unity and cohesion of this object?[3] In this chapter, I argue that the object of French historical epistemology is neither "science" nor "history" nor even "the history of science" but an altogether different thing called *scientific discourse*.[4] Since at least the 1970s scholars working on the history of French thought have noted the importance of this concept for historical epistemologists.[5] Unfortunately, these observations rarely go beyond superficial acts of naming that leave the meaning, significance and status of scientific discourse *qua* philosophical object largely under-determined.[6] That this object matters is undisputed. But how and why it matters remains somewhat of a mystery. Often presupposed but rarely understood and regularly cited yet infrequently described, this "proper object"[7] of historical epistemology has come to denote both a focal point of scholarly reference and an inordinate blind spot in the literature. One could say that Foucault's original lament in *AK*—that is, his claim that scientific discourse "has been neither registered nor reflected upon"[8] in the history of thought—has endured as an unfortunate but accurate, all too accurate, indictment of the status quo as this concept continues to elude the register of serious philosophical reflection.

This chapter corrects this pernicious pattern of neglect and pins down the meaning of this object. Following Dominique Lecourt's insight in *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (1975) that "the first characteristic"[9] of scientific discourse is its normative profile, I propose that we think of this object as a specific form of communicative action (using this term freed from its Habermasian determination) that actualizes itself in the element of norms—norms that Canguilhem refers to as "norms of scientificity"[10] and I call "scientific-epistemic norms."[11] Scientific-epistemic norms can be thought of as post-Kantian principles that regulate the production of scientific experience and scientific discourse, i.e., as rudders for rational thought that govern the formation, maturation and modification of scientific knowledge. These norms enable and constrain scientific discourse, or, as John Zammito argues in a different context, they "enable it *through* constraint."[12] By observing and obeying these specialized norms, agents bring their discourse into the *element of truth* ("in the true [Fr. *dans le vrai*]," as Canguilhem and Foucault both say) and into the *space of reasons* ("in rationality [Fr. *dans la rationalité*]" as Bachelard puts it), thus constituting it as "scientific." Through these norms, in other words, individuals speaking and acting under determinate historical circumstances coronate themselves as emissaries of scientific rationality and position themselves not simply as speakers capable of forming valid and meaningful propositions before a community of speakers, but also as knowers capable of making truth-claims before a community of experts.[13]

The study of French epistemology must begin with a theory of these norms. Following the thought of two figures that, as it were, "book-end" the history of historical epistemology (Cavaillès and Foucault), I argue that there are two kinds of scientific-epistemic norms that govern the production of scientific discourse: *rules* and *concepts*. *Rules* I define as tacit,[14] often unconscious[15] and period-specific commandments that determine the "form" statements must take in order for them to count as candidates for scientific truth and thus potentially count in scientific debates, arguments and controversies. These rules, which Robert Nola describes as "presuppositions of discourse"[16] and Foucault calls "rules of formation" in *AK*, make up the rational syntax of a scientific discourse; they give those who occupy the subject-position of "scientist" a silent understanding of how they must express themselves in order for

their claims to carry weight in scientific problematics. By contrast, concepts are ideas, schemas and notions that scientific theories are made of, the epistemic elements or entities that the above-mentioned rules control and manipulate. Concepts—the concept of *planet* in astronomy, the concept of *photon* in physics, the concept of *illness* in physiology, etc.—, are the "content" of epistemology that make up what Cavaillès, Bachelard, Canguilhem and Foucault all describe as the "ontology"[17] of a rational domain.

In the first part of this chapter I focus on the relationship between scientific discourse and scientific concepts and argue that although scientific discourse is constituted by concepts *and* rules, concepts play a more central role in the writings of historical epistemologists. Then, in the second part, I show that there are philosophically motivated reasons for this privileging of *the conceptual.*

A digression into Jean Cavaillès's *On the Logic and Theory of Science* will show that if post-Cavaillésian authors give concepts a position of eminence in historical epistemology, it because they want to overcome the trend that has ravaged the history of epistemology since Kant—the trend of reducing scientific rationality to the rules that are employed in the formation of scientific statements. By associating concepts, rather than rules, with the immanent rationality and determinacy of scientific discourse epistemologists, historical epistemologists correct and transmogrify the long tradition of post-Kantian epistemology. Bachelard, Canguilhem and Foucault were all intimately acquainted with Cavaillès *chef d'oeuvre*: Foucault cites it multiples times during his lifetime; the name "Gaston Bachelard" appears at the end if its 1960 "Preface"; and Canguilhem was the person responsible for its posthumous publication, as well as the person to whom we owe its title as the original manuscript Cavaillès left behind did not have one. One possible way of explaining this intimacy is simply by recognizing the fact that this work is a demand for a new epistemological way of thinking, a plea for a philosophy that realizes itself in the historical and epistemological analysis of scientific concepts. And this, I hope to show, is precisely what Bachelard, Canguilhem and Foucault try to articulate, each in his own way, i.e., a philosophy that realizes itself as a historical epistemology, as a philosophy of the concept.

What is Scientific Discourse?

In a conference presentation delivered at the 1966 meeting of the Canadian Society for the History and Philosophy of Science in Montreal, which was subsequently published in 1968 under the title "The Object of the History of the Sciences," Canguilhem warns a room full of historians and philosophers against conflating the object of the history of science with the object of the sciences themselves. While the sciences deal with natural objects called "pre-texts," the history of science investigates an un-natural and cultural object called "scientific discourse" [Fr. *le discours scientifique*].[18] The history of science, he says, is the "the history of an object—discourse—that *is* a history and *has* a history." To my knowledge, this is the first time the term *le discours scientifique* appears in the history of Western philosophy. But soon after it is put in circulation, it quickly gains traction as a way of describing not only the object of Canguilhem's philosophy but also the object of French historical epistemology more generally. After its initial appearance in 1966, the term surfaces again in the 1969 publication of Foucault's *AK* and then again in Foucault's 1970 "Foreword" to the English edition of *OT*. In the latter, as in the former, Foucault follows his teacher's example and openly claims *discours scientifique* as the object of his archaeological approach to the human sciences.[19] After 1970, the term becomes a common way to index *what* historical epistemology claims to be the epistemology of.[20]

Although one would search in vain for the term before the 1960s, it is important to stress that the concept is already there in earlier writings by Canguilhem and Bachelard (Cavaillès and Koyré, too) harking back to the 1940s and '30s.[21] But before 1930 neither the words nor the concept appear anywhere in the history of philosophy because, before 1930, the concept does not exist. Certainly, before the 1930s, thinkers had thought long and hard about the logic, nature and methodology of science, and that speakers had spoken at length and with conviction about the force and power of various forms of discourse. One even finds scattered across the chronological landscapes of the seventeenth, eighteenth and nineteenth centuries innumerable treatises by historians, sociologists, scientists and philosophers devoted to the discourse of science (scientific rhetoric)[22] and the science of discourse (linguistics).[23] But none of these works operate with the same concept of *scientific discourse* that has become the chisel stamp of historical

epistemology because before the 1930s this concept simply cannot be thought. And it will not be thought until a group of Francophone authors working in the interest of a historicized notion of reason in the wake of Kant, Hegel and Comte give birth to it in France.

Historical epistemologists make this object—scientific discourse—available to epistemology by means of two theoretical displacements. First, as Francisco Jarauta argues in *La Filosofía y su Otro (Bachelard, Cavaillès, Canguilhem, Foucault)* (1979), they displace the meaning of epistemology from the theory of knowledge to the history of the sciences. The history of the sciences, then, becomes a center of gravity for epistemological inquiry. Second, these thinkers displace the meaning of science itself, defining it not in terms of facts, theories or methods but in terms of discursive formations. What matters for the study of science is not the empirical content of scientific theories, the logic of the scientific method or the lives of eminent scientists, but the discursive practices through which a rational domain is historically constituted. What matters, in other words, is not what scientists *do* or *think*, but what they *say*. Historical epistemology is subject "not to a theory of the knowing subject, but rather to a theory of discursive practice."[24] These displacements transform "epistemology" into the study of the history of *scientific discourse*, its regularities, thresholds, limits, crevices and densities. By studying discourse, Bachelard, Canguilhem and Foucault inaugurate a novel approach to the study of scientific rationality that stands in opposition to the existentialist phenomenology of the French, the neo-Kantianism of the Germans and the logical positivism of the Austrians.

The best way to think about *discours scientifique* is as a specialized form of communicative action, as "an objective discourse consisting of certain propositions that arise out of a particular kind of work"[25]—namely, scientific work. What distinguishes these "propositions" (which Bachelard calls "judgments" and Foucault calls "statements") from non-scientific ones is that they are beholden to all the syntactic and semantic norms that regulate ordinary language use *plus to an additional set of norms that non-scientific forms of communicative action need not respect.* I call thee norms "scientific-epistemic norms." Scientific discourse is "normal" in the connotational sense Popper and Feyerabend have given this term—in the sense that "that there is a determinacy to the practice" because the practice "is governed

by norms."[26] But this "normalcy," as understood by Bachelard, Canguilhem and Foucault, is connected to norms that have little, if anything, to do with the norms of syntax and semantics that regulate ordinary language use.

What makes scientific-epistemic norms unique is that they give scientific discourse its vital proximity to "truth," the same proximity that sets it apart from other forms of discourse. Non-scientific modes of discourse, such as Austinian common speech acts or Habermasian communicative acts, aspire only for meaningfulness in content and understandability in form. They do not aspire to *truth*. And the norms that each of these discursive modes surrenders to underscores why. For instance, Austinian speech acts are necessarily subject only to syntactic rules of sentence-construction and semantic rules of meaning-production. To succeed at producing a "locutionary act," one need only ensure the syntactic validity of one's proposition, the correct arrangement of the terms that appear therein. But nothing internal to speech act theory requires that my proposition be "rational" or "true" in any substantive way. Similarly, Habermasian acts of democratic discourse are subject to syntactic and semantic rules and, in addition, to norms of rational argument protocol.[27] To succeed at being a Habermasian democrat, all one would have to do is ensure that one's sentences are linguistically valid (syntax), meaningful (semantics) and democracy-apt (formally rational).

Notice that the norms Austin and Habermas absorb into their philosophies of language only tell speakers *how to speak* (i.e., how to put their thoughts into the proper linguistic and political *form*), not *what to think* (how to give their thoughts determinate content). They are formal rather than substantive in nature. The norms historical epistemologists bring to the surface, to the contrary, guide thought at the level of form and content (*how* and *what*) and tell individuals not only how to speak meaningfully, but also how to speak rationally and truthfully, how to speak "in rationality" and "in the true." Borrowing an articulation of Canguilhemian origins, Foucault famously suggests that scientific discourse seeks to dwell in the very element of truth, "to be *in the true* [Fr. *être dans le vrai*]." In direct contrast to norms of syntax, semantics and communicative action, the norms of scientific epistemology instate an intimate partnership between discourse and truth, a partnership that allows us to distinguish scientists from non-

scientists and, subsequently, science from non-science. We might express the same point in a different way. A discursive act that is meaningful in content and understandable in form may be a candidate for scientific truth, but not necessarily so since the conjunction of meaningfulness and understandability is a necessary but not a sufficient condition for the formation of a scientific claim. To be an Austinian speaker or a Habermasian democrat, one need not have a substantive notion of rationality or truth. But to be a scientist, one cannot do without both.

An Old Boundary Re-Visited

As "codes of knowledge,"[28] scientific-epistemic norms establish what counts as a "scientifically based idea"[29] and police that old boundary that has aggravated Anglo-Saxon philosophers of science throughout the twentieth century: the boundary between *science* and *non-science*.[30] In somewhat technical language, one could say that scientific-epistemic norms monitor the border between science and its outside by certifying material conditionals and underwriting counterfactual conditionals such that,

1. As a matter of *inclusion*, if discursive act *A* abides by the norms of discipline *B*, then *A* is properly scientific under *B*. (Material Conditional). And,

2. As a matter of *exclusion*, if discursive act *A* fails to abide by the norms of discipline *B*, then *A* is not properly scientific under *B*. (Counterfactual).

Borrowing a concept from political theory, we may speak of these norms as enacting a sort of gerrymandering operation since they not only determine who is a sanctioned harbinger of scientific knowledge and hence a denizen of what Bachelard calls "the scientific city," but also who is to be banished from the scientific *agora* as a fraud, a sham and a charlatan. These norms legislate who counts as a scientific expert and an actuary of scientific truths and who ought to be ostracized as a swindler and a salesman of snake oil; they adjudicate membership conflicts and create the logical and conceptual landscape where the battle lines between truth and error are constantly being drawn, erased, and re-drawn. And they do this without requiring an analytic distinction between "science" and "non-science" that is de-

contextualized and absolute. As Foucault points out in an interview conducted in 1978 by Colin Gordon and Paul Pattton and published in English for the first time in a 2012 edition of *Foucault Studies*:

> To make a clean and binary demarcation between on one side forms of discourses, types of analyses, types of practices that count as scientific, and on the other side those that don't, I think that absolutely does not work. On the other hand, it seems to me, and I tried unsuccessfully to point this out in The Archaeology of Knowledge, that precisely from within a type of discursive practice one can identify perfectly well the moment at which one reaches some thing that one could call a threshold of scientificity […] So there it is, roughly, there is no homogenous, general threshold of scientificity for all discourses, but rather you have types of discourse for which the transformation was such that as of a certain moment they functioned according to rules of verification sufficiently homogenous and stable that in certain cases we could say "it's false."[31]

Where French historical epistemologists deviate from their Anglo-Saxon counterparts is in their belief that the problem of demarcation can only be surmounted historically, by looking at the history of science and at the history of "inauthentic" knowledge that has been excluded from the domain of rationality as un-scientific. In the same way the study of *the pathological* reveals the meaning of *the normal* in medicine,[32] the study of the logic of banishment in the history science reveals, by a sort of ricochet effect, the logic of inclusion at work in scientific epistemology. In *IR* Canguilhem writes:

> Perhaps the first question to ask is what it is that the history of science claims to be a history of. An easy answer is that the history of science is the history of a certain cultural form called "science." One must then specify precisely what criteria make it possible to decide whether or not, at any given time, a particular practice or discipline merits the name science. And it is precisely a question of merit, for "science" is a kind of title, a dignity not to be bestowed lightly. Hence another question becomes inevitable: Should the history of science exclude or, on the contrary, should it tolerate or even include the history of the banishment of inauthentic knowledge from the realm of authentic science?[33]

A social form "merits" the name "science" not because it is essentially opposed to myth but because its history has been a struggle to overcome myth, because its history can be grasped as "the history of the banishment of inauthentic knowledge." "I use the word *banishment*," Canguilhem says, "quite intentionally for what is at stake is nothing less that the legal withdrawal of legitimately acquired privileges."[34]

The norms secreted by scientific *praxis* allows us to meaningfully, though not absolutely, distinguish science from non-science largely because when historically situated agents surrender themselves to them, this act of intellectual surrender brings about a radical event of *subjectivation* that crystalizes the subject-position or subject-function of "the scientist." This event makes it possible for the individual's rhetoric to take on an aura of rationality and become legible, relevant and authoritative in scientific controversies. But no individual can occupy this category unless they surrender their discourse to the norms of a discipline and couch their pronouncements and activities in terms of the conceptual *regime* of their field. In her 2007 book, *Objectivity*, the historian and philosopher of science Lorraine Daston captures the nature of this moment of subjectivation by using the Aristotelian language of virtue ethics. Scientific-epistemic norms, she claims, are the stuff out of which "epistemic virtues" in science are made.[35] They distinguish the good from the bad scientists as well as the scientists from the non-scientists, which in the end amount to the same thing.

Two Kinds of Norms: *Rules* and *Concepts*

Inspired by similar distinctions made by Foucault[36] and Cavaillès,[37] I propose that we split scientific-epistemic norms into two kinds:

> -CONCEPTS: In *On the Logic and Theory of Science, AR* and *AK*, Cavaillès, Bachelard and Foucault all describe concepts as the building blocks of discourse—Cavaillès calls them "the objects" of epistemology, Bachelard describes them as "cellules of *savior,*"[38] while Foucault refers to them as "atoms of discourse."[39] Concepts are the indivisibles that make up the "ontological foundation"[40] of a scientific domain and represent the most primitive elements, the indivisibles, of scientific reason.
>
> -RULES: implicit, often unconscious, principles that decree how scientific concepts are to be mobilized, conjoined, activated and assembled into full-fledged scientific judgments; unspoken though comprehended rules for the constitution of scientific statements that speakers grasp pre-thetically largely on account of their indoctrination into a particular epistemic community.[41] These rules, Foucault's "rules of formation," give us the rational syntax or rational grammar of a specific discursive field.[42]

Concepts and rules play equally important roles in the formation and production of scientific discourse since both are insufficient yet necessary conditions for the genesis of scientific discourse.[43] Together, they

embody the "technical and conceptual organon"[44] of scientific reason and mortgage the normativity that, according to Bachelard's philosophy, "is the epistemological character of all scientific experience."[45] Without either, no utterance or act can "attain the form of scientificity."[46]

Still, it would be hard to situate oneself in the bosom of historical epistemology—the French philosophy of the concept, that is—and not notice that concepts, more so than rules, are frequently given pride of place in analysis. In the primary literature, concepts are discussed more frequently and extensively than rules, being often broadcasted in the titles of articles, book chapters and manuscripts. In the secondary literature, "concepts" are regularly cited as the sinew of this tradition, as its most powerful theoretical innovation and as its most influential philosophical category. In *Marxism and Epistemology* (1975), Dominique Lecourt argues that if we want to get a sense of the impact factor of historical epistemology, "it is these concepts we must be on the lookout for."[47]

The Concept of The Concept

Every work of historical epistemology is filled with examples of scientific concepts. Cavaillès writes about the concepts of *necessity, infinity, set, magnitude, proof* and *probability* in mathematics; Bachelard talks about the concepts of *particle-wave duality*, *causality*, *space-time*, *energy* and *mass* in physics and about *substance, element, blending, synthesis* and *resistance* in chemistry; Canguilhem's works on the history of the life sciences are all organized around the epistemic significance of concepts such as *reflex motion, average, norm, normality, cell*, *character* and *gene*, to mention only a few; and the same can be said of Foucault's archaeologies and genealogies of the human sciences. What is *OT* if not an excavation of the concepts that regulate the sciences of life, labor and language in the Renaissance, Classical and Modern periods, concepts such as *labor power* (in economics)*, organic structure* (in natural history) and *designation* (in linguistics)? What are *BP* and *BC* if not compendiums of the concepts that normalize the discourses of criminology and medicine from the eighteenth century onward? And what is *HoS* if not a memoir of the concepts that form the orb of our historical knowledge of sexuality?

Although historical epistemologists never give a crisp definition of them, these concepts may be thought of as domain-specific schemas of scientific experience and scientific discourse that, as Pierre Macherey claims in *De Canguilhem à Foucault: La Force des Norms*, are replete with normative "force."[48] They are ideas, notions and categories through which scientific understanding of the world is achieved and expressed. But these concepts are not abstract universals or general notions detached from the natural objects they refer to. Rather, these concepts are normative criteria of scientific epistemology that, more than *referring* to objects in the world, actually determine what counts as an natural object (and thus as an object of scientific experience) in the first place. Using proto-phenomenological language, we can say that concepts monitor the gap between "the visible and the invisible"[49] in scientific experience and determine which phenomena, processes and systems can become, at least in principle, sites for the investment of scientific interest. Instead of simply "representing" the world, the scientific concepts of historical epistemology "disclose" it. Borrowing Kant's famous dictum, we may put forth as the thesis that without concepts scientific experience is (almost literally) blind.[50]

But, as historical epistemologists understand then, concepts do more than this. In addition to determining what sorts of objects can appear *as objects* in scientific experience, concepts also determine what problems are deemed worthy of scientific interest and can appear *as problems* in the first-order discourse of science. In *Michel Foucault's Archaeology of Scientific Reason* (1989), Gary Gutting tries to put his finger on the French concept of the concept by stating that a scientific concept represents "the initial understanding of a phenomenon that allows us to formulate, in a scientifically useful way, the question of how to explain that phenomenon."[51] The key word here is "formulate." Concepts, as Lecourt argues, "make problems *formulatable*"[52] and this means that the monitor the line between the sayable and the unsayable as much as the line between the visible and the invisible. Concepts are "props for thought,"[53] Bachelard says, that create "force fields"[54] in the minds of scientists—force fields that regulate *what* gets talks about (referentiality) and *how* its gets talked about (formulatability).

But, still, what are these concepts? Are they structures of subjectivity in the vein of Kantian categories or social conventions in the tradition of Kuhnian paradigms? Are they linguistic and mind-

independent universals like the ones that recur in medieval disputations about epistemology or pre-linguistic, psychological modules like those invoked in naturalized and evolutionary epistemology circles? Are they transcendent idealities analogous to Platonic forms or transcendental entities analogous to Husserlian logical concepts? Are they empirical generalizations induced from the sensible observation of particulars or eternal principles of thinking reducible to the laws and tenets of classical logic? Unfortunately, the primary literature leaves this ontological question unresolved—first, because the ontological status of concepts is not discussed concretely by Bachelard, Canguilhem or Foucault; and, second, because in those rare occasions the topic is broached, these figures adopt a purely negative definitional strategy, telling us what concepts are only by cataloguing everything they *are not*.[55] This has left the French concept of the concept suspended in mid-air…like a *definiendum* without a *definiens*.

In my view there are five great disavowals by which historical epistemology props itself up. These are (see also "Appendix 3—Conceptual Disavowals" for a close investigation of some of these):

- *First, the disavowal of subjectivism: concepts are not subjective forms or subjective possessions.* They do not originate in subjects or in subjective processes[56] and, consequently, must not be confused with Kantian *a priori* forms of subjectivity,[57] Husserlian phenomenological intuitions,[58] Baconian empirical inductions,[59] neurological brain-processes,[60] existential beliefs[61] or Lockean impressions.[62]

- *Second, the disavowal of idealism: concepts are not transcendental but historical entities.* They differ from Husserlian categorical intuitions (which are temporal but not historical),[63] from Kant's categories of the Understanding (which are neither temporal nor historical),[64] from the rules of classical logic (which are also neither temporal nor historical)[65] and from the ideal stages of the education of Geist (which are only historical in a reified ideal sense).[66]

- *Third, the disavowal of linguisticism: concepts are not units of language.* A concept is not a word, a lexical concept, or a linguistic sign. Bachelard,[67] Canguilhem[68] and Foucault[69] all make this claim explicitly and multiple times.

- *Fourth, the disavowal of sociologism: concepts are not social facts, social conventions or social forms*. Importantly, the argument here is not that science is not a social activity, but that it is a form of human *praxis* whose immanent logic cannot be comprehended or exhausted through the lens of sociology. Concepts are not mere conventions or traditions. They are not products of democratic consensus or communal agreement among scientists.[70]

- *Fifth, the disavowal of positivism: concepts are neither facts nor theories.* Concepts are the (non-transcendental) conditions for the identification of facts as facts and for the articulation of theories. They precede facts and theories from a logical, if not also a chronological, standpoint.

Through these disavowals, historical epistemology wrestles the concept of "the concept" away from transcendental philosophies, philosophies of consciousness, linguistics, psychology, sociology, psychology and positivist theories of science, affirming along the way that the true meaning of this term remains un-thought in, and repressed by, these other disciplines. Ontologically, concepts are not subjective formations (empirical or transcendental), they are not conventional objects (linguistic, psychological or sociological) and they are not positivist postulates (facts or theories). Ontologically, they are something else. But what? Here, I believe, we run up against the internal limit of historical epistemology itself and are left in the uncomfortable position of only drawing *negative inferences* about the ontological status of scientific concepts.

Still, there are two valuable negative inferences to be drawn from this avalanche of disavowals. The first is that concepts lie *beyond the Subject*. Concepts are not things that individuals control, possess or constitute. They are things individuals obtain or receive (largely passively) from their discursive domains, like a grant or a gift.[71] Indeed, the thrust of Bachelard's, Canguilhem's and Foucault's work is not the consciousness of the scientist but a common and normative reality that surpasses the individual forms the foundation of life in the scientific city; that mantel of concepts under which scientists think, then, is not a web that scientists themselves weave and unravel at will, but a complex system whose logic supersedes the subjects that make it, contemplate it and speak through it. This mantel is less like Penelope's famous shroud, which Penelope weaves by day and unravels by night, and more like the picture of Dorian Gray, which moves by a force and will of its own. But since these concept that make up this mantel do not quite reach the status of spiritualist idealities or totalities, ontologically they also *lie beneath Spirit*. They transcend the confines of subjectivity without cutting the strings that moor them to the tumultuous and empirical realm of human existence. Lodged in the hiatus between pure subjectivity and pure objectivity, positioned at an oblique angle from both empiricism and idealism, they lie in the parallax created by the intersection of Subject and Spirit. This parallax is their ontological status.[72]

Notes on the Primacy of Concepts—Cavaillès's Promise

Recall that the armature of a rational system of thought is built from concepts *and* rules. Why has the concept of "the concept" monopolized historical epistemology to the point of commanding its very name? This is a question that, to my knowledge, has never been asked before. But I suspect there are philosophically relevant reasons, and important ones too, behind this privileging of concepts. And, if my suspicions are correct, these reasons have only everything to do with a single book, a book that has been described as "ambitious,"[73] "dense"[74] and "very difficult to read"[75]—Jean Cavaillès's *On the Logic and Theory of Science*. The reason French historical epistemology positions itself as the French philosophy of the concept lives inside this text.

There truly is something daunting and intimidating about *On the Logic and Theory of Science*. For starters, the text is as ambitious as it is short. The complete1970 English translation of this work is fifty-two pages long. Yet, in the span of fifty-two pages the author provides short but masterful interpretations of Kant's, Carnap's and Husserl's positions on the relationship between logic and thought, as well as intricate commentaries on the philosophies of Brower, Brunschvicg, Bolzano and Tarski—all of this while elaborating an original theory of mathematical rationality founded on concepts such as *unity*, *order*, *abstraction*, *constructability*, *non-saturation*, *a priori*, *coordination*, *dialectic*, *formalization* and *virtual existence*. In addition to its depth and brevity, the text is difficult to read. Penned "in the heroic solitude of a prison,"[76] the text's form and style mirror the harsh conditions of its conception. The argument moves hurriedly and abruptly from philosophy to philosophy and from concept to concept, making it often difficult to tell whether at a given point in the text Cavaillès is engaging in describing, interpreting or critiquing another author or venturing an original viewpoint of his own. Even so, that this work is a real feat of intellectual strength with far-reaching consequences for epistemology and the philosophy of science is, I take is, beyond doubt.

In my interpretation, the central insight developed by Cavaillès in this work is the idea that two constant planks in the program of Western epistemology from Kant to Husserl have been the assumptions that (1) what matters when thinking about a scientific theory or statement is its *form* rather than its *content*

and (2) that the form of a scientific theory or statement is best captured by investigating the rules by means of which such theories or statements are formed (be they logico-mathematical, sociological or subjective). For Cavaillès, all scientific philosophy after 1781 is overwrought by a wanton obsession with the form of scientific rationality (i.e., with the "rules" operative in the generation of scientific judgments) *at the expense* of any serious philosophical consideration of its content (i.e., the "objects" or "concepts" that these rules arrange, manipulate and organize). The titans of idealism, positivism and phenomenology, Cavaillès says, "neglect the bearing of *the object* on the structure of theory."[77]

It is crucial to clarify that by "object" Cavaillès does not mean those empirical formations—suns, tables, electrons, genes—that scientific concepts refer to (i.e. the objects of scientific discourse), but the concepts themselves—the concept of *planet*, the concept of *atom*, the concept of *gene*, etc.—with which scientists make sense of the world around them (i.e. the objects *of* epistemology). Concepts, and this is consistent with Cavaillès's usage, *are* the objects that have been neglected by every theory of scientific rationality since Kant in spite of the fact that it is the concepts that appear in a scientiic theory, more so than the rules that form it, that give that particular theory *content*—they are what the theories are about. For him, rules equal form and objects equal content.

Let us take a moment to clarify what is meant by Cavaillès since his use of terms flaunts tradition. For him, the living thrust of scientific reason comes not from the activity of rules of construction or formation, but from the "bearing" of objects (read: concepts) on theory. Consequently, when he tells the reader that all post-Kantian epistemology has "neglected the bearing of the object on theory," his suggestion is rather clear: modern and analytic epistemologies have reduced the active principle of scientific rationality to a gaunt formalism purged of all determinate content, such that only an epistemology that rescues this content from oblivion can position itself as the vanguard of a new epistemological movement to reclaim a scientific rationality that is more than a skeleton of rules.

After showing in Part One of *On the Logic and Theory of Science* that Kant buries the autonomy of scientific reason (especially logic) under rules of the understanding, he goes on in Part Two to make a

similar criticism, first of Carnap, then of Tarski. A quick glance at the nature of this criticism will shed further light on the importance of concepts for the epistemology of science.

In his 1937 book, *Logical Syntax of Language*, Carnap embarks on a mission to seize the "the logic of science" by employing the newly emergent method of logical analysis. Influenced by developments in the philosophy of logic, language and mathematics, Carnap believed that the "logic of science" is reflected in "the language of science" and can therefore be grasped with the aid of a second-order, philosophical meta-language that captures the "essence" of the first-order language of science (which is always couched inside a natural language). This meta-language, as the title of the work insinuates, takes the form of a logical syntax that is achieved through a regimenting strategy by means of which all the synthetic, empirical sentences of science—including all the sentences of classical mathematics and classical physics—are formalized (or "reconstructed") in a logical language that renders "exactly formidable" the results of logical analysis.[78] This, Carnap says, would be "general syntax applicable to any language whatsoever."[79] (For a more substantial description of Carnap's logical syntax see "Appendix One"). What Tarski then shows is that this general syntax, which Cavaillès himself mocks as "only a set of abstract rules,"[80] dilutes the determinacy of scientific judgments by reducing science to its form. The logical syntax assumes that only the formal and logical structure of the language of science matters for its philosophical investigation and that the objects this syntax necessarily presupposes contribute nothing of value to scientific or philosophical reasoning. Content becomes a mere placeholder that occupies no positive moment in the unfolding of logical analysis.

Interestingly, what Cavaillès presents as Tarski's criticism of Carnap already appears in Carnap's own text as a tenet of his methodology. In the "Foreword" to *Logical Syntax of Language*, Carnap makes his disdain for content known by stating that scientific reason is, in principle and fact, reducible to the syntax of scientific claims. "The logic of science is *nothing other* than the logical syntax of the language of science,"[81] he says. In the "Introduction" he then boasts that in his system "no reference is made […] either to the meaning of the symbols (for example, the words) or to the sense of the expressions (e.g. sentences), but simply and solely to the *kind and order* of the symbols from which the expressions are

constructed."[82] The sole thing that matters in the philosophy of science is logical form. "The *content* of thoughts" is simply irrelevant.[83]

Either way, in *On the Logic and Theory of Science* Cavaillès states that Tarski's chief contribution to the philosophy of science is to show the inadequacy of Carnap's empty formalism and the vacuity of his quest for a "general syntax of science." It is true that the logical syntax requires familiarity on the part of the philosopher with the empirical language of science in order for the formalization procedure to take place, but it does not require the philosopher to consider the content of the empirical sentences it formalizes. In the logical positivist framework, questions such as "What is this thing called 'atom' that our physical theories to frequently speak of?" "What is genetic drift?" or "What is a photon?" are sidelined. Why? Because they pertain to the content of scientific propositions (the concepts they employ) rather than their "logical form" (the rules by which they are produced) and, as such, fall outside the domain of philosophy. In Carnap's framework, if one wants to know what is meant by "atom," one must strike up a conversation with a scientist rather than a philosopher since the content of scientific theory is a purely scientific, and therefore extra-philosophical, affair. Philosophy only deals with rules.

Tarski's work on semantics challenges the content-less syntactical formalism of Carnap by stressing the importance of content. Content demands investigation in its own right.

> The formal definition of a system is not complete with the enunciation of the syntax. It is again to the credit of Tarski for having constituted in its originality semantics alongside syntactics as such. It is in fact a question of not only giving the form of statements invested with meaning (rules of *structure*) and the modes of passing from one group of propositions to another (rules of *consecutiveness*) but of defining the objects themselves, the elements and intervening components with their properties in the sequences: variables, functions, individuals, demonstrations—in short, introducing the *concepts* of the system.[84]

As read by Cavaillès, this semantic intervention into the philosophy of language teaches us that the "enunciation of the syntax," the articulation of the form of scientific claims when considered as a body of linguistic propositions, does not suffice to beget a robust theory of science. For that, the formal aspect must be supplemented with, and perhaps even supplanted by, a meticulous exploration of the "elements" or "objects" (again, read: concepts) that make these propositions possible to begin with. Cavaillès does

not mince words when he says that to truly grasp the logic and theory of science (hence the title given to his work by Canguilhem), "an *ontological* analysis seems necessary."[85] It is compulsory that considerable analytic and interpretative labor be devoted to grasping the meaning, nature and essence of the objects that are arranged by logic-syntactical rules, "the concepts of the system." Without such ontology, Cavaillès forcefully proclaims, epistemology risks becoming an absurd "abdication of thought."[86]

Yet, even Tarski does not quite succeed at carrying out this ontological assignment. Immediately after lauding him for proving that a theory of science "requires an ontology,"[87] Cavaillès goes on to criticize Tarski for misunderstanding what this assignment actually entails. As a philosopher of language, Tarski reasons (i) that the study of scientific concepts is accomplished with the patronage of semantics and (ii) that once the *semantic content* of these objects is expounded, a full theory of science can finally be redacted. Against this semanticist stance, Cavaillès asserts that what is needed is not an analysis of the *semantic content* of scientific concepts, but an analysis of their *epistemological content*. How does this concept shape what we can know about the world? How does it frame or pre-frame the questions that are asked by science? How does it shape what counts as a "fact" or as a "theory" and what is viewed as a legitimate scientific "problem" in need of being addressed?

To capture this epistemological content, Cavaillès recommends two things. First, he recommends a shift in epistemological theory from *form* to *content*, i.e., from rules to concepts. The theory of science must get its first impulse from the ontology of scientific reason and transform itself into a philosophy of the concept. "It is not a philosophy of consciousness but a philosophy of the concept which can provide a theory of science."[88] Second, he recommends a historical (rather than purely empirical) interpretation of the content of scientific concepts. What do I mean by this? Recall that for someone like Carnap, the content of concepts is exhausted by their empirical import. If we want to figure out the content of the concept "planet," we simply ask the scientist what this concept means in his or her field. Once we get a sense of its extension (of all the empirical things that "fall under" it), we will understand its epistemological content. But, according to Cavaillès, concepts also have *historical* content because they are products of a particular history—the history of the sciences. In a puzzling but rich passage found at

the end of *On the Logic and Theory of Science,* Cavaillès contends that when it comes to concepts, "the generating necessity is not the necessity of *an activity*, but the necessity of *a dialectic*."[89] In my view, this means that what gives a concept its normative force (what generates necessity) is not simply *an activity* (such as Kantian synthesis or Carnapian reconstruction) but *a dialectic* (i.e. the dialectic *of its own history*). When thinking about a scientific concept, therefore, it is not enough to wonder "Oh, what is the empirical content of this concept given the way it is used by science today?" One must also ask a question of a different order: "And of what dialectic is this empirical content the consequence?"

An Ambivalent Promise

Unfortunately, Cavaillès died before he could realize the promise contained in this work In January 1944, the Gestapo executed him at an unknown date at the prison in Arras, in northern France. Because of this, "one can only guess how he might have developed the particulars of this dialectic."[90] But without lapsing into overblown conjectures, we might get a glimpse into what a Cavaillèsian philosophy of the concept might have looked like in concrete form by looking at the writings of those who posture as heirs to this concept-driven epistemology, those who try to redeem his interrupted promise.[91]

This digression into Cavaillès's work serves two purposes relative to the aims of this chapter. First, it shows that what is traditionally taken to be a philosophically insignificant feature of historical epistemology—its emphasis on *concepts* over *rules*—is, frankly, all-important. If Cavaillès's *On the Logic and Theory of Science* "set a precedent others followed," this is because this text brings out from under the history of rule-oriented epistemologies those elements or objects (i.e. concepts) that these epistemologies presuppose but neglect and, in a display of philosophical genius, makes these concepts the foundation of the very *spirit* of scientific rationality. And second, this digression also shows the entent to which promise Cavaillés's philosophy of the concept is an ambivalent one. When we inquire into the status of concepts (Are they empirical? Transcendental? Are they mental abstractions? Subjective beliefs?) we rub up against the internal limit of historical epistemology and raise a problem that can only be answered *negatively*. "Concepts are not…" The reason is that the scientific concepts of historical

epistemology possess an “oblique” ontological status that crisscrosses the empirical and the transcendental and leaves them inhabiting an odd region of being that lies, as I put it in the title and exposition above, beyond the Subject but beneath Spirit. And this, I take, is as much as can be said about them from an ontological point of view.

[1] Canguilhem, Georges. *Études d'histoire et de philosophie des sciences* (Paris, France: Vrin, 1983), 9-10

[2] For an account of why philosophy has a troubled relationship to its object, especially when this object is interconnected with both history and science, see Gordon Graham, *Historical Explanation Reconsidered* (London: Aberdeen University Press, 1983), 1-5.

[3] In a 1968 essay entitled "The Object of the History of Science," Canguilhem suggests that if these questions are never openly raised in debates about the history and philosophy of science, this is because historians, philosophers and scientists alike have fallen into the nasty little habit of assuming that these questions have already been "resolved." I, for one, have a more sinister hypothesis on this point. I suspect that the reason the question of *what?* is consistently and unquestioningly neglected in the field of the history and philosophy of science is because this question taps into a fundamental anxiety that shapes the experience of those of us who have made of the study of the history of science a philosophical vocation. This question forces us—"us" philosophers—to confront the un-confrontable and admit the inadmissible, namely, that when we do the history of science, our object is neither *science* nor *the sciences* but an altogether different entity that, quite honestly, is hard to detect, locate and identify and even harder to describe, conceptualize and theorize. That this question is almost never posed, then, is no accident. It is a deliberate forgetting that reflects the machinations and operations of a defense mechanism more than the effects of an innocuous assumption about theoretical achievements past. See *Etudes,* 7-25.

[4] The reader should keep in mind the fact that this is not an investigation of scientific discourse *per se,* but of scientific discourse *qua* philosophical object; that is, not of scientific discourse as it manifests itself in the first-order domain of the history of the sciences, but of it as it appears in the second-order reflections on the history of science made by Bachelard, Canguilhem and Foucault

[5] Francisco Jarauta, for example, contends that this lineage of philosophy "has *savoir* and its different discourses as its proper object." See his *La filosopfía y su otro (Cavaillès, Bachelard, Canguilhem, Foucault)* (Valencia: Pre-Textos, 1979), 12.

[6] According to Jarauta, Bachelard's philosophy is anchored in "an epistemological history of [scientific] discourses," (Jarauta, *La filosofía,* 63) but fails to develop an account of what these "discourses" are and how they are to be understood. Similarly, in his *Encyclopedia of Modern French Thought* (New York: Routledge, 2004), Christopher Murray explains that the epistemological writings of Canguilhem also take up the problematic of "scientific discourse" (Murray 119). Unfortunately, Murray also says nothing more about this problematic other than noting that it "involves a search for truth." And the case is perhaps even more acute in the case of Foucault, who first popularized the term "discourse" in the *Archaeology of Knowledge* and *The Order of Things*.

[7] Jarauta, *La filosofía,* 12

[8] Foucault, *AK*, 12

[9] Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: NLB, 1975), 84.

[10] Canguilhem, IR, 33

[11] Although the term "norm" appears in the writings of Bachelard, Canguilhem and Foucault alike, I am ultimately borrowing the term—in the plural—from Karl Popper. In *The Logic of Scientific Discovery,* Popper argues that before one can successfully distill a "theory of theories" (Popper, 29) in the philosophy of science one must capture all and only the procedural and methodological norms that guide scientific rationality and direct the production of scientific claims about the empirical world. One must, in other words, analyze and subsequently regiment "the rules, or if you will the norms, by which the scientist is guided when he is engaged in research or in discovery" (Popper, 37). Although I find Popper's language helpful, my use of the term differs from his in two significant regards. Unlike him, I do not analyze the norms that regulate scientific activity in order to extract a Catholic philosophy of science that claims to, in one stroke of the pen, turn the page on the problem of the logic, structure, and anatomy of science with a Popperian "theory of theories," a Carnapian "science of science," or Comtean "logic of scientific history." Moreover, unlike Popper, who reduces scientific rationality to scientific method and scientific "norms" to methodological rules, I give the term more flexibility and versatility (including concepts within its domain).

[12] Zammito, John H. *A nice derangement of epistemes: Post-positivism in the study of science from Quine to Latour* (University of Chicago Press, 2004), 56

[13] Various figures have noted the importance of these norms. See Grene, Marjorie's "The philosophy of science of Georges Canguilhem: a transatlanticview." In *Revue d'histoire des sciences* 53 (2000): 47–64; Thomas Ebke's "The Rupture And The Screw: The Structure of History According to Georges Canguilhem and Helmuth Plessner" Presented at the Max Planck Institute For The History Of Science 2012 Conference "Epistemology And History From Bachelard And Canguilhem To Today's History Of Science"; Chimisso, Cristina. "The tribunal of philosophy and its norms: history and philosophy in Georges Canguilhem's historical epistemology." *Studies in History and*

Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences 34.2 (2003): 297-327; Macherey, Pierre. *De Canguilhem à Foucault, la force des normes* (Paris, La Fabrique, 2009).

[14] For an analysis of the role of "tacit knowing" in the philosophy of science, see Michael Polanyi, "The Logic of Tacit Inference" *Philosophy* 41 (1966): 1-18. See also his "Tacit Knowing: Its Bearing On Some Problems Of Philosophy" *Reviews Of Modern Physics* 34 (1962): 601-615.

[15] For an analysis of historical norms of reason of which "no one is conscious," see Ian Hacking, *Historical Ontology* (Massachusetts: Harvard University Press, 2002), 77. In *AK*, Foucault reiterates this by stating that the "historical *a priori*" that is laid bare by his method "is not a form of knowledge (connaissance) or type of rationality which, crossing the boundaries of the most varied sciences, manifests the sovereign unity of a subject […but] the totality of relations that can be discovered, for a given period, between sciences when one analyses them at the level of discursive regularities" (Foucault, *AK*, 191).

[16] Nola, Robert. *Rescuing reason: A critique of anti-rationalist views of science and knowledge* (Springer Science & Business Media, 2012), 381.

[17] Foucault, *GSO,* 309

[18] In this paper, which grew out of various seminars on the history of science that took place at the University of Paris's Institute of the History of the Sciences and Techniques between 1964 to 1966, Canguilhem established the independence of the object of the history of the sciences relative to the object of the sciences by suggesting that these objects really "have nothing in common" with one another. While the object of the scientists is something "natural" and "initial" (that which perhaps exists, but cannot be known, before inscription and language), the object of historians of science is "non-natural" and "historical" (that which is produced through acts of linguistic and technical mediation). The former he christens "pre-text," the latter "scientific discourse." (Canguilhem, *Etudes*, 18)

[19] Foucault, *OT*, xi

[20] Sawyer, Keith. "A Discourse On Discourse: An Archeological History Of An Intellectual Concept." *Cultural studies* 16.3 (2002): 433-456.

[21] "Bachelard thinks the process of the sciences from that other process of the progressive complexity of experience, which would be reflected in the order of *savoir* and in that of its constructions: discourses" (Jarauta, *La filosofia*, 37). Canguilhem himself notes that since Bachelard's aim is to recuperate the progress of science, this can only be done by analyzing the epistemology of scientific discourses (Jarauta, *ibid.*, 63).

[22] An example of a historical analysis of scientific discourse that remains purely linguistic is Dwigth Atkinson's *Scientific Discourse in Sociohistorical Context: The Philosophical Transactions of the Royal Society of London, 1675-1975* (London: Lawrence Erlbaum Associates Publishers, 1999). See also Gray, Jeremy J. "Languages for mathematics and the language of mathematics in a world of nations." *Mathematics unbound: The evolution of an international mathematical community* 1945 (1800): 201-228; Andrews, Stephen Pearl. *The Primary Synopsis of Universology and Alwato: The New Scientific Universal Language*. D. Thomas, 1871

[23] Tompkins, Arnold. *The science of discourse*. (Gin and Company, 1897). Hill, David J. *The science of rhetoric: An introduction to the laws of effective discourse*. (American Book, 1877).

[24] Foucault, *OT*, xiv

[25] Canguilhem, *VR*, 25

[26] Zammito, *A Nice Derangement*, 56

[27] See Jürgen Habermas's *A Theory of Communicative Action Vol. 1* (Boston: Beacon Press,1984); also, *A Theory of Communicative Action Vol. 2* (Boston: Beacon Press,1987)

[28] Foucault, *BC,* 90

[29] Foucault, *BC*, 162

[30] Historical epistemologists recognize a meaningful distinction between science and non-science. Canguilhem explicitly talks about the "science and non-science" split (see the "Introduction" to *IR*), while Bachelard and Foucault use slightly different language. Bachelard revivifies the Platonic opposition between *epistêmê* and *doxa* and argues that that, on account of its propinquity to objectivity or rational truth, science "opposes itself absolutely to opinion" (quoted by Canguilhem, *Etudes*, 159). Foucault prefers to talk about the distinction between "knowledge and opinion." See David Webb's *Foucault's Archaeology: Science and Transformation* (Oxford, UK: Oxford University Press),120.

[31] Foucault, M., Gordon, C., Patton, P., Beaulieu, A. "Considerations on Marxism, Phenomenology and Power. Interview with Michel Foucault; Recorded." *Foucault Studies* 14 (2012): 98-114.

[32] Peña-Guzmán, David M. "Pathetic Normativity." *Chiasmi International* 15 (2013): 361-384.

[33] Canguilhem, *IR*, 27

[34] Canguilhem, *IR*, 27
[35] Lorraine Daston and Peter Galison, *Objectivity* (Boston: Zone Books, 2007), 369
[36] In Part II of *AK*, Foucault draws a critical distinction between two kinds of normative principles that make up "the field" of a scientific discourse: *elements* and *rules.* According to him, scientific discourse is constituted when certain *elements* (which he calls "concepts") are mobilized, organized and manipulated according to certain *rules* (which he calls "rules of formation"). He writes: "Whenever one can describe, between a number of statements, such a system of dispersion, whenever, between objects, types of statement, concepts, or thematic choices, one can define a regularity, we will say, for the sake of convenience, that we are dealing with a *discursive formation*—thus avoiding words that are already overladen with conditions and consequences, and in any case inadequate to the task of designating such a dispersion […] The conditions to which the *elements* of this division (objects, modes of statement, concepts, thematic choices) are subjected we shall call the *rules of formation*. The rules of formation are conditions of existence (but also of co-existence, maintenance, modification and disappearance) in a given discursive division" (Foucault, *AK,* 38). When we speak of a discursive formation, independently of whether we have in mind the highly formalized discourses of mathematics and physics or the more weakly regimented discourses of psychiatry and economics, we are speaking of a practice that is thrown into relief by a certain number of elements ("objects, modes of statement, concepts, thematic choices") and the rules of formation that represent these elements' "conditions of existence."
[37] Twenty years before the publication of *AK* or *OT*, however, Cavaillès makes this same distinction in *On the Logic and Theory of Science,* with the sole exception that he prefers a different terminology. He speaks of scientific domains—especially the domain of mathematical reason—as constituted by the interplay of *objects* and *rules*. By "objects," of course, Cavaillès does not mean those empirical entities that scientific concepts *refer to* (i.e. suns, meteors, genes, atoms, germs, etc.). For him, the objects that matter in epistemology are the scientific concepts themselves, the concepts that shape how scientists perceive, experience and interpret the world around them—the concept of the planet, the concept of an orbit, the concept of the atom, etc. Like Foucault, who equates *elements* with *concepts*, Cavaillès uses the terms "objects" and "concepts" synonymously (Webb, *Foucault's Archaeology: Science and Transformation*, 20).
[38] Bachelard, *AR*, 66
[39] Foucault, *AK,* 80
[40] Foucault, *BC*, 190;
[41] Rules are not explicit laws that can be consulted either in scientific training manuals or in scientific publications. They are not like Kant's categorical imperative*,* which regulates the practical thinking of its author while also appearing on the face of his discourse (both in the *Groundwork* and the second *Critique*). They are not given as propositional formulas that rational agents can access and master like a mantra or refrain. If anything, these rules that structure the form of scientific discourse to the "logical form" of language described by Wittgenstein in the *Tractatus,* which is mirrored but not positively represented in propositional language. They are reflected in the physiognomy of scientific discourse without appearing in it as positive terms.
[42] In the 1970 "Preface" to *OT*, Foucault says the following about the aims of this text: "In short, I tried to explore scientific discourse not from the point of view of the individuals who are speaking, nor from the point of view of the formal structures of what they are saying, but from the point of view of the *rules* that come into play in the very existence of such discourse: what conditions did Linnaeus (or Petty, or Arnauld) have to fulfill, not to make his discourse coherent and true in general, but to give it, at the time when it was written and accepted, value and practical application as a scientific discourse—or more exactly, as naturalist, economic or grammatical discourse?" (Foucault, *OT*, xiv). In *AK,* he thensays: "By systems of formation then, I mean a complex group of relations that function as the rule; it lays down what must be related, in a particular discursive practice, for such and such enunciation to be made, for such and such a concept to be used, for such and such a strategy to be organized. To define a system of formation in its specific individuality is therefore to characterize a discourse or group of statements by the regularity of a practice" (Foucault, *AK,* 74)
[43] For example, in *AK* Foucault says that his analysis of the history of the human sciences in *OT* was an attempt to understand the interaction between these two types of scientific-epistemic norms: "In *The Order of Things*, my attention was concentrated mainly on the network of *concepts* and their *rules of formation* (identical or different) as they could be located in General Grammar, Natural History, and the Analysis of Wealth" (Foucault, *AK*, 65).
[44] Foucault, *BC,* 159
[45] Bachelard, *AR*, 148
[46] Foucault, *AK*, 136
[47] Lecourt, *Marxism and Epistemology,* 92

[48] Macherey, Pierre. *La force des normes: de Canguilhem à Foucault* (Paris: La Fabrique, 2009), 9

[49] In *BC*, Foucault argues that, during the classical period, medical reason operated primarily through a "classificatory logic" that analyzed the visible in terms of the invisible. This focus on invisible essences as grounding forces for rational medical discourse, however, soon gave way to a new mode of reasoning in medicine. In the modern period, the standards of reasoning shifted and "sensibility" came to play a new and foundational role in the nineteenth century that it did not previously possess. By the late-nineteenth century, medical rationality no longer articulated the visible by "looking" at the visible, rather it saw the visible as exhaustive of nature. Thus in nineteen century, sensibility (literally the senses of medical experts) become central to medical reasoning and this shift in the "rational form" of medical science explains why certain things (such as the body) were, in an important sense, absolutely outside the possible field of scientific perception from the 1700s to the early 1800s--because the extant norms of medical thought did not illuminate the body for the medical gaze. It was not until "the technical armature of the medical gaze [was] transformed" (*BC*, 121) that the body was place beneath the burning gaze of the doctor as an object worthy of scientific investigation. For an analysis of the proto-phenomenological nature of these concepts, see Beatrice Han's *Foucault's Critical Project: Between the Transcendental and the Historical* (Palo Alto: Stanford University Press, 2002), 47.

[50] "Since concepts regulate the relations that at different times constitute the horizon of scientific truth, no scientific theory can have epistemological content or be intelligible qua scientific theory in the absence of concepts." See my "Essential Revelations: Canguilhem's Phenomenology of Scientific Rationality," presented at the 51st Meeting of the *Society for Phenomenological and Existentialist Philosophy* (SPEP). Held at the Rochester Riverside Convention Center and Hyatt Regency in Rochester, NY. November 1-3, 2012.

[51] Gary Gutting, *Michel Foucault's Archaeology of Scientific Reason* (Cambridge: Cambridge University Press, 1989), 34

[52] Lecourt, *Marxism and Epistemology,* 173

[53] Bachelard, *NSS* 59

[54] Bachelard, *NSS,* 174

[55] This negative definitional strategy could very well be a deliberate move since it allows Bachelard, Canguilhem and Foucault to claim a term as the grounding element of their thought (the philosophy *of the concept*) without worrying about accidentally over-determining this object and opening themselves up the charge that, as philosophers, they are trying to legislate fixed principles for the scientists. By naming and identifying concepts, that is, they can deny the accusation of having a bottomless project that, bereft of a stable object, searches for something in vain like Cadmus for Europa; and they also secure for themselves the right to gamble at the high-stakes table of philosophy, where wagers about truth, reason and meaning are staked. Yet, by defining this object only vis-a-vis *what it is not*, they also manage to hedge their bets so as to avert a possibly catastrophic over-determination.

[56] Cassou-Noguès, Pierre. "The Philosophy of the Concept" In *The History of Continental Philosophy: Volume 4: Phenomenology: Responses and Developments,* ed. Alan Shrift (University Of Chicago Press, 2011).

[57] Bachelard, Canguilhem and Foucault follow Kant in thinking that scientific thinking itself is law-bound, but whereas in the *Critique of Pure Reason*, Kant equates the conditions for the possibility of all experience with the conditions for the possibility of scientific rationality, French philosophers of science explicitly contradistinguish the realm of subjective experience from the realm of scientific rationality. For them, the specificity of science stems precisely from the fact that scientific rationality abides by a series of normative strictures that are alien to subjective experience The criteria for scientificity are not the categories of understanding but the "history of triumphant rationality" (Canguilhem, *VR,* 154). Bachelard argues that as long as the Kantian categories are de-subjectivized and rendered plastic, they may be a good model for thinking about the epistemology of science. "In order to face up to the complexity of the scientific phenomenon," Bachelard claims, we must "demonstrate the sudden plasticity of the categories of understanding" (*PN,* 59). See also Bachelard, *PN*, 57, 95; Foucault, *AK,* 203-4; Foucault, *OT*, 242.

[58] For a criticism of phenomenological intuitionism, see Bachelard's *DD* and *II*.

[59] Bachelard argues that empirical induction from the general to the particular simply gives us a table of empty generalities, not a set of scientific notions. And he uses Baconian philosophy as his whipping boy and speaks of "the sclerosis of concepts formed by Baconian method" (*FSM,* 69).

[60] "We have to think *against* the brain," Bachelard writes in the last chapter of *FSM*. According to him, although the temptation to reduce scientific discourse to the psychic operations of the scientist is an understandable "first reflection" on science, ultimately this reflection is incapable of explaining the nature of scientific discourse in all its relational complexity. As an paradigmatic example of an "epistemological obstacle" that stems from the prejudices of common sense and naive realism, the assumption that scientific discourse is simply the outward manifestation of the inner dynamics of a gifted brain must be abandoned. "Modern scientific thought requires us to resist this first

reflection. The very use of the brain is therefore called into question. From now on, the brain is no longer unreservedly the appropriate instrument of scientific thought. It is an obstacle" (*FSM*, 248)

[61] According to Ortega y Gasset, the only way to make the study of history "scientific" (rather than just "story-telling") is to recognize that beliefs (Spanish, creencias) get sedimented overtime and become unthought assumptions or background premises from which we reason. Although these beliefs take on certain qualities that link them to a collective unconscious, they nevertheless are subjective beliefs that are reducible to psycho-sociological origins. In his work, Ortega y Gasset links his epistemology to a philosophy of life, in the vein of Bergson, by tracing these beliefs to the pre-thetic life-world where subjective cogitation unfolds. See his "Sobre la razón histórica" *Obras Completas* Volume 12 (1983).

[62] Bachelard, *NSS,* 94; Foucault, *AR* 32; Bachelard, *MR*, 1

[63] Categorical intuitions, for Husserl, are temporal in the sense that they appear in the temporal flow of consciousness's immanence. But they are not historical due to their transcendental form. At best, these intuitions undergo historical change through the sedimentation process describes by Husserl in the *Crisis*.

[64] Canguilhem says the rules of which science makes normative use are not "rules of the understanding [Fr. règles de l'entendement]" (Canguilhem, *Etudes*, 200). This is why Bachelard says that epistemology can never be the "science of science" (Lecourt, *Marxism and Epistemology,* 121) and why Foucault says archaeology does not seek, in its conception of discourse, "a restored transcendence" (*AK,* 113). See also Canguilhem, *IR*, 10.

[65] The rules and concepts of scientific discourse are not to be confused with the rules of classical logic. Foucault says that "the statement cannot be reduced to a grammatical or logical form" (Foucault, *AK,* 102) because statements "may but not need not be of a grammatical or logical order" (*AK*, 106). Similarly in NSS Bachelard, using the example of Eucledian geometry, argues that the history of science cannot be reduced "to a closed and immutable system of logic" (Bachelard, *NSS*, 20)

[66] Canguilhem rejects Hegelianism (Canguilhem, *WM*, 6); Foucault rejects Hegel's idealism by saying that the field of discourse is not a synthetic or organic form and must be studied in its "non-synthetic unity" (Foucault, *AK,* 26); Bachelard more explicitly moves away from the father of German idealism by claiming that his dialectical theory of science "has nothing to do with an *a priori* dialectic" and little to do with "Hegelian dialectics" (Bachelard, *PN* 135)

[67] Bachelard, who studied under the French sociologist Léon Brunschvicg along with Koyré, makes the same claim. For him, scientific concepts are not simply words (whether uttered in isolation or in the form of sentences) but "nodes" in a system. Concepts may be expressed and communicated through words but, unlike words, they that acquire their meaning on account of the *scientific* system they belong to, or the "group" of which they are "members." When chemists from the 18th century and those from the 19th wrote the word "heat" in the laboratory notebooks, in their diaries and in their published materials, they may have been talking about the same thing from the standpoint of the linguist, but from the standpoint of the epistemologist they were using different concepts. In *FSM,* Bachelard writes: "The same word can at the same period in time have within it very many different concepts. What misleads us here is the fact that the same word both denotes and explains. What is denoted stays the same by the explanation changes. [...] Epistemologists must therefore make every effort to understand scientific concepts [...] by establishing an array of concepts for every individual idea and by showing how one concept has produced another and is related to another" (Bachelard, *FSM*, 28). And elsewhere in the same text, he reiterates this claim almost as if to stress its significance (*FSM*, 76)

[68] Lecourt, *Marxism and Epistemology,* 173

[69] In the first chapter of "Part Three" of *AK*, Foucault explains that scientific statements do not exist in the same way a language (*langue*) exists. Using the notion of the "statement" as the proper object of analysis (rather than propositions or sentences), Foucault explains, in a manner redolent of Koyré, that the same utterance may in fact represent two distinct statements if it takes place in different enough contexts (Foucault, *AK*, 80ff). "The fact that two enunciations are exactly identical, that they are made up of the same words used with the same meaning, does not, as we know, mean that they are absolutely identical" (*AK,* 143) Elsewhere in the same book, Foucault goes as far as to say that his "archaeological" approach to the history of thought is not simply concerned with language and, in fact, represents "a possible line of attack for the analysis of verbal performances." And in the chapter entitled "The Formation of objects," he says: "From the kind of analysis I have undertaken, *words* are […] deliberately absent […] I would like to show that 'discourses', in the form in which they can be heard or read, are not as one might expect, a mere intersection of things and words." (*AK* 48).

[70] According to Canguilhem, when it is not promoting the most egregious psychologism through its appropriation of Gestalt psychology, Kuhn's work explains "paradigm shifts" in the history of science through sociological behavioral models rooted in the logic of "community consensus" and "choice." This empirical sociologism or "logical empiricism" (not to be confused here with the more famous "logical empiricism" of the Vienna Circle)

presupposes that the network of scientific norms changes when scientists decide—either individually or as a community—to abide by a different set of formal guidelines or rules of sentence-formation and when they agree to play by a new set of rules that better explains previously anomalous events without thereby sacrificing the explanatory and problem-solving prowess of the old paradigm. That this sociological conception fails, Canguilhem proclaims, is clear for at least three reasons. First, this permutation of sociology and psychology is a regress into an empiricism bereft of conceptual subtlety for it collapses the distinction between "science" and what Canguilhem calls "non-science," which describes human projects that are not beholden to scientific norms like politics, art and religion. Second, Kuhn's approach to the history of science represents merely another facet of subjectivism. Sociology, consciously or not, re-instates the primacy of subjectivity while concealing it behind a façade of inter-subjectivity. What does it mean to say that scientist *decide* upon paradigms? Is this not simply another way of saying that the Subject remains the ultimate "source" of scientific history, the "origin" and "master" of scientific language? Third and finally, Canguilhem points out and Bachelard would agree that Kuhn simply fails to make sense of the normative content of scientific discourse and the constraints imposed upon scientists by science itself (Canguilhem, *VR,* 46). And in Chapter 2 of *Vital Rationalist*, he accuses him of reducing truth to social psychology.

[71] In the context of distinguishing between two different spheres of temporality ("empirical" and "rational"), Bachelard uses the French term "*apanage*" to describe the relation between the members of a scientific city and their shared rational history. The word refers to a practice that was born in the middle ages in Europe to protect the younger male offspring of the king who, under the system of primogeniture, would otherwise be left destitute. An *apanage* was a gift or a grant, usually a minor but valuable portion of the demesne of the crown, meant to provide protection for the royal descendants. It was bequeathed upon the sons of the sovereign (from the Latin ap-panare, "to give bread") to ensure their ongoing access to a series of social, economic and cultural privileges. According to Bachelard, the principles or concepts that a scientific discipline has retained from its past are "the sole *apanage* of the members of a limited scientific city" (Bachelard, *AR*, 32).

[72] Or quoting Foucault: again: "this ennunciative domain [discourse] refers neither to an individual subject nor to a collective consciousness not to a transcendental subjectivity" (*AK,* 122). This mantel "refers neither to a horizon of ideality not to an empirical genesis of abstraction" (*AK*, 62). It is, as Bachelard says "a doctrine of reports or relations [*rapports*] without support and without reporter [*rapporteur*]" (Bachelard, *AR*, 10)

[73] Peden, Knox. *Spinoza Contra Phenomenology: French Rationalism from Cavaillès to Deleuze*. (Palo Alto, California: Stanford University Press, 2014). 42

[74] Crimmins, Kem. "Transforming Necessity: Transcendental Logic after Cavaillès." *Philosophy Today* 51 (2007): 148-153.

[75] Parry, William. "Reviewed Work: *Sur la Logique et la Theorie de la Science* by Jean Cavailles." *Philosophy and Phenomenological Research,* 11.1 (1950): 138-140

[76] Kockelmans, Joseph and Theodore Kisiel. *Phenomenology and the Natural Sciences (Studies in Phenomenology and Existential Philosophy)* (Northwestern: Northwestern University Press, 1986), 354

[77] Cavaillès, Jean. "On the Logic and Theory of Science." In *Phenomenology and the Natural Sciences (Studies in Phenomenology and Existential Philosophy)*, eds. Joseph Kockelmans and Theodore Kisiel (Evanston, Illinois: Northwestern University Press, 1986)

[78] Carnap, Rudolf. *Logical Syntax of Language,* (London: Routledge, 2000), xiii

[79] Carnap, *Logical Syntax,* xi-xiv

[80] Cavaillès, *On the Logic and Theory of Science,* 380

[81] Carnap, *Logical Syntax of Language,* xiii

[82] Carnap, *Logical Syntax,* 1

[83] Carnap, *Logical Syntax,*1

[84] Cavaillès, *On the Logic and Theory of Science,* 381

[85] Cavaillès, *On the Logic and Theory of Science,* 369

[86] Cavaillès, *On the Logic and Theory of Science,* 408

[87] Cavaillès, *On the Logic and Theory of Science,* 386

[88] Cavaillès, *On the Logic and Theory of Science,* 409

[89] Cavaillès, *On the Logic and Theory of Science,* 409

[90] Kockelmans and Kisiel, *Phenomenology and the Natural Sciences,* 352

[91] See David Hyder's "Foucault, Cavaillès, and Husserl on the Historical Epistemology of the Sciences" in *Perspectives on science* 11 (2003): 107-129; also, see David Webb's "Cavaillès and the Historical *A Priori* in Foucault" in *Virtual Mathematics: the Logic of Difference*, ed. S Duffy (Clinamen Press, Manchester, 2005)

3

NORMATIVITY'S WARP AND WOOF

CONCEPTUAL NETWORKS AND METASTABILITY

> "[In the production of theoretical knowledge], the system of the hierarchy of concepts in the combination determines the definition of each concept, as a function of its place and function in the system. It is this definition of the place and function of the concept in the totality of the system which is reflected in the immanent *meaning* of this concept."
>
> -Louis Althusser[1]

The previous chapter argued that certain ontological primitives called "concepts" constitute scientific discourse. As the building blocks of scientific reason, these concepts represent the *terminus a quo* of epistemology. Unfortunately, in describing them are "cellules," "atoms" and "elements," our last chapter may have left the reader with a wrong impression about concepts—that they are little bundles of normative energy, self-contained *quanta* of scientific rationality that can, in principle, be studied in isolation from one another. This is incorrect. Concepts are not windowless Leibnizian monads that float around epistemic space like Democritean atoms in the void. Quite the contrary, they are relational fibers that interrelate, interact and interlock with one another and that, through their mutual determinations, give rise to emergent bodies or anastomotic systems that cannot be reduced to the multiplicity of their parts. These bodies, which I call "conceptual networks," are mantels or fabrics of normative power that determine the meaning of the particular concepts that appear in them as links, threads or nodes. As such, they are crucial for the elaboration of a theory of meaning specific to the philosophy of science.

The questions that will beset our thinking in this chapter are: What are these networks? And what do they do? After showing that networks occupy a dominant position in the epistemological writings of Bachelard, Canguilhem and Foucault, this chapter develops a theory of conceptual networks that turns on the notion that these networks are defined by three chief properties. These are:

i. *Power of Sur-venience* (Weak Emergence). Networks are contextures of scientific reason that emerge from a "base" of determinate socio-historical and technico-material conditions. Once born, however, these formal structures acquire a relative autonomy (relative, that is, to their base) that allows changes "above" (in the network) to occur without these changes necessarily mapping onto correlate changes "below" (in the base).

ii. *Downward Causation* (Strong Emergence). Although not quite "subjects," networks are actants or agents endowed with causal powers. The most notable of these powers or capacities is the power of *synthesis* that in existential and phenomenological philosophy is reserved for the transcendental ego. And,

iii. *Morphogenesis* (Historicity). Conceptual networks are not stagnant aggregates of norms. They are coherent assemblages that change in form and content over historical time.

At the core of this theory is the idea that conceptual networks *are* and *are not* simply echoes of social life and human existence. At no point does this chapter deny that conceptual networks stand in a circuit with the socio-historical world, that they affected by the commotions and upheavals that shape social reality, or that they change and morph with the turn of history's wheel. But formal structures that dispense objectivity and exhibit proto-agential capacities, these networks cannot be reduced to the social totality from, and in, which they appear.

When thinking about the relation that holds between the conceptual network that embodies the spirit of a particular scientific domain and the rich social, historical and material reality that forms its "base," the standard notion of (weak) emergence is inadequate. Not inappropriate. Just inadequate. Networks do not simply emerge from the thickets of the socio-historical world like a mirage from the desert floor. They certainly emerge from a base or bedrock, but once they are born they also turn around and exert a causal influence over the very base on which their existence depends, like a dust devil that arises from the desert floor and tears it apart along the way. Toward the end of the chapter, I try to capture the essence of conceptual networks with John Protevi's concept of "meta-stability."[2] Conceptual networks are meta-stable formations that have a seriously uncanny ability: the ability to *condition their own conditions of possibility*. They are the catalysts for their own transformation.

Already in the 1930s, Bachelard suggested that in the philosophy of science "elementary realism is an error"[3] because the concepts that ordain a scientific discipline are not elementary units that exist in a state of epistemological quarantine.[4] They are "intensible"[5] variables whose value of rational effulgence (or "cash value," to borrow a term from William James)[6] depends wholly on the place they occupy in a complex field of knowledge, in an economy of rational thought.[7] The richness of scientific notions, their *content,* comes "from their very circulation, from their conversions of value and from their relations with other ideas."[8] As Bachelard states in *AR*, "scientific concepts have no meaning but in an inter-conceptualism"[9] because "the normativity [*normativisme*] that all rationalist cultures tend to is an instance that only has objectivity in the function of a large system of norms."[10] Normativity, simply put, is a network-effect.

In tandem with Bachelard, Canguilhem believes that "in a coherent system of thought, every concept is related to every other concept."[11] Thus, the philosopher set on investigating scientific discourse must do more than unearth from the cemetery of the history the sciences the bare bones of *this* or *that* concept and dig out the entire constellation of concepts through which the meaning of *this* or *that* concept is disclosed. The philosopher must set free the entire network on account of which individual concepts acquire a life of their own. Surely, those who write the history of the sciences from the standpoint of the philosophy of the concept may concentrate on one primary concept, as Canguilhem does in *FCR* with the concept of "reflex" that Canguilhem himself takes up in *FCR*. But it would be intellectually and methodologically remiss of them to treat the concept as a wolf without a pack because the life of the concept is not the life of the hermit or the life of the maverick. It is "the life of relation."[12]

In "The Philosophy of Science of Georges Canguilhem: A Transatlantic View," Rudolf Carnap's protégé, the philosopher of biology Marjorie Grene, says that when Canguilhem etches "the history of a concept" he is educing the diachronic movement of that concept in historical time *and* divulging the synchronic relations that lend such a concept significance relative to a rational system of thought. Canguilhem thus maneuvers his way not only through a complex historical dialectic of the kind

demanded by Cavaillès, but also through a "complex and many-leveled cluster of norms"[13]; through a thick web that in *Etudes* Canguilhem describes as a "knot of concepts" (French, *nœud de concepts*).[14]

Like Bachelard's, Canguilhem's is an anti-Cartesian and post-positivist philosophy. Against the Cartesian claim that reason rests upon "clear and distinct" ideas, he holds that clarity and distinctness are mutually exclusive properties. By definition, a distinct idea is one that has been separated, as if by pricking, from a larger body or frame (from *distinctus,* the past participle of the Latin *distinguere*: dis- "apart" + -stinguere "to prick"). But separated from its frame an idea loses its concreteness and gravitas, and become as expressive as a note without a melody and as useful as a coin without a market. The cognitive process simply cannot get off the ground if all it can avail itself of on in its rush toward truth is a stunted little idea that relates to, and thus illuminate, nothing outside itself. Can the biologist grasp the meaning of evolution without putting it in dialogue with the concepts of selection and reproduction? Can the physicist think energy without thinking mass? And mass without force? Can the mathematician think addition without subtraction? Descartes's assertion in the *Meditations* that "when ideas are considered solely in themselves and not taken to be connected to anything else, they cannot be false"—this assertion, considered in itself or otherwise, cannot be true.

But this escape from the hyper-rationalist epistemology of Descartes is not a flight to the anti-metaphysical theory of science promulgated by logical empiricists. Concepts get their meaning from something external to themselves, but not from something external to *the order of the conceptual* as such. In contradistinction to the Comtean notion that concepts get their meaning from the observation, certification and organization of empirical "facts," Canguilhem asserts that the meaning of theoretical notions exceeds their observational or empirical support and depends primarily on the relations they sustain with *other theoretical notions*. So-called "facts," the linchpin of positivist creed, no doubt help scientists support and falsify theories. But they not transparent or diaphanous reflections of the way things are that have the last word on the content of theory because facts are themselves conceptually mediated and theoretically laden reports that become meaningful only via the concepts that help us isolate and interpret them. "Theories never proceed from facts. Theories only proceed from previous theories, often

very old ones. Facts are only the route (rarely direct) by which theories proceed from one to another."[15] In a key passage from *KL*, Canguilhem says: "it is an epistemological fact that an experimental fact […] has no biological *meaning*."[16] Experimental or empirical facts, by themselves, have no significance in epistemology. They are background-dependent creations that "come into relief against a permanent backdrop of biological signification."[17] And this backdrop, I argue, is the conceptual network of biology, that cluster or knot of concepts through which the discourse of the living participates *in the true*.

With Foucault things are a bit more complex because in his earliest works, at least according to Webb (2012), he seems to have an "atomist understanding of formal thought"[18] that stands in tension with a network-based theory of scientific meaning. Perhaps influenced by Bachelard's claim that scientific ideas are "cellules of *savoir*," Foucault describes concepts in *AK* as "atoms of discourse"—a formulation that evokes memories of the sort of methodological individualism that dominated discussions in the natural and human sciences pre-WWII.[19] Yet, in the same way that Bachelard avoids the pitfall of elementary individualism in *AR* by clarifying that the cellules of *savoir* that appear in his works "intercalate" themselves into complex tissues of rationality so, too, Foucault distances himself from epistemological atomism by specifying that concepts exist "in a domain of coordination and coexistence."[20] From the viewpoint of ontology, they are *elements*. But from the viewpoint of the theory of meaning, they "form a complex web." He writes: "what we have discovered is not the atomic statement—with its apparent meaning, its origin, its limits, and its individuality—but the operational field of the enunciative functions and the conditions according to which it reveals various units."[21]

The networks Bachelard calls "systems of norms" and Canguilhem describes as "knots of concepts," appear in Foucault's work as "operational fields" or "associated fields." Like Bachelard's systems, these fields are conceptual structures that infuse each term in them with meaningfulness and rational value.[22] They "turn a sentence or a series of signs into a [scientific] statement."[23] But, as Foucault clarifies, they never "operate on a sentence or proposition in isolation."[24] Instead, they turn utterances into scientific judgments by placing them in a rational melody or inside an epistemological market, by providing them "with a particular context."[25] Atomic "statements" (Foucault's term for synthetic

scientific judgments in the human sciences) are actuated vis-à-vis these associated fields.[26] Like Canguilhem's knots, these fields set the "background on the basis of which formal rules can be established."[27]

The prevalence of this relational language (of clusters, fields, webs and systems) is a sign that French historical epistemology transitions, quite naturally, from an *ontology of reason* to a *theory of meaning*, from the concept of "concept" to the concept of "network." Conceptual networks are non-aggregative, non-linguistic contextures that, having "warp and woof" as Bachelard says in *MR*,[28] ground belief authentication in science; they are plexuses of normative power that, to quote Althusser, "ensure the presence of scientificity in the production of knowledge […] and confer on a knowledge its character as a ('true') knowledge."[29] I propose that these networks be interpreted as French epistemologists' version of Kuhnian "paradigms," Laudanian "research traditions" and Lakatosian "research programmes."

A Quick Note on Emergence

For the sections that follow, it matters that historical epistemologists bring conceptual networks under the *proviso* of a material theory of origins. Unlike Kant's "Ideas of Reason" and the various "moments" in the Hegelian dialectic, the concepts that make up these networks do not come from some immaculate sphere of pure reason or from the arbitrary hypostatizations of a wily philosophical consciousness. Neither are they miraculous "events" that wondrously burst into being from thin air like the visions of St. Bernadette at Lourdes or St. Juan Diego at Tepeyac. No, these concepts are engineered in the umbra of social relations and the antumbra of determinate historical conditions and thus emerge from a *material base* that acts as their anchor, support and ballast; from a base that embeds, funds and sustains them.[30] (See "Appendix Five—A Few Thesis on the Materialism and the Materiality of Knowledge," for an in-depth analysis of this material base).

Once concepts are born from this base, however, concepts acquire a life of their own and organize themselves into larger assemblages. Using metaphysical parlance evocative of Nietzschean genealogy and Freudian psychoanalysis, one could say that concepts exhibit a will-to-tessellate, i.e., they display a social

impulse that drives them to meld with one another through a rational movement of intra-alignment or intra-adjustment. Bachelard, Canguilhem and Foucault recognize this process and name it. Bachelard vacillates between calling it "consolidation"[31] and "intercalation,"[32] while Foucault and Canguilhem consistently use the term "coordination"[33] to refer to it. Either way, these terms point to one and the same phenomena: the autonomous process whereby concepts tessellate themselves into networks, a process that ensures concepts do not close themselves off in the pristine dream of an unqualified interiority or in a vicious loop of self-reference, but are interwoven or perplicated into a synergy that supersedes the subjects that make it, contemplate it and speak through it. This gives us a theory of the genesis of conceptual networks in which (1) concepts emerge from the material, concrete and world-building activity of scientific labor, in the depths of human history and the theater of social life and (2) these concepts, once born, they break from their base and, almost as if my an autonomous logic of self-movement. They "arrange themselves [*se solidarisent*] rationally"[34] into webs and knots; they "group themselves into systems [*se groupent en système*]."[35]

In the sections that follow, the question I try to clear about is the following: how do conceptual networks interact with their *material base*? What relation holds between these fabrics (as emergent phenomena) and the base without which they wouldn't be possible? Following some of the extant literature in the philosophy of mind and science, we can discriminate between two types of emergence: weak and strong.[36] Weak emergence describes a non-reductive relation that holds between different levels of phenomena (say, K and G) when the relation of one phenomenon relative to the other (say, K's relationship to G) meets two conditions: (1) the principle of existential dependence (K cannot exist without G), and (2) the irreducibility thesis (K possesses certain properties [a, b, c] that G lacks). This concept of weak emergence explains the *relative* autonomy of K since *it is the case* that K emerges from G (G functioning as K's "base") but *it is not the case* that one could translate all K-predicates into G-predicates. The properties and features of K are autonomous relative to those of G even though K cannot exist in the absence of G.

Strong emergence, on the other hand, differs from weak emergence in that although it holds onto both of the latter's criteria, it adds a third one: the possibility of what we can call "downward causation." A phenomenon K can be said to strongly emergent relative to G iff the following conditions are met: (1) the principle of existential dependence (K cannot exist without G), (2) the irreducibility thesis (K possesses certain properties [a, b, c] that G lacks), and (3) the downward causation relation (K can exert a causal influence over the constitution, formation or properties of G). Because of this critical addendum, all relations of strong emergence subtend relations of weak emergence but the opposite does not hold. Strongly emergent phenomena differ from weakly emergent ones in that they condition their own conditions of existence. Like weakly-emergent phenomena, their strongly-emergent counterparts surface from a base, but unlike them, they also "turn around" and exert a necessitating pull over this base. My claim will be that conceptual networks are both weakly and strongly emergent. I show that conceptual networks are weakly emergent and thus irreducible to their material base through an investigation of the epistemological category of "synthesis." Then, I show that they are strongly emergent as well through a study of scientific "co-discoveries."

Survenience (or, Weak Emergence)

Scholars of emergence theory agree that the most reliable way to prove the irreducibility of a phenomenon to its base is to show, with an empirical argument, that such phenomenon possesses a property that its base does not have or that it performs a function that cannot be carried out by its base. Here, I present such an argument by showing that conceptual networks enact a function that their material base (which I take to be the communities of scientists who engage in epistemic labor under social-historical conditions and with the help of material and technical means of production) cannot perform. This function is *synthesis*. In French historical epistemology, conceptual networks are impersonal formations that execute the knowledge-relation in epistemology, while scientists are simply the empirical particulars that actualize the operational acts objectively synthesized at the higher level.[37] Networks, not subjects, synthesize.

My story begins with a return to Cavaillès. In the last chapter I presented *On the Logic and Theory of Science* as a discourse about the ontology of reason. But it is important to keep in mind that this discourse is articulated through the elaboration of a philosophy of mathematics. Here, Cavaillès's primary aim is to present a theory of science that refuses to fold the objectivism of mathematical reason under the subjectivism of idealism, intuitionism, the philosophy of language or phenomenology. Mathematics, he writes, is not the "internal armor" of a transcendental subject or the formal grammar of thinking itself, but an objective dialectic that moves by the powerful weight of its inner logic, by the force of its own historical momentum. Mathematics is an autonomous form and a formal autonomy that is irreducible to empirical or transcendental notions of subjective experience. By foregrounding the self-governing and autopoeitic nature of mathematical domains, Cavaillès turns topsy-turvy Kant's claim that subjectivity determines science and brings to ill repute Kant's claim in the first *Critique* that the Understanding's "legislation defines logic."[38] Instead, Cavaillès puts forth a theory of science in which precisely the reverse turn out to be true—it is science that determines the form of the Understanding because science is "a creative autonomy" because science is "a necessity which is related to nothing other than itself."[39]

Writing under the influence of the Bohemian philosopher Bernard Bolzano,[40] Cavaillès argues that mathematics is *creative* in the sense that it is capable of synthesizing and constituting concepts without the interference or interpolation of consciousness. Scientific rationality is capable, in other words, of executing and actuating the knowledge relation without tracing this relation to a transcendental or embodied cogito that *originates* or *founds*. "It is the entire body of mathematics," he writes, "which develops itself through steps and in a variety of forms, and it is likewise this which in its entirety, technical devices included, accomplishes or does not accomplish the very function of knowledge."[41] It is not the mathematician (as Husserl would have it) or the mathematician's body (as Merleau-Ponty might clarify), but the entire body of mathematics that properly speaking *thinks*! In her book *La Conscience de la Rationalité: Étude Phénoménologique sur la Physique Mathématique*, Cavaillès's protégé, the French philosopher of science Suzanne Bachelard, echoes this line of reasoning, arguing that the body of mathematics is an active Mallarméan language that produces meaning outside, and independently of, the

deep confines of consciousness. "One can properly say," she proclaims, "that the language of mathematical physics is a language which 'thinks.'"[42] For Bachelard as for Cavaillès, the point seems to be the same. And the point is that Heidegger was wrong. Science *can* think. In fact, only science truly thinks because only science thinks itself necessarily, only science thinks the necessity that *it is*.

In the essay "The Structure of Mathematical Experience According to Jean Cavaillès," the Belgian philosopher Paul Cortois explains that, for Cavaillès, the creative dimension of mathematical reason stems not from the constitutive acts of a transcendental ego but from the "operational acts" mathematics's formal domain. These acts "[instantiate] a quasi-Kantian notion of [objective] conceptual synthesis"[43] without requiring a transcendental unity of apperception. Unlike the Kantian doctrine according to which objects of experience are brought into existence by the synthesis of appearances, Cavaillès's theory holds that new objects of scientific experience emerge instead from "a never ending concatenation of *concepts* without initial term."[44] This concatenation sustains an objective rather than subjective logic of constitution that we could describe, borrowing the work of Michael Serres, as a "formal analytic of pure reason."[45]

Cavaillès's claim that mathematics is irreducible to subjective acts or subjective forms is mirrored in the works of other French epistemologists. The philosopher of physics Gaston Bachelard and the philosopher and historian of medicine Georges Canguilhem also share this view. In an essay dedicated to Gaston Bachelard, Canguilhem argues for a non-subjective theory of concept-generation and against any theory of science that, like Karl Popper's or Thomas Kuhn's, "presupposes intentionality."[46] He argues that subjectivity, intentionality and consciousness ("the struggles of genius") are obstacles to a genuine theory of the genesis of scientific experience because scientific concepts—such as the concept of the normal and the pathological in medicine or the concept of adaptation in biology—are "constituted" by what Canguilhem calls "historical syntheses,"[47] which he opposes to the subjective syntheses of Kantian and post-Kantian idealism. These are "epistemological acts" that, as he playfully puts it, are entirely divorced from the realm of sensibility.[48]

In multiple places, Bachelard makes the same argument using different terms. In works as varied as *NSS*, *FSM, PN* and *AR*, he affirms the anti-subjectivism that we find Cavaillès and Canguilhem but also in Althusser and Foucault. He calls for the "de-psychologization" of scientific discourse.[49] Like his French allies, Bachelard was convinced that science is an auto-poietic and auto-propelling formation can do without a philosophy of consciousness. This is why in *AR,* he describes scientific reason not as an unmoved mover but a movement without mover, as a "doctrine of reports […] without reporter."[50] Remember the female without a phallus, the Freudian "horror of nothing to see"[51] described by Irigaray in *This Sex Which is Not One*? Here, I think, we find ourselves in the presence of the epistemological rendition of this psychoanalytic fear. Here we find the constituted without the constituter, the synthesized without the synthesizer, unity without apperception. This is Kant's version of Freud's nightmare—not the horror of no-thing to see, but the horror of no-one to see!

The conclusion here is clear: one must abandon subjective accounts of knowledge-generation and follow Cavaillès in drifting away from any theory of science that would bring the legitimacy and objectivity of scientific rationality to rest in a theory of knowledge or philosophy of consciouness. Only the dialectic of the concept, a dialectic in which subjectivity is a invention rather than an origin, can endow epistemology with the assets needed to finance a theory of rationality worthy of the name. This is why Bachelard defends the "impersonality" of scientific knowledge and demands the "de-psychologization" of scientific discourse and why Foucault talks about the "anonymity" of knowledge and calls for the history of the sciences to be "freed from the anthropological theme,"[52] "freed from the grip of phenomenology."[53] "In the analysis proposed here," he writes in Part II of *AK,* "the rules of formation operate […] in discourse itself; they operate therefore, according to a sort of uniform anonymity, on all individuals who undertake to speak in this discursive field."[54] And in the "Conclusion" he claims: "My aim was to analyze this history […] to allow it to be deployed in an anonymity on which no transcendental constitution would impose the form of the subject; to open it up to a temporality that would not promise the return of any dawn. My aim was to cleanse it of all transcendental narcissism."[55]

Canguilhem, too, is caught up in this cleansing operation. Redolent of Cavaillès's contention that the philosophy of science deals with the concatenation of objective concepts rather than the synthesis of subjective representations, Canguilhem's states that epistemology must be rid of its almost pathological attachment to subjectivity. "The history of science," he writes, "[is] an effort to discover and explain to what extent discredited notions, attitudes and methods were, in their day, used to discredit other notions, attitudes or methods."[56] It is not, contrary to popular belief, an effort to explain how and by what means particular subjects (or "the Subject" more generally) came to be in the possession of knowledge. In the essay "The Various Models," he juxtaposes his (and Bachelard's) historico-epistemological approach to the history of the sciences with four other philosophical schools—positivism, empirical logicism, internalism and externalism—and claims that the failure of these other traditions stems from their inability to shake off the influence of intentional subjectivity as a philosophical category. A proper epistemology of science must reject any theory that, like Popper's or Kuhn's, "presupposes intentionality."[57] Elsewhere, he contends: "Scientific discovery is more than individual good fortune or accidental good luck, the history of science should be a history of the formation, deformation and rectification of scientific concepts. […] What the individual scientist is capable of depends on what information is available."[58] *Savoir*, he notes in a strikingly Foucauldian voice, "is *impersonally* formulated" in the mouths of empirical scientists.[59]

This claim that conceptual networks are loci of objective syntheses supports the weakly emergent character of conceptual networks. Conceptual networks might be existentially dependent upon their base (insofar as it is difficult to imagine a scenario in which conceptual networks exist in the absence of scientific communities), but they are irreducible to this base because they carry out functions that they base cannot realize. Hence, propositions about the lawful relations of the higher-level phenomena (i.e. the networks) cannot be articulated, without remainder, in the language of the lower-level material base (i.e. the labor of scientists).

I propose to use the term *sur-venience* (from the Latin *sur,* meaning "in addition" and *venire*, meaning "to come") rather than *supervenience* (from *super,* meaning "on top") to characterize this

relationship of weak emergence that unites conceptual networks to their empirical support base. Conceptual networks survene upon their base in the sense that they cannot exist without them but can nonetheless undergo autonomous changes "above" that cannot be imputed to correlate changes "below." They can undergo token events—i.e. changes in the meaning of particular concepts or entire groups of them—without necessary there being necessary correlate token (aetiological) changes in its base.[60] This indifference to what in the philosophy of mind is called the "token identity thesis" distinguishes survenience relations from supervenience relations.[61]

Downward Causation (Or, Strong Emergence)

The emergence theorist Douglas Porpora describes downward causation in terms of higher-level structures "affect[ing] the ways in which situated actors think and act."[62] Using chess as an example of how feedback-controlled action can determine how individuals think and act, he writes:

> The flow of each specific game is emergent from the 'constitutive rules' of the game and from the successive actions of the two players. Yet soon after the game begins, objective relationships become established, as pieces begin to occupy positions with strategic relationships which emerge only in the context of the rules but which exist, nevertheless, whether or not the players are aware of them.[63]

Porpora's insight seems to be that there are activities or practices—chess, in this case—that can yield objective propensities or necessities even though they are under-determined by their initial boundary conditions. At the start of a game of chess, players can chose from an almost infinite number of possible strategies, enjoying a wide range of freedom. But as the game develops and players make moves and counter-moves, objective relationships begin to take form such that, before long, players find themselves confronted with a complex situation in which their freedom appears to diminish at every turn. After certain threshold, which cannot be determined *ab initio*, the players' own past choices determine their future actions such that eventually certain moves become unavoidable, essentially mandated by the nascent logic of the game itself. This logic issues its own demands and exerts a causal pressure over the very individuals without which the game itself could not exist. When the American author Dave Barry

jokingly said that his "problem" with chess was that "all my pieces wanted to end the game as soon as possible," he was referring to this odd phenomenon of necessitation in chess that Porpora dubs "downward causation."

Scientific "games of truth" are similar to competitive games of chess in this regard since the conceptual networks that make up a scientific domain determine the thought and behavior of the very scientists without whom scientific inquiry itself would not exist much like the pawns and queens push chess players this way and that. In his 1935 book, *The Genesis and Development of a Scientific Fact,* the Polish philosopher of science Ludwik Fleck showed that, as a form of feedback-controlled action, scientific discourse is liable to this sort of downward-causation. As sciences mature and reach certain levels of conceptual sophistication and predictive prowess, they create epistemic prescriptions that scientists cannot *not* abide by. These "inevitable connections,"[64] Fleck says, are "what can be thought in no other way."[65] Like Fleck, French historical epistemologists believe that scientific rationality begets "inevitable connections" or "objective relationships" that affect the behavior and cognition of epistemic agents without being reducible to the latter's intents or desires. And they all defend this claim by looking at a bizarre fact of scientific history—the fact of scientific co-discoveries. While networks are said to be "weakly emergent" because they are headquarters of synthetic activity, they are "strongly emergent" because they are oases of epistemic necessitation. They issue forth objective relations of scientific experience and cognition that *compel* scientific knowers (their base) to think in particular ways. And this compelling effect is most evident in the fact that "co-discoveries" are ubiquitous in the history of science.

In the "Introduction" to Part Two of *Galileo Studies*, Alexandre Koyré explains that one of the most pressing dilemmas faced by historians and philosophers of science is the isochronous appearance, in the history of scientific thought, of seemingly unexplainable scientific co-discoveries—moments in which individuals lacking any discernible ties to one another (biographical, educational, or geographical) magically "stumble upon" the same discovery around the same time. How do we explain that Newton and Leibniz discovered the infinitesimal calculus from different angles and with different notations systems at the same time in the seventeenth century? How do we explain that Carros and Clausis both discovered the

law of entropy in the 1850s and '60s? And how do we explain that Galileo, Beeckman and Descartes gave slightly different formulations in the same decade of what turned out to be the law of falling bodies?

> This kind of coincidence is not uncommon in the history of scientific thought. The very same ideas crop up in different places and in quite different minds. Everyone is familiar with disputes about who was first […] and everyone agrees that these amazing cases of simultaneous discovery are of the greatest interest for the history of scientific thought.[66]

French historical epistemologists take these "amazing cases" as evidence of *downward causation*. Recall that for Bachelard, Canguilhem and Foucault, scientists do not "invent" ideas; they merely "tap into" the epistemic resources made available to them by conceptual networks. And since these networks, as Fleck has shown, render certain rational connections, deductive inferences and scientific conclusions inevitable it stands to reason that individuals bearing no intellectual, biographical or geographical connection to each other can may "land on" the same discovery simply by following the epistemic routes made available by the network under which they think. Discoveries are pre-figured routs in a network, they are, as Canguilhem says, "theses waiting for an author."[67]

In *The Logic of Life* (1993), the French biologist and philosopher François Jacob argues that a scientific "domain of truth" causes empirical co-discoveries by its nascent power of necessitation. "If an observation is not made here today, it will most frequently be made somewhere else tomorrow," he writes.[68] "For a long time," he goes on to state, "men have wondered what would have become of scientific thought if Newtown had been an apple-gatherer, Darwin a sea-captain or Einstein a plumber (as he said he would have preferred to be). At worst, there might have been a few years' delay in the development of the theories of gravity or relativity, and even less in the development of the theory of evolution, which Wallace put forward at the same time as Darwin."[69] Once the conceptual stones have been laid, the crossing is only a matter of time.

On this particular point, however, Canguilhem is more aggressive than Jacob. Whereas Jacob seems to believe merely that co-discoveries are byproducts of established scientific domains, Canguilhem contends that co-discoveries are sufficient conditions for considering a domain scientific. Where there are

co-discoveries, there is scientificity. And where there is scientificity, by definition, there is truth. Hence, the very phenomena that raise ominous questions for Koyré about the status of scientific history settle an important dispute for Canguilhem, who uses his interpretation of the history of physiology as an example of the significance of scientific co-discoveries. In "Epistemology of Physiology," in a paragraph that begins with an explicit reference to Bachelard, Canguilhem advances the thesis that physiology is a science *because* its history is replete with apparently unexplainable co-discoveries. He notes:

> One sign that it [physiology] was an authentic science is that from Magendie to Sherington to Pavlov we find a great many overlapping studies and a large number of *separate and simultaneous discoveries* (sometimes with disputes over priority, sometimes not). The history of physiology enjoyed a relative independence from the history of physiologists. It matters little whether it was Sir Charles Bell or Megendie who "really" discovered the function of the spinal nerve roots, whether Marshall or Johannes Müller first discovered reflex actions, Emile De Bois-Reymond or Hermann motor currents, or David Ferrier or Hermann Munk the cortical center of vision. As soon as methods and problems become adjusted to each other, as soon as instruments become so highly specialized that their very use implies the acceptance of common working hypotheses, it is true to say that science shapes scientists just as much as scientists shape science.[70]

Notice that the claim is an inference rather than a conjunction. It is not that physiology is a science and that its history contains co-discoveries. Physiology is a science because co-discoveries are strewn throughout its history.

But that is not all. In an article entitled "The Pathology and Physiology of the Thyroid in the 19th Century," Canguilhem uses the same argument from epistemic causation to explain single-author discoveries. Using the discovery of iodine in the 1800s as his select example, he claims that discovery "occurs non-accidentally."[71] The discovery of iodine (although in the breath he also cites the discovery of morphine, quinine and codeine, among other substances) was solicited by a "theoretical and technical context that, at any rate, would have called it forth by other routes or ways [French, *voies*]."[72] In *Marxism and Epistemology : Canguilhem, Bachelard and Foucault*, Lecourt latches on to this example to show that Canguilhem's "intention is as follows: to refute the 'contingent' conception of the history of the sciences on its own terrain."[73] As it turns out, Canguilhem manages to kill two birds with the same stone—he rebuffs contingent interpretations of scientific history while advancing what I am construing as a theory of epistemic downward causation.

Foucault, who has killed a few birds of his own, joins Canguilhem in rejecting a purely contingent theory of scientific history. Foucault's comments about the history of the science of wealth in *OT*, to chose only one notable example, showcase the verisimilitude of his and Canguilhem's views. The fact that similar interventions in the science of money were made by Cantillon, Jevons, Menger, Petty and Lock[74] during the classical period, Foucault says, ought not to strike us as an aberration of history. That these intellectual productions appeared around the same time, Foucault says, is clarified by bringing into consideration "the archaeological network that makes those things possible *and necessary*."[75] The associated field or conceptual network of any human science generates a "link of necessity,"[76] a "historical *a priori*," that explains the existence of what, from the standpoint of a non-normative theory of scientific history, would be a random compilation of works about money, exchange and wealth. As a genealogist, Foucault is aware that a history of rational thought cannot be written without the causal anchors and normative pulleys that a conceptual network provides. These anchors and pulleys, and not any biographical accounts of "influence," explain both the co-emergence of scientific discoveries and the emergence of scientific co-discoveries in the history of scientific thought.

> The history of knowledge can be written only on the basis of what was contemporaneous with it, and certainly not in terms of reciprocal influence, but in terms of conditions and *a prioris* established in time. It is in this sense that archaeology can give an account of the *existence* of a general grammar, a natural history, and an analysis of wealth, and thus open up a free, undivided area in which the history of the sciences, the history of ideas, and the history of opinions can, if they wish, frolic at ease.[77]

While Foucault's multiple references to the "links of necessity" and the historicized *a priori* that are responsible for the formation and generation of scientific discoveries are clear signs of his commitment to a theory of downward epistemic causation, I recognize that this attribution does not come without its difficulties. As any Foucault scholar knows, the extant literature on the subject of his relationship to epistemic causality and epistemic determination is overwhelming complex and hopelessly inconclusive. According to some, Foucault's "structural determinism"[78] makes him exceed Canguilhem and Bachelard on the subject of necessitation and put forth an entirely deterministic theory of the

downward causation that elides any possibility of subjective action and subjective agency.[79] Others argue exactly the opposite and, while stressing Foucault's Nietzschean proclivities, argue that his sensitivity to contingency upsets any deterministic reading of his work.[80] Foucault himself complicates this already labyrinthine scenario by invoking, as we just saw, the causal language of necessity while also holding, in the "Foreword" to the English edition of *OT*, to be indifferent to the problem of "epistemological causality."[81] Where, then, do our comments about downward causation fit in the topology of this debate?

Before taking sides in what could very well be a bottomless scholarly dispute, let us raise a crucial point of definitional clarification. What exactly do we mean by when we say that networks exert "epistemic necessitation" over subjects? There are two possible interpretations. If we equate epistemic necessitation with a pervasive determinism in which all facets of scientific experience are pre- and over-determined by the objective dictates of a conceptual network, then I accept that we would be incapable of distilling a theory of downward causation from Foucault's philosophy. But if, taking a more charitable route, we simply associate epistemic necessitation with moments or episodes of epistemic determination, then Foucault's work appears in a slightly different light and allows us to appreciate the degree to which, on this point, he once again is in philosophical proximity with Canguilhem.

Possibly taking inspiration from Bachelard's critical observation in *NSS* that "causality is much more general than determinism"[82] or from Canguilhem's distinction between "open" and "closed" determinism,[83] Foucault is eager to clarify that although he sees history as overlay with systematic regularities that find their *raison d'être* in the inner dynamism of conceptual networks, this does not consign him to the camp of determinist philosophy. "The establishment of an ennunciative homogeneity," he writes, "in no way implies that, for decades or centuries to come, men [sic] will say and think the same thing; nor does it imply the definition, explicit or not, of a number of principles from everything else would flow as inevitable consequences."[84] But it does mean that, for decades or centuries to come, men will say and think certain things that, for them, will be *that which can be thought of in no other way*. What these things will be, we cannot predict. When they will emerge, we do not know. But we can predict and we can know that these things will indeed exist, even if they are only a small fraction of all

the things humans will say and think in their pursuit of knowledge. In *AK*, Foucault illustrates this downward causal power with a metaphor from physics. Conceptual networks, he intimates, are like remnant ferromagnetic metals; they are magnetized structures that have the power to exert an invisible force from above.[85]

One difference worth noting here between Canguilhem's and Foucault's approach is that whereas Canguilhem and Jacob limit themselves to examples from the history of science, Foucault also uses examples from the history of philosophy. In *AK* Foucault makes the same argument he made in *OT* about the sciences of wealth, life and language, but this time using an example that hits much closer to home. How do we explain, he says in a rare display of self-referential reasoning on his part, the temporal simultaneity of his own, Canguilhem's and Bachelard's historical approach to epistemology? Why is it that all three of them (and Koyré too) historicized reason around the same time and in roughly similar ways? This happened because an objective shift took place in the field of history-writing around the turn of the 20th century that is reflected in the "new history" of the French. Thus, in the same way that Cantillon, Jevons and Lock became recognizable names in the history of economics by chancing upon a set of objective theses waiting for an author so, too, Canguilhem, Foucault and Bachelard became recognizable names in the history of philosophy by chancing upon their own objectivities in the field of history-writing. Thus, it is not that Bachelard, Canguilhem and Foucault created a new historical approach to epistemology. It is that a new approach to epistemology created Bachelard, Canguilhem and Foucault.

Echoing, *avant la lettre*, Canguilhem's analysis of the discovery of iodine and Foucault's genealogies of economics, biology and linguistics in *OT*, Bachelard argues that even if scientific discoveries are never fated, they never contingent either. To make this point clearer, he quotes Juvel:

> The surprise created by a new idea or association of ideas is surely the most important element of progress of the physical sciences, for it is astonishment that excites logic, which is always rather cold, and that forces scientists to make new connections. But the ultimate cause of progress, the reason for our surprise itself, has to be sought in the force fields that new associations of ideas set up in our minds, fields whose strength measures the good fortune of the scientists luck enough to bring those ideas together.[86]

Thus, it is not that there is no contingency in history as post-Idealist historians contend. It is simply that this contingency applies to the *who,* not the *what* of scientific discovery. The *what* is an original connection that is the result of existing "force fields." The *who* is the actor "lucky enough" to be in the right place at the right time. (One might compare this language of "force fields" with Foucault's metaphor of "remanence").

In *NSS*, Bachelard applies this view of scientific necessitation to the history of geometry. "In the two thousand years after Euclid," he writes "the quantity of geometrical knowledge undoubtedly increased, but the nature of geometrical thought remained fundamentally unchanged." But with the advent of non-Euclidean geometry, classical geometry entered a period of turmoil. Why the non-Eucledian revolution happened was a mystery well into the twentieth century. Kantians couldn't explain it. Hegelians barely understood it. And Neo-Kantians were too busy saving Kant from the waters of historical embarrassment that they, too, drowned along with him. According to Bachelard, the reason the "undisturbed unity" of geometry bellied up in the nineteenth century is because, again, an objective shift—this time toward dialectical reasoning—began to take place at the level of *savoir*. "One cannot fail to be struck by the fact that dialectical tendencies appear at almost the same time in philosophy and in science."[87] Hence, when the "sixth postulate" of Euclid (the postulate of parallelism) was problematized by the proto-dialectical thinking of Taurinus and the dialect implicit in the constructions of Lobachevski and Bolyai, what we are facing are not radical contingencies that dumbfound reason, but symptoms that the whole edifice of rational thought was being dialectized. And so, in allegiance with Canguilhem's and Foucault's normative conceptions of history, Bachelard concludes**,** this time citing Halsted, that "the discovery of non-Euclidean geometry around 1830 was inevitable."[88]

In *AR*, Bachelard explains the nature of downward causation through a criticism of Freudian psychoanalysis. He faults Freud for assuming that all regulation encountered by the self is psychic in nature (rather than, say, epistemic) and for collapsing the distinction between authoritarian and intellectual surveillance.[89] In scientific communities there are values or commands analogous to those of the superego's surveillance over the desirous id that are rational and objective (rather than psychic and

subjective). These demands, which orthodox psychoanalysis cannot accommodate, differ from authoritarian impositions of the father figure in two ways. First, they come from within rather than from without—namely, from the self's ability to think rationally under a domain of truth.[90] And, second, they come from "intellectual," "sympathetic," "de-personalized"[91] superego whose demands are purged of moral content. These demands not produce neuroses but truth. And they are experienced as invitations for inquiry rather than as sources of discontent. Surely, in Bachelard's framework the nature of the compulsion has changed in form (from psychic to epistemic) and in content (from moral to scientific), but its power and intensity remain the same.

But let us make no mistake here. Although Bachelard is fond of maneuvering with metaphors, the concept of compulsion is no mere French *manière de parler*. Bachelard, for one, is ready to defend a literal interpretation of compulsion since, as he understands it, the primary purpose of a notion or concept is to diminish the level of contingency or "freedom" that mediates scientific experience.[92] This argument, which is also made by Canguilhem,[93] means that as contingency in scientific epistemology dwindles, scientists are in a position of necessitation relative to their domain of thought. They are obliged, that is, to author the objective theses that lay before them; to give a voice to the rational connections, inferences and conclusions that they chance upon; and to acknowledge the objective epistemic "shapes" that rest before their eyes. This is why Bachelard claims that conceptual networks are a type of "finalism"[94]—that is, they begin to generate propensities that make certain rational conclusions take on a radical air of inevitability. This is also why, for him, scientific discoveries are never to be explained through elocutions of enablement ("X was able to conclude that Y") but through elocutions of determination ("X is *unable not* to conclude that Y").[95]

The important point here is that French historical epistemologists see scientific discourse not simply as a reflection of human activity (as something *caused* and *produced*), but as a sort of "agent" that exerts a pull over human thought (something *causal* and *productive*). In this sense, the mantels of normativity that regulate meaning and sense in scientific discourse and that I am depicting as "networks" are, to borrow an simile from literature, less like the famous shroud in *The Odyssey*, which Penelope

voluntarily weaves by day and unravels by night, and more like the picture of Dorian Gray in Oscar Wilde's masterpiece, which moves by an immanent and autonomous logic of its own. They are monstrous grids or lattices that all too often ride roughshod over the very individuals that think "in" them. Neither material, nor formal, nor efficient, nor final, we could say that, for Canguilhem, Bachelard and Foucault, these conceptual networks embody a missing "fifth" Aristotelian cause—at least in the terrains of epistemology.

Historicity, or Morphogenesis

Our double interpretation of conceptual networks as weakly emergent (base-conditioned) and strongly emergent (base-conditioning) produces a dialectical interpretation of these structures and the material conditions that ground them. In this dialectic, the arrows of causal influence are bidirectional in orientation. Changes in social, historical and material conditions alter the structure of concepts, while alterations at the level of concepts and logical relations, in turn, affect the empirical practice of scientific inquiry, research and discovery. Base and emergent phenomena stand in relation to one another as two interlocking and mutually co-dependent levels that co-evolve over time in a loosely orchestrated movement that, as George Gaylord Simpson would say of biological evolution, varies "in tempo and mode."[96] This, at any rate, is what I take Cavaillès to have meant when petitioned for an epistemology wedded to the "dialectic of the concept" before his death. He wanted to ensure that, for epistemologists of science, the "systems of reason" or conceptual networks that govern a rational domain are not ossified fossils that reify but living forces that alter their shapes and contours over time and beget ever new and unpredictable silhouettes of reason. And behind this dialectical interpretation of networks, there is an implicit the theory of scientific change.

For French philosophers of science, membership into a scientific community is acquired by percolating one's language and thought through a filter of historically-determinate scientific-epistemic norms that cascade and glide over time. I take it as a rather uncontroversial assertion that Bachelard, Foucault, and Canguilhem all follow the Israeli-born historian and philosopher of science Ludwik Fleck

in thinking that, in epistemology, "the bonds of history can never be cut."[97] Form them, as for Cavaillès, "the road should not be abolished, if we want it to be followed."[98] What these thinkers share, above all, is the conviction that notions, concepts and positivities that rule scientific discourse change over time. For them, the concepts and rules that operate at a given moment, T1, may no longer operate at another, T2, or they may operate in a new capacity. "Even if words live on," Bachelard says "concepts change."[99] Like Kuhnian paradigms, a scientific concept "is rarely an object for [mimetic] replication. Instead, like an accepted judicial decision in the common law, it is an object for further articulation and specification under new or more stringent conditions."[100] In *DD*, Bachelard writes: "Concepts multiply and diversify as they are applied, as they become factors of thought."[101]

Whether in the form of micro-scale shifts or macro-scale revolutions in scientific rationality, the phenomena of scientific change has been a source of debate and controversy amongst philosophers of science. And in the 20th century, we can roughly identify three competing theories of scientific change.

- *Socio-Psychological Theories* (i.e. Kuhn): According to these theories, scientific change is first and foremost a sociological fact that must be studied with the aid of social psychology. Scientific change is a community-based event that is reached through some form of decision or consensus and that can be compared to religious experience of conversion and gestaltic shifts in perspective. Change is an effect of a decision to abandon ship in the face of theory-failure (i.e. when anomalous phenomena that a theory is incapable of explaining or predict reach a critical mass).

- *Internalist Theories* (i.e. Lakatos): After the publication of Thomas Kuhn's *The Structure of Scientific Revolutions* in 1962, some philosophers of science were dissatisfied with his overbearing emphasis on socio-psychological factors. What ensures that community decisions to leave one "paradigm" for another are rational? What ensures that the new paradigm will be progressive rather than regressive when compared to its predecessor? To rectify this, internalist philosophers of science followed a putatively Hegelian line that postulated the existence of a teleological logic internal to scientific reason and argued that this inner logic—analogous to the Hegelian doctrine of *Begriff*—guides scientific progress and ensures the rational elaboration of science in time.

- *Externalist Theories* (i.e. Bloor): Unwilling to grant the metaphysical postulates demanded by the internalist approach and skeptical about the implicit desire on the part of socio-psychologists to retain some element of rationality in their account of scientific change, some thinkers came to adopt an unabashedly reductionist reading of scientific rationality in which scientific change was nothing but the reflection of extra-scientific interests groups, power relations, and identitiarian loyalties (race, gender, class, etc). For them, there was no meaningful distinction between, on the one hand, the beliefs that scientists "hold" and, on the other hand, those they may be said to "justifiably hold."

Foucault, Bachelard and Canguilhem's position regarding the dialectical underpinnings of conceptual networks gives us a fourth theory of scientific change. In this account, if scientific rationality is said to have a historical frame, this is not because scientific communities undergo sociological changes or because science is disfigured by extra-scientific determinants or because there is a metaphysical and trans-historical reason that forces science to move forward. If scientific rationality is historical, this is because the conceptual networks that rule the scientific mind are themselves supple entities that change with the seasons. As these networks are blown this way and that by the forces of historical time, scientific "paradigms" (to employ a popular Kuhnian term) begin to vary and the nature of scientific rationality begins to take on new and unforeseen faces, new and unforeseen forms. The source of scientific change, therefore, is not sociological or metaphysical or ideological but conceptual. The dialectic of the network *explains* the fact of scientific change.

Although Canguilhem, Bachelard and Foucault are not entirely consistent in their descriptions of how exactly scientific micro- and macro-change occurs and how the causes of this change are to be isolated and characterized—a failure that has produced a robust strand of criticism from a variety of readers—their writings imply that there are roughly three ways in which conceptual networks can be transformed: (a) through *local reformations*, i.e. revisions in the meaning of existing concepts, (b) through *punctuated creations*, i.e. the invention of new concepts that, when plugged into the larger fabric of a scientific domain, alter its inner sense and the meaning of neighboring elements, and (c) through *total re-organizations,* i.e. re-arrangements in the ordering of existing concepts. These three types of events represent critical moments in which the entire architecture of scientific reason—its epistyles, awnings, spandrels and columns—face if not outright demolition, then at least invasive scaffolding. In these moments, the mantel of normativity we described in the previous chapter changes in texture, color and even thread-count and produces apparently unexplainable changes in scientific procedure, perception, discursive reasoning and technique. Bachelard describes these "re-organizations of *savoir*."[102] We find examples of scientific change through local reformations in Bachelard's historical epistemology of chemistry in *PN*, through punctuated creations in Canguilhem's epistemological history of natural history

in *KL*, and through total re-organizations in Foucault's archaeology of the science of wealth in *OT*. In "Appendix Six—A French Theory of Scientific Change," I look at these causes of scientific change more closely.

What can we say about these "network events"? Above all, we can say that they are reasons for scientific change. From one standpoint, they are reasons (i.e. explanations) insofar are they function as *explanans* for the actuality of scientific change and as the conceptual reeds from which rational accounts of scientific change are woven. From another standpoint, they are also reasons (i.e. causes) insofar as they produce the "unnamable reversals in perspective"[103] that we observe in scientific history. Yet, these causes are not empirical ones. As phenomena that are not given in experience but that also do not exist in some everlasting kingdom outside time, these network events are *immanent-transcendental causes*[104] that produce changes at the level of concrete scientific practice only by catalyzing modifications at the level of concepts and notions. Borrowing an analogy from epigenetics, we could argue that *local reformations*, *punctuated creations*, and *total re-organizations* affect the region of epistemic operators (i.e. conceptual networks) that are in charge of regulating how scientific rationality manifests itself in the discourse of actual scientists. At any rate, that these network events buttress Foucault's contention in *AK* that "the topology of the epistemological camp is never definitive"[105] and shore up Bachelard's claim in *FSM* that the history of sciences is marked by "interruptions," "discontinuities," and "ruptures."

But why do conceptual networks change? How are these events precipitated? One answer lies in the "eminently extensible"[106] nature of concepts, which all too often are transposed onto rational domains other than the ones in which they originally emerge. As these concepts move between domains—say, from the rationalism of biology to the rationalism of chemistry or from the rationalism of psychiatry to that of criminology—their meaning begins to fluctuate as do the contours of the networks in which they cease to or come to play a role. A second answer lies in the "alveolar"[107] nature of the networks themselves, which enable the playful movement and transposition of the elements that compose them. Unlike the rigid axiomatic systems characteristic of rationalist philosophers like Hobbes and Spinoza, French conceptual networks are "open-ended" creatures that are swayed by the solicitations and

insinuations of historical time. They are supple formations that fund and authorize scientific discourse without congealing into closed axiomatic systems that lose themselves in the bottomless depth of an eternal interiority.

Granted, these networks incorporate "axiomatic" principles that are akin to *a priori* truths and that are experienced by particular scientists as inviolable truths of reason. But even the most seemingly eternal anchors of reason are historical to their very core. Even the logical principle "A=A" is neither trans-historical nor absolute since it depends on a whole host of conceptual links and circumstances without which it, too, would disappear into the oblivion of obsolete history.[108] The only absolute that remains constant in the history of science is the existence of networks composed of absolutely inconstant ontological elements.[109] When Foucault, for instance, speaks of the "historical *a priori*,"[110] he is referencing precisely those scientific-epistemic norms function as irrefutable principles of rational thought and exert a necessitating force upon the scientific mind (synchronically) but that nonetheless remain vulnerable to revision and death (diachronically). "We must make way," according to Bachelard, "for the kaleidoscopic and discontinuous character of change."[111]

Conclusion – Remarks on Meta-stability

In his latest book *Life, War, Earth, Deleuze and the Sciences*, John Protevi provides a Deleuzian-inspired analysis that brings together a relational ontology and a strongly emergent conception of Nature. According to him, natural events are complex networks of causality that cannot be reduced to the logic of substances and properties, and strongly emergent forces that condition their own metaphysical conditions of possibility and thus change over time. Protevi uses the term "meta-stability"[112]—a term he borrows from the philosophy of Simondon—to denote the nature of Nature. In particular, he mobilizes this term as an alternative to the popular concept of *autopoiesis*, which in his view explains how complex networks self-sustain, but not how they change over time. Metastability, for him, represents a property of strongly emergent structures that enables them to maintain their cohesion and unity (i.e. nominal identity) while remaining open to that the contingencies of history and the vicissitudes of time, to that which is to come.

In the critical "Introduction" to this text, Protevi uses the example of cloud formations to make his case. Cloud formations, he claims, are not Aristotelian substances that possess attributes and follow a strict logic of linear causality. Rather, clouds and cloud-related events—like rain and thunder—are actualizations that emerge out of a complex network of materio-virtual conditions, out of a plane of imminence constituted by a series of variables that interact with one another in complicated ways. Temperature, atmospheric pressure, humidity, electricity, etc.—all of these elements produce a multifaceted topology *in which* and *out of which* events like thunder come into being and then *become*. But, Protevi goes on, when these new events burst onto the scene, they change the very network of virtuality that conditioned them and facilitated their existence. Clouds change the temperature, electric charge and pressure of the environment and thus introduce a principle of variation into the very plane of immanence without which they could not have been. Natural events are more than epiphenomena that glean the surface of Being; they are actors (although not Subjects) that can change the face of the earth and revolutionize the conditions of their origin. Although he also does not use this language, Protevi's notion of metastibility presupposes that there is something analogous to a ricochet effect (up and down) that introduces contingency and change into the heart of this natural equation.

Meta-stability is a type of emergence that satisfies the following desiderata:

1) the existential dependence of the emergent phenomena on its base,
2) the methodological irreducibility of the higher to the lower,
3) the relative autonomy of the supervening (or in this case sur-vening) element,
4) downward causation, and
5) the historicity of both the emergent register and the base.

And I argue that meta-stability, which in Protevi's work is predicated only of natural phenomena, can be also predicated of scientific discourse, or rather, of the conceptual clusters, webs and tissues through which scientific discourse makes its gubernatorial presence felt in scientific experience. In my view, conceptual networks, much like the clouds in Protevi's work, are meta-stable events that condition their own conditions of possibility and contain within themselves what Cavaillès once called an internal "principle of variation." They are morphogenetic, materially-, and strongly emergent configurations that,

aside from begin *sui generis* and autopoietic, are supple creatures of time. Yet, amidst the significant and often revolutionary change they undergo, these networks retain enough of their identity to allow epistemologists, looking at it in hindsight, to recognize in their diachronic displacement the movements a genealogical progression belonging to a specific scientific domain. What method or methods, therefore, must the epistemological historian deploy in order to capture these complicated creatures? This leads us directly to our next chapter.

[1] Althusser, Louis, and Etienne Balibar. *Reading capital* (London: Verso, 1997), 68
[2] John Protevi's recent work applies the concept of meta-stability to make sense of complex phenomena that occur in nature, such as clouds and lightening. I use the concept to make sense of complex epistemological phenomena, namely epistemic networks. See the "Introduction" to Protevi's *Life, War, Earth: Deleauze and the Sciences* (Minneapolis, MI: University of Minnesota Press, 2013).
[3] Bachelard, *NSS*, 130
[4] Bachelard, *PN*, 24
[5] Bachelard, *AR,* 39
[6] James, William. *Pragmatism* (Toronto: Dover Publications, 1995).
[7] Bachelard, *FSM,* 26
[8] Bachelard, *AR,* 33
[9] Bachelard, *AR,* 214
[10] Bachelard, *AR,* 66
[11] Canguilhem, *VR,* 50
[12] Canguilhem, *KL,* 5
[13] Marjorie Grene, "The Philosophy of Science of Georges Canguilhem: A Transatlantic View" *Revue D'histoire Des Sciences* 53 (2000): 47-64.
[14] Canguilhem, *Etudes*, 178
[15] Canguilhem, *KL*, 31
[16] Canguilhem, *KL,* 4
[17] Canguilhem, *KL*, 5
[18] Webb, David. "Microphysics: from Bachelard and Serres to Foucault," *Angelaki* 10 (2005): 123-133.
[19] See "Appendix Four"
[20] Foucault, *AK,* 106
[21] Foucault, *AK,* 106
[22] Webb, *Foucault's Archaeology*, 42ff
[23] Foucault, *AK,* 98
[24] Foucault, *AK,* 109, 128
[25] Foucault, *AK,* 98
[26] It might help to recall that Foucault is writing at the apex of actor-network theory (ANT) in the 1970s and '80s. For more on this subject see Stephen Fox, "Communities of Practice, Foucault And Actor-Network Therory" in *Journal of Management Studies* 37 (2000): 853–868. See also John Law, "Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity" in Systems Practice 5 (1992): 379-393. And also Kai Eriksson, "Foucault, Deleuze, and the Ontology of Networks" in The European Legacy: Toward New Paradigms 10 (2005): 595-610. See also John Law, "Notes on The Theory Of The Actor-Network: Ordering, Strategy, And Heterogeneity" *Systems Practice* 5 (1992): 379-393.
[27] David Webb, *Foucault's Archaeology: Science and Transformation* (Edinburgh: Edinburgh University Press, 2012), 96
[28] Bachelard, *MR,* 42
[29] Althusser, *Reading Capital,* 67
[30] In *On Historicizing Epistemology: An Essay* (Palo Alto: Stanford University Press, 2010), Hans-Jörg Rheinberger explains that Bachelard's, Canguilhem's and Foucault's concentration on science's historical and material conditions of being is itself a reflection of the historical material and conditions that determined philosophical discourse post-WWI. "After 1918," he writes, "the relationship between science and technology appeared very different from how it had looked before the Great War. The material conditions of the production of knowledge, which previously mattered only marginally or rhetorically to those who reflected on the development of the sciences, acquired central importance in historical consideration" (Rheinberger, *On Historicizing Epistemology,* 19). This different relationship between science and technology, I argue, led many European philosophers to realize that scientific discourses could not be divorced from their social and political environments and to consequently abandon wholesale the positivist project. They begin to dismiss as illusory the positivist assumption that science could be shielded from the contingencies of human history by being swathed in, and reduced to, a *logic*. But after 1918, it was not sufficient simply to salute the material *contexts* in which science necessary takes place. Philosophers also had to confront the material *origins* of scientific-epistemic norms and admit that (a) the very concepts and notions through which scientists think in social contexts are themselves created by the scientists' own labor activity and (b)

that the material tools and equipment (i.e. the technologies and techniques) required by this activity contribute to the overall constructive process we call "science."

[31] Bachelard takes the notion of consolidation from Dupreel. It is not unlikely that Dupreel's influence on Bachelard found also its correlate in Canguilhem since the latter was also familiar with his work and references it in several of his works, most importantly in *KL.* See Anne Fagot-Largeault, , Claude Debru, and Hee-Jin Han, eds. *Philosophie Et Médecine: En Hommage À Georges Canguilhem* (Paris: Vrin, 2008), 54.

[32] See Paul Bains, *The Primacy of Semiosis: An Ontology of Relations* (Toronto: U of Toronto Press, 2006), 129.

[33] Foucault, *AK,* 106

[34] Bachelard, *NSS,* 51

[35] Bachelard, *AR*, 58

[36] For the dominant classification of emergence into two types, see Chalmers, David J. "Strong and Weak Emergence" In *The Emergence of Emergence,* ed. Clayton P. and Davies P. (Oxford University Press, 2006), 244-256.

[37] The anti-subjectivism of historical epistemology flies in the face of received philosophical wisdom. Through a large part of the history of modern epistemology, especially in the wake of the publication of Kant's *Critique of Pure Reason* (1781), synthesis—here understood as the core condition for the possibility of scientific knowledge—was predicated of subjective activity. Subjects synthesize. In the Kantian architechtonic, for instance, synthesis is a subjective activity—some would say "mental process"—whereby the transcendental subject schematizes different representations vis-à-vis the faculty of imagination thus giving unity to the manifold of sensibility before subsuming it under the categories of the Understanding. Through these acts, the subject transcendentally imbues representations with cognitive content. In the Hegelian system, too, we find a similar notion of synthesis. In *The Phenomenology of Spirit* synthesis retains this subjective bent, appearing as the act through which consciousness repeatedly overcomes the apparent separation between "in-itself" and "for-itself" in order to reach higher stages of education. In both cases, subjective experience and scientific knowledge are placed if not on the same plateau, at least on the same continuum without any gap separating them. Kant and Hegel bequeath upon post-nineteenth century thought a subjective interpretation of the foundations of scientific knowledge that has manifested itself in the subjectivist existential phenomenologies of Husserl, Sartre and Merleau-Ponty (on the continental side) and the philosophy of mind traditions (on the analytic corner).

[38] Cavaillès, Jean. "On the Logic and Theory of Science." In *Phenomenology and The Natural Sciences,* Ed. Joseph Kockelmans and Theodore J. Kisiel (Evanston: Northwestern University Press, 1970), 363

[39] Cavaillès, *On the Logic and Theory of Science*, 370

[40] See Leonard Lawlor, *Derrida and Husserl: The Basic Problem of Phenomenology* (Bloomington, IN: Indiana University Press, 2002), 58.

[41] Cavaillès, *On the Logic and Theory of Science,* 406

[42] Bachelard, Suzanne. "The Specificity of Mathematical Physics," In *Phenomenology and the Natural Sciences*, ed. Joseph Kocklemans and Theodore Kisiel (Evanston: Northwestern University Press, 1970), 430.

[43] Cortois, Paul. "The Structure of Mathematical Experience According to Jean Cavaillès," *Philosophia Mathematica* 4 (1996): 27

[44] Cortois, "The Structure," 28-9.

[45] Webb, *Foucault's Archaeology,* 27

[46] Delaporte, François, ed. *A vital rationalist: Selected writings from Georges Canguilhem*. Zone Books, 1994, 44

[47] Canguilhem, *Etudes,* 182

[48] Canguilhem, *Etudes*, 199

[49] In 1934, Bachelard introduced the playful term "transcendental induction," indubitably a playful take on Kant's transcendental deduction, to explain how scientific concepts are born. According to him, a transcendental induction is an epistemological moment that generates new concept or idea from a set of concepts that already exist. From particulars we move to a general that, once articulated, becomes a new particular. What is interesting about Bachelard's theory of transcendental induction, aside from its oxymoronic name, is its thoroughly a-subjective nature. Much like the "objective syntheses" of Cavailles and the "historical syntheses" of Canguilhem, transcendental inductions are acts of creation that are carried out by the formal networks of concepts that make up a given scientific domain. They are "transcendental," therefore, not in the sense that they are the jurisdiction of an apperceptive subject but in the sense that they transcend subjectivity itself. A transcendental induction is an event whereby a scientific domain reorganizes itself by itself and gives birth to a new member of itself without the aid of a scientist and without the intervention of consciousness. Echoing Canguilhem's claim later in *Ideology and Rationality in the History of the Life Science* (1988) that knowledge (*savoir*) "is *impersonally* formulated" [49] in the

mouths of empirical scientists and Foucault's assertion in the *Archaeology of Knowledge* that knowledge (*savoir*) is defined by its "anonymity," Bachelard argues that transcendental inductions are objectivities without authors. They are not strokes of genius that can be traced back to a proper name or attributed to the laborious efforts of what Kuhn once called to what Kuhn once called "the great weavers of scientific fabrics." Like the waves of the sea or the clouds in the sky, they belong to none, are caused by no one and owe their being to no one.

[50] Foucault, *AK,* 10

[51] Irigaray, Luce. *This Sex Which Is Not One.* Trans. Catherine Porter and Carolyn Burke (Ithaca: Cornell University Press, 1985), 26

[52] Foucault, *AK,* 16

[53] Foucault, *AK,* 203

[54] Foucault, *AK,* 63

[55] Foucault, *AK,* 203

[56] Canguilhem, *VR*, 45

[57] Canguilhem, *VR*, 44

[58] Canguilhem, *VR*, 110

[59] Canguilhem, *IR,* 1

[60] The proof for this argument is provided by Canguilhem. In his analysis of the epistemology of medicine, Canguilhem claims that entire scientific discourses can be constituted by people who do not live in the same historical moment. Thinker A at time t1 may discover or codify or invent a given concept X, while thinker B at time t2 may give a clear articulation to new concept Y. As part of the same network, X and Y together interact. And they can give birth to new concept Z or an entirely new scientific discipline that neither A nor B predicted, foresaw or even could have understood (Canguilhem, *VR,* 147). Here we find support for my theory of survenience because the token event at the higher level (the creation of Z) lacks a correlate causal token event at the lower level. The event above lacks a cause below.

[61] In the philosophy of mind, supervenience describes an emergence relation bound by the token identity thesis. In supervening dynamics, the emergent level cannot exist without the material base and, moreover, for every token event that unfolds at the higher-level structure there must exists a corresponding token event that unfolds in the lower-level base. No sound in the attic without a voice in the basement. Although arguably fruitful for theorizing the relationship between mental and brain states and hence useful in the philosophy of mind, I consider this token identity requirement too burdensome in relation to scientific epistemology. A survenience relation differs from a supervenience one in that although it holds that emergent phenomena cannot exist without their material base, it does not require that every individual (token) change at the higher level be, at least in principle, aligned with a token event in the material base. Thus, a survenience relation allows changes specific to the emergent base and thus rejects the notion that all causal power is held by the material base.

[62] Sawyer, Robert. *Social Emergence: Societies As Complex Systems* (Cambridge University Press, 2005)*,* 84

[63] Sawyer, *Social Emergence,* 85

[64] Fleck, *The Genesis and Development of a Scientific Fact* (Chicago, IL: University of Chicago Press, 1981), 95

[65] Fleck, *Genesis,* 99

[66] Koyré, Alexandre. *Galileo Studies* (Leiden, Netherlands: Brill Publishers), 65

[67] Canguilhem, *WM,* 45

[68] Jacob, François. *The Logic Of Life: A History Of Heredity* (Princeton: Princeton University Press, 1993), 11

[69] Jacob, *Logic of Life,* 12

[70] Canguilhem, *VR,* 107

[71] Canguilhem, *Etudes*, 283

[72] Canguilhem, *Etudes,* 283

[73] Lecourt, *Marxism and Epistemology,* 169

[74] Foucault, *OT,* 166-7

[75] Foucault, *OT,* 168

[76] Foucault, *OT,* 168

[77] Foucault, *OT,* 208

[78] See Appiah, Anthony. "Tolerable Falsehoods: Agency and the Interests of Theory." In *Consequences of Theory: Selected Papers from the English Institute*. Ed. Jonathan Arac and Barbara Johnson (Baltimore: Johns Hopkins Univ. Press, I99I), 63-90.

[79] Dews, Peter. "Foucault and the French tradition of historical epistemology." *History of European Ideas* 14.3 (1992): 347-363.

[80] Moussa, Mario, and Ron Scapp. "The practical theorizing of Michel Foucault: Politics and counter-discourse." *Cultural Critique* (1996): 87-112.
[81] Foucault: "In this work, then, I left the problem of causes to one side; I chose instead t confine myself to describing the transformations themselves, thinking that this would be an indispensable step if, one day, a theory of scientific change and epistemological causality was to be construed" (OT, xiii). Notice, however, that for us a "theory of scientific change" and a theory of "epistemological causality" are not necessarily co-extensive. Scientific change describes shifts in the epistemic network. Epistemic causality describes how an existing network—even in moments of stasis—affects the thinking of scientists.
[82] Bachelard, *NSS,* 111
[83] Pénisson, Guillaume. *Le Vivant Et l'Épistémologie des Concepts: Essai Sur le Normal Et le Pathologique de Georges Canguilhem* (Paris: L'Harmattan, 2008), 107
[84] Foucault, *AK,* 146
[85] In the chapter entitled "Rarity, Exteriority and Accumulation," Foucault states that his archeological method "presupposes that statements are considered in the *remanence* that is proper to them" (*AK,* 123). In physics, remanence is a type of magnetic induction that remains in some ferromagnetic metals after a magnetic field has been eliminated or removed. In cases of remanence, metallic structures exhibit a magnetic memory as they continue to be permeated by an immanent magnetic tension that, in very literal terms, has no source or origin, no lifeline. Yet, these structures (even in the absence of an actively operational magnetic field) can nonetheless continue to exert an agential "pull." For Foucault, then, the "system of formation" that constitutes the "historical a priori" of a particular historical period is a remanent field in two senses of the term: first, this system or network can, literally, move things like a magnetized iron-frame (in this case the thinking of particular scientists) and, second, its agential force is immanent to its plane of existence and does not presuppose an origin or source (like a Transcendental Unity of Apperception). Epistemic networks exert downward causation by pull scientific thought this way and that without thereby embracing a pervasive determinism that takes contingency entirely out of the picture.
[86] Bachelard, *NSS*, 173-4
[87] Bachelard, *NSS,* 21
[88] Bachelard, *NSS*, 21
[89] Bachelard, *AR,* 73
[90] Bachelard, *AR,* 70
[91] Bachelard, *AR,* 71
[92] Bachelard, *AR,* 11
[93] Canguilhem, *OC1*, 646
[94] Bachelard, *AR,* 34
[95] Lecourt, *Marxism and Epistemology,* 92-6
[96] George Gaylord Simpson, *Tempo and Mode in Evolution* (West Sussex, UK: Columbia University Press, 1944).
[97] Fleck, *Genesis,* 22
[98] Cavaillès, *On the Logic and Theory of Science,* 372
[99] Bachelard, *MR,* 6
[100] Kuhn, Thomas. *The Structure Of Scientific Revolutions* (Chicago, Illinois: University of Chicago press, 2012), 23
[101] Bachelard, *DD,* 36
[102] Lecourt, *Marxism and Epistemology*, 91
[103] Bachelard, *MR,* 3
[104] I borrow this idea from Gilles Deleuze. See Guattari, Felix, and Gilles Deleuze. *A thousand plateaus: Capitalism and schizophrenia*. Athlone Press, 2000.
[105] Foucault, *AK,* 39
[106] Bachelard, *AR*, 40
[107] I take this term from Dupreel.
[108] Bachelard, *AR*, 83
[109] Foucault, *AK,* 47
[110] See my essay "What is the historical apriori?" (delivered at the *First Annual Philosopher's Cocoon Conference*
[111] Bachelard, *DD,* 79
[112] See John Protevi's *Life, War, Earth: Deleuze and the Sciences* (University of Minnesota Press: Minneapolis, MN)

4

A HISTORICO-RECURRENT METHOD
FROM PRESENT TO PAST TO PRESENT

> History must from time to time be re-written, not because many new facts have been discovered, but because new aspects come into view, because the participant in the progress of an age is led to standpoints from which the past can be regarded and judged in a novel manner.
>
> - Goethe[1]

> At various moments in the history of thought, the past of thought and experience can be seen in a new light.
>
> -Bachelard[2]

> Taken in an absolute sense, the "past of a science" is a vulgar concept. The "past" is a catchall of retrospective inquiry. Whether the question is the shape of the earth, the "hominization" of man, the social division of labor, or the alcoholic delirium of a particular individual, one turns to the past as required by present needs in search of more or less remote antecedents to some present state of affairs.
>
> -Canguilhem

In multiple occasions Bachelard, Canguilhem and Foucault use the French noun "*récurrence*" or the adjective "*récurrent*" to describe their respective approaches to the history of the sciences. They share a recurrent philosophical method. This chapter explores this method from a microscopic and macroscopic angle. From a microscopic angle, it argues this common method can be understood as consisting of three different steps, which are:

Step 1: Begin from the history of recorded discourse, from what Foucault calls the "archive."

Step 2: Perform a philosophical *epochē* to suspend all second-order philosophical judgment that may over-determine the meaning, form or structure of archival phenomena.

Step 3: Create maps of *dispersion* in order to trace genealogical "ladders" that connect past and present in a series of rational steps.

After investigating in some detail each of these steps (which I argue are followed by all historical epistemologists), the chapter looks at the movement sketched by them as a whole and considers why this movement is so frequently described as *recurrent*, rather than, say, *cyclique, répété,* or *périodique*. My argument will be that this method is so described because its most salient feature is its structurally necessary incompleteness. "Epistemological recurrence," the term I will use to designate this method, describes an approach to the history and philosophy of science that makes the "output" of historical investigation contingent upon its own *conditions of deployment*. The historical context in which the three-step method is deployed, in other words, has a hand in shaping the histories that are produced by it. Thus it is a prescription of the method itself (a meta-norm of method) that as the historical present shifts, the method itself must be deployed anew, *ad infinitum*. Like the labor of Sisyphus, the work of the historical epistemologist can never reach a final end.

Step One—Begin from the Archive

The hallmark of logical positivism is the idea that reflection on the logic of science is done through the logico-linguistic analysis of the scientific propositions or through the study of scientific procedure. The quintessence of the French tradition in epistemology, by contrast, is the idea that "reflection on the nature of science is done in close relation with the analysis of historical cases."[3] As Yves Gingras argues in his essay "Naming Without Necessity: On the Genealogy and Uses of the Label 'Historical Epistemology,'" "the French tradition in epistemology [is] distinguished from and even opposed to the kind of analysis of science then typical of logical positivism."[4] Specifically, the notion that historical particulars—that is, concrete episodes from the history of the sciences—might in any way contribute to epistemological debates about the nature and justification of knowledge, strikes positivist philosophers as a deterioration of epistemology for this notion, as Tim Lenoir argues in the "Foreword" to Hans-Jörg Rheinberger's *An Epistemology of the Concrete: Twentieth-Century Histories of Life* (2010), "contrasts sharply with earlier philosophies of science, such as Karl Popper and Imre Lakatos, who

proclaimed that the history of science belonged to the footnotes of epistemologists treating the logic and methodology of the growth of knowledge."[5]

This shift from logical to historical analysis throws into relief the first step of historical epistemology, which is a step into what Foucault calls "the archive." Of course, by "archive" Foucault does not simply have in mind the sum of all recorded traces left behind by a culture's past (documents, notes, graphemes, books, etc.) or the aggregate of institutionalized spaces that facilitate historical research and ensure the preservation of these very traces (such as libraries, collections, oeuvres, compendiums, museums, etc.), but an expansive field of historical possibility that includes but exceeds this sum and this aggregate. The archive refers to a set of coordinates that make possible the archaeological investigation of the history of systems of thought, a position from which one can gaze at the history of scientific discourse and grasp the system of rules and concepts that internally regulate it.[6] Here conceived both as a material space and as a more general research orientation, the "archive" of historical epistemology truly lives up to its name—it is literally an *archē*, an office, a governing principle, and a point of beginning. It is "the first the law of what can be said."[7] From within it, epistemology sets itself in motion.

Unfortunately, neither Bachelard nor Canguilhem, to my knowledge, explicitly theorize the "archive" as the methodological foundation of their research. Still, there are good reasons to think that their respective projects presuppose it as an initial boundary condition. In a review of Foucault's *OT,* for instance, Canguilhem presents Foucault's *magnum opus* as a sort of "epistemic alarm clock"[8] (to borrow Thomas Flynn's phrase) that wakes philosophy up from the slumbers of continuist theories of histories that, like logical positivism, see the category of *the past* as a smooth slab without breaks, disruptions or interferences. And, while nothing importance of extensive and detailed archival research for epistemology, he claims that have "interest" and "competence" in the archaeological method that spawned *OT*, having already implemented his own version of it in his own excursions into the history of the life sciences. Meanwhile, in *Michel Foucault's Archaeology of Scientific Reason: Science and the History of Reason* Gary Gutting explains that Bachelard's philosophy of science resembles Foucault's archeology of reason in its emphatic reliance on historical and archival research,[9] while in *Historical Ontology* Ian Hacking

contends that Foucault's very interest in the scientific archive "was inherited from Gaston Bachelard."[10] In *AK,* Foucault himself gives credence to these associations when he notes his journey into the archive of history and his uptake of a discontinuist model of history was not without historical precedent. Well before the publication of *HoM* or *OT,* he says, "G. Bachelard and G. Canguilhem [had] provided models."[11]

This turn to the archive, I would like to suggest, is designed to reveal the poverty of a-historicism in epistemological inquiry and loosen the reins that, for much of the first half of the twentieth century, ensured epistemology's subjection to the logical philosophy. When historically oriented epistemologists take the plunge into the gray element of history, they are not simply situating themselves atop an old pile of relics whose only purpose is to keep alive in desiccated form the memory of what once was. Rather, they are reminding us that all systems of belief, including our own, suffer from an irreducible kind of *provincialism* that limits their range of application and validity to a particular historical epoch or period. They are reminding us, then, that rational agents from periods past have truly thought otherwise and that this "otherwise" cannot be easily dismissed as a bundle of little errors, as a compendium of oddities and curiosities that casts a positive light on the universality of present truths by highlighting what happens when one deviates from it. There is more to knowledge that the innards of a logical system, and to capture this excess one must bring about a double reversal. One must subdue the present to its past rather that the other way around. And one must also begin from the concrete and particular rather than the abstract and universal. This is precisely what logical positivism cannot do.

But if the archive gives Bachelard, Canguilhem and Foucault, as *historians* of systems of thought, a window into the dimension of history that logicist philosophers cannot fathom or apprehend, it also gives them, as historical *epistemologists*, a window into a particular dimension of history professional historians find abhorrent given that it stands at one-remove from historical "facts," i.e., the normative dimension of scientific history described in Chapter 2. This the dimension that allows the epistemologist to marvel at the system of concepts and rules that organize, regulate and order what would otherwise be an amorphous blob of data without any hierarchy, without any cardinality and without any rational sense.

The archive, then, turns *data* into *discourse* and tunes the epistemologist in to the frequencies of a normatively charged current of history. It brings within earshot a certain murmur that is neither the gargled speech of a trans-historical subject living beneath the parabola of time nor the gesticulation of a spiritualized history that seeks, intends and desires. This murmur is the murmur of the archive itself.[12]

Step Two—A Philosophical *Epoché*

To hear the murmur of discourse, it is important to let it be heard. For this reason, as soon as the epistemologist takes a step into the archive, she must quickly take a step back and—to the extent that this is humanly possible—bracket any pre-existing philosophical assumptions she may have about *science*, *discourse* or *history* that may inadvertently over-determine the meaning of archival phenomena from without. The epistemologist, in other words, must actively permit these events to reveal themselves in the full plenitude of its complexity and be careful not to let her pre-established philosophical convictions blind her the playful, though lawful, mobility of archival events. To ward against this danger, the epistemologist must perform what I call a "philosophical *epoché*" whereby she suspends any and all "second-order judgments" that could sneak into the research process as unwarranted and unquestioned assumptions. These second-order judgments are interpretative schemas or positive beliefs about scientific history that are externally brought to bear onto archival research (usually from the realm of the history of philosophy or the philosophy of history) and slip into the process of inquiry as unconscious premises of judgment and that prevent historical epistemologists from seeing in the archive anything other than what they themselves project onto it.

Canguilhem gives us to concrete examples of what happens when second-order judgments seep into historical research. In *Etudes*, he chastises Henri-Marie Ducrotay de Blainville and François-Louis-Michel Maupied's 1847 book *Histoire de Sciences de l'organisation et de leurs progrès, comme base de la philosophie* as a historical project overrun by pre-established theoretical assumptions. Designed to catalogue the progress of French science under Napoleon, Blainville and Maupied's *Histoire* was written from a perspective tinted by two different second-order judgments judgments: (1) a theological belief that

all knowledge presupposes "divine revelation" and (2) a philosophical belief in history's necessarily linear progress. As a consequence of these preconceptions, the authors go down an inferential rabbit-hole that ends up asserting the scientific status of scriptural revelation and the essential continuity between antiquity and modernity. The polluted methodology "almost always end in sermons" and lead its enactors to assert as a scientific fact that "Descartes, Bacon and all the others [...] are merely the logical consequence, the elaboration, of Aristotle."[13] Here, we have an instance of historical research that, while informed by history, in unable to shake off the derailing insinuations of philosophical convictions.

In *FCR*, in the chapter entitled "Histoire de l'historique du réflexe aux XIX^{e} et XX^{e} siècles," we find a more interesting example of failed attempt at historical investigation: Emil Du Bois-Reymond's 1858 history of the reflex. Unlike Blainville and Maupied's *Histoire*, which does not portend to have explicitly epistemological content, Du Bois-Reymond's account is presented as the history of a scientific concept and, therefore, as an essentially epistemological endeavor. In this work, the author advances the thesis that the concept of *the reflex* that circulates in medical, anatomical, pathological and physiological discourses in the early-to-mid nineteenth century can be traced back to the mechanical writings of Descartes, especially *The Passions of the Soul*. Du Bois-Reymond "refers to Descartes the honor of having ingeniously anticipated, in matters of the reflex, the word and the concept."[14] Yet, in spite of the fact that his writing includes ample historical research, this history of reflex is steeped in its own set of second-order philosophical valorizations (some philosophical, some political, some nationalist) that warp the explanation from within and pre-determine the conclusion from without.

First, at the time Du Bois-Reymond writes the history of the concept of the reflex, he is already a vocal participant in philosophical controversies about the value of the mechanistic philosophy on the continent. He is an adamant defender of mechanistic explanations and sees all non-mechanistic accounts of natural phenomena (especially vitalistic and spiritualist acounts) as pathologies of critical thought, as expressions of metaphysical rank. In tracing, therefore, the origins of the concept of the reflex back to the mechanistic writings of Descartes rather than, say, the proto-vitalist writings of Thomas Willis (a Professor of natural philosophy at Oxford) or Georg Prochaska (a professor of anatomy at the University

of Prague), Du Bois-Reymond is doing something *other* than formulating a historical explanation. He is validating, through his own historical research, his conviction that all legitimate scientific concepts must be produced by mechanistic styles of thought because only these styles fuel the advance of postivie, scientific knowledge. "It was not so much for reasons of pure physiology as for reasons of philosophy," Canguilhem says, "that Descartes was anointed a great physiologist [by du Bois-Reymond] and illustrious precursor."[15] This anointment, rather, is how the author of the *Histoire* judges as "guilty of metaphysical sin" an entire school of biology that calls into question the reign of mechanics: "the school of *Naturphilosophie*" to which Prochaska, and before him Willis, belonged.[16]

But there is more. In "putting down"[17] Prochaska and idolizing Descartes, Du Bois-Reymond is also writing, vis-à-vis the history of science, a political treatise about the ascendancy of Germany culture. He, as Dominique Lecourt notes, is affirming "the nationalist supremacy of a 'strong' science over the science of a dominated nationality embodied in this case by Prochaska."[18] It is no accident that in Du Bois-Reymond's analysis the figure who "embodies" the strong German science is the German physiologist Johannes Müller, whose work on the reflex became an important for the dissemination of mechanistic conceptions of life in Germany during the nineteenth century and whom Du Bois-Reymond succeeded as Chair of Physiology at the University of Berlin. The 1858 history of the reflex, then, is the site for a true crosspollination of epistemic, political and nationalist subtexts that moves comfortably back and forth between the superiority of mechanistic philosophy over non-mechanistic philosophy, on the one hand, and the superiority of German over non-German culture, on the other, often using the one as a premise for the other and vice-versa.

Canguilhem's unforgiving attack on Du Bois-Reymond, we must be clear, is not motivated by the fact that history of the reflex *also has political and philosophical implications*. It is not because this history *happens* to be a testament for German preeminence and because it *happens* to attest to the success of mechanistic philosophy that the history of the reflex is turned into an object of opprobrium. Rather the attack is motivated by Canguilhem's suspicion that the logic of the 1858 history *begins* from the assumption of German preeminence and of the superiority of mechanistic thought and then *happens* to

find in Descartes a viable anchor for a historical narrative. It is a political and philosophical treatise, in other words, that expresses itself as a history of science.

In *FCR*, Canguilhem makes explicit that the true danger of second-order philosophical judgments is not that they lead to self-aggrandizing scientific histories awash with petty nationalist and ideological tones. The danger is that, once they infiltrate the historical method and take command of the research process, these judgments impose blinkers on our vision that make it difficult for us to notice any patterns or forms in the "stuff" of the archive other than the arabesques that we consciously or unconsciously project onto it. Indeed, the central thesis of *FCR* is that if we bracket these kinds of philosophical presuppositions and let the murmur of the physiological archive resonate, we realize that there is an different and more plausible origin of the concept of the reflex. What makes possible the thinking of *reflex movement* in the nineteenth century is not Descartes's mechanistic theory, which defines life as machine, but the vitalistic theory of life that equates life with *light*. The thinking of life as light allows first Willis and then Prochaska to think of living motion as *reflection*, which is to say, as *reflex*. Thus, even though there is a passing reference to "reflected spirits" in Descartes's *The Passions of the Soul* (a reference Du Bois-Reymond alludes to many times), the truth remains that Descartes is not, and could not have been, the father of the concept of the reflex that frames medical discourse in the 1800s. This concept is an essentially vitalist notion that could only have come from the region of *Naturphilosophie*. To be sure, in Descartes we find the word. But we don't find the concept. In Willis and Prochaska, however, we find both.

FCR, which some consider Canguilhem's most important work after *NP,* is dedicated to two people: "*A Monsieur Gaston Bachelard, philosophe [et] a Charles Kayser, physiologiste*." It is dedicated to Charles Kayser, I believe, because Kayser and Canguilhem studied the complex history of physiology together while they were colleagues at Strasbourg (a job, we may add, that Canguilhem got solely on account of Cavaillès's influence).[19] And it is dedicated to Bachelard because Bachelard helped Canguilhem avoid those second-order judgments that threaten to run riot in research and that produce a

real disruption in the process of inquiry thus allowing Canguilhem to distinguish his work in the history of the sciences from the works of people like Du Bois-Reymond.

In *FSM*, Bachelard investigates, largely from a psychoanalytic angle, various examples of second-order judgments (philosophical, moral, political, etc.) that cause researchers to deform the objects they study. These examples, which Bachelard calls "epistemological obstacles," are ideas and convictions ("intellectual habits," he says) that "take on an unwarranted *value*"[20] in the research process and cheapen the results of inquiry by over-saturating it. They cloud perception and introduce a "*false rigor*"[21] into the order of analysis comparable to the rigor we find in the histories of Blainville, Maupied and Du Bois-Reymond. Examples of these obstacles include:

- *The Obstacle of Primary Experience*: The assumption that lived, subjective experience and scientific experience lie on a smooth continuum such that the truths of science are only elaborations or developments of the truths of lived experience that differ from them solely in degree.
- *The Obstacle of Empiricism*: The presupposition that all scientific knowledge operates according to general principles (universals) that are abstracted from the observation of particulars.
- *The Obstacle of Substance*: The idea that all scientific claims in the sciences of matter (physics and chemistry) necessarily presuppose the existence of a metaphysical substance that stands behind or under the world of experience and grounds it.
- *The Obstacle of the Unity of Nature*: The conviction that all scientific knowledge, and all conceivable knowledge, can be synthesized from an individual perspective. And,
- *The Obstacle of Hyper-Precision*: The view that scientific objectivity necessitates the complete eradication of all error and that the detection of even the slightest margin of error throws into disarray the entirety of the scientific enterprise.

No doubt, a complete exorcism of philosophical demons is impossible. But the difficulty of the task must not become a license for recklessness at the level of method. This is why Bachelard declares that his aim, as an epistemologist, is always "to take a fresh approach the philosophy of science, to examine the subject without preconceptions and free of the straightjacket imposed by the traditional vocabulary of philosophy;"[22] and why Canguilhem claims to try to approach "the history of science without any

simplifying *a priori* assumptions"[23] and with "a spirit which we would like to be able to call 'unprejudiced.'"[24]

The philosophical *epochē* is a crucial second step of historical epistemology since the arresting of second-order judgments sets free a dimension of historical research that would otherwise remain below the threshold of visibility. In the same way that, according to Husserl, the phenomenological *epochē* liberates a new realm of being (the immanence of mind) and makes its contents available for thought so, too, the philosophical *epochē* silences the echoes of philosophical judgment in order to render audible the murmurs of the archive. It brings pre-established certainties to a halt for the sake of releasing a wealth of new objects—regularities, concepts, rules, notions, discursive fields, historical *a prioris*, etc.—that can then become objects of epistemological study. This kind of bracketing strategy, Foucault says in *AK*, brings about the "the uncovering of the archive,"[25] an uncovering that makes realizable a post-Husserlian turn, or return, to the *archive's things themselves*!

Step Three—Mapping and Connecting

The moment of release is everything. But the contents that flood out of archive are initially given over to thought as a chaos to be tamed and as a whirlwind to be ordered. They appear, suddenly and at once, as a surge or gush of novelty, as a torrential output that, lacking any discernable logic, befuddles and frustrates the epistemologist, who soon realizes the intractability of her task: to extract a sense of order from this disorder and establish patterns of continuity and discontinuity inside what seems to be a magma without clear form. My argument is that this ordering is carried out via "spatializing" or "mapping" maneuver whereby the phenomena that burst forth from the archive are, as it were, laid out or spread out across an imaginary space that makes possible the application of what Foucault calls "related analysis."[26] As soon as the murmur of the archive becomes turns into audible discourse, in other words, the epistemologist must bring this discourse to rest on something like an epistemological table so as to distill the connections that immanently order it. This spatializing procedure is the third and final step of French historical epistemology.

Foucault has often been frequently been read as a spatial thinker. In *Foucault*, Deleuze describes him as a "diagrammatical" philosopher,[27] while in "Foucault's Mapping of History" Thomas Flynn presents him as a cartographer of historical reason.[28] What lends weight to these interpretations, in my view, is Foucault's belief that the contents the archive can only be analyzed and described if they are first spatially arranged on an imaginary background or "epistemological space"[29] (elsewhere, Foucault calls this "the space of knowledge") that makes turns them into objects for archaeological reason. For only against this background or space can one ascertain those filiations, connections, links, divisions, regularities, isomorphisms and breaks that characterize archeological narratives. In *Etudes,* Canguilhem also speaks of a "logical space"[30] that represents the "condition of the possibility"[31] of epistemological history, while in *PN* and *DD* Bachelard speaks of a "notional spectrum"[32] or a "rational canvas"[33] that makes possible the combination, association and relation of concepts and gives epistemologists "an outline for the narration of our past."[34] Either way, before one can craft a concrete narrative about the conceptual progression of a discursive field or formation, one must lay out the material that will be used to feed this narrative side-by-side on a background plane.

This spatialism comes out concretely in Foucault's analysis of "the table" of knowledge in the "Preface" to *OT*. He opens this important text by quoting Borges's famous reference to the entry of a Chinese encyclopedia that orders animals according to a logic that, from the standpoint of Western reason, appears as alien and illogical ("the impossibility of thinking *that*," he says). Through its very existence, the Chinese encyclopedia upsets our epistemic assumptions and confronts us with the irreducible finitude that haunts that system of knowledge we call "ours." It performs a "vanishing trick" that "does away with the *site*, the mute ground upon which it is possible for entities to be juxtaposed."[35] It removes the ground that supports our intricate web of beliefs and replaces it with a different topology of knowledge that we cannot easily navigate or traverse and in which we feel lost and disoriented. Foucault writes:

> What has been removed, in short, is the famous 'operating table' […] I use that word 'table' in two superimposed senses: the nickel-plated, rubbery table swathed in white, glittering beneath a glass sun devouring all shadow—the table where, for an instant, perhaps forever, the umbrella encounters the sewing machine; and also a table, a *tabula*, that enables thought to operate upon the entities of our world, to put them in order, to divide them into classes, to group them according to names that designate their similarities and differences—the table upon which, since the beginning of time, language has intersected space.[36]

Occasionally, scholars interpret this "table" as a reference to the epistemology of the classical age. For me, however, this "table" represents a trans-historical condition for the possibility of there being a connection between things and words at any age, a trans-historical condition for the possibility of there being a knowledge relation *at all.*[37] The table is that virtual or imaginary surface on top of which objects encounter each other for the first time, the space in which "the fundamental mode of being of empiricities [...] is affirmed, posited, arranged, and distributed."[38] By spreading the contents of the archive on a table, historical epistemologists give themselves the formidable ability to decipher, so to speak, the normative longitude and latitude of a given system of knowledge and plot lines of conceptual progression that introduce a sense of order into what would otherwise remain an untamable chaos. Epistemologists, Bachelard tells us, must "empty" concepts of their empirical duration "in order to give them a precise place"[39] in a system of knowledge, in a system that relates them and makes them candidates for use in a rational discourse.

But doesn't this specializing step entail a forceful denaturing of archival material? How can a spatial strategy like mapping be applied to a temporal object like scientific discourse without the latter being subjected to a vicious denaturing? Placing the contents of the archive on something analogous to a grid—isn't this yet another example of what Bergson has so vociferously warned against, i.e., the crushing of time under space? To answer this objection, we must first raise a different query. When historical epistemologist create epistemic maps, what are these maps the maps *of*? What do they represent, depict or symbolize? The answer is provided by Foucault:

> Such an analysis would not try to isolate small islands of coherence in order to describe their internal structure; it would study forms of division. Or again: instead of reconstituting *chains of inference* (as one often does in the history of the sciences or of philosophy), instead of drawing up tables of differences (as the linguists do), it would describe *systems of dispersion.*[40]

The key word here is "dispersion." What gets mapped in the third step of historical epistemology is not so much the *location* as the *dispersion* of scientific-epistemic norms; not the state of an epistemic network but its patterns of diffusion, transfusion, transmission and transformation.[41] Unlike the "chains of inference" of historians and the linguists' "tables of differences," "systems of dispersion" track not only the "assignable positions [that elements occupy] in a common space" but also the "forms of division" that these elements undergo with the passage of time.[42] Historical epistemology maps "the law of the dispersion of concepts."[43] "My aim," says Foucault, "was to analyse this history [of thought], in the discontinuity that no teleology would reduce in advance; *to map it in the dispersion* that no pre-established horizon would embrace."[44] Mapping the dispersion of archeological coherences is also the chief aim of Canguilhem according to Andrea Cavazzino[45] and of Bachelard according to David Webb.[46]

By looking at these maps of dispersion, historical epistemologists are able to discern lines of descent and filiation that explain how present states of knowledge (*our* biology, *our* psychiatry, *our* mathematics) were sired by their historical pasts; they are able to, in a sense, "connect the dots" revealed by the uncovering of the archive and plot trajectories that track the historical formation of modern-day practices, institutions, concepts and ideas. These trajectories are then used as *genealogical ladders* that bring past and present together in a rational account that reveals present scientific discourses to be rational though not logically inevitable consequence of a concrete historical development, of a particular historical un-folding. With these three steps, philosophers of the concept articulate "histories of the present"[47] in what I will characterize as a *recurrent* fashion.

The Method Considered As A Whole—Epistemological Recurrence

The concept of *recurrence* has a long and complicated history: in philosophy it appears as a theory of the metaphysics of time in the writings of Pythagoras and Eudemus, and as an ethical position (closely linked to *amor fati*) in the works of Nietzsche; in mathematics, it is used to define a variety of number sequences such as exponentials, factorials, greater common divisors and Fibonacci numbers;[48]

and in physics it explains certain behavioral tendencies of complex systems.[49] In historical epistemology, however, this concept describes neither a theory of time nor a theory of ethics, neither a theory of number nor a theory of nature. Rather, recurrence refers to a *methodological orientation*, loosely a mix of Hegelian recollection and Nietzschean genealogy, that makes the "output" of the method contingent upon its own *conditions of deployment*. The present determines how we view the past such that as the times change, it becomes necessary to re-interpret the past. "The past" of a science is not a stable category that remains constant over time. Rather "the past" of a science is always a rational re-construction that must itself be systematically reconstructed in light of shifting historical circumstances.[50]

The first thing to note about the method of historical epistemology is that although it is firmly oriented toward the past (its first step being always a leap into "the archive"), its orientation is always determined by the present. For Bachelard, Canguilhem and Foucault, Nietzsche's dictum hasn't lost any of its vigor or relevance: "the past is to be interpreted only through the greatest force of the present."[51] In *Etudes*, for example, Canguilhem argues that the main difference between historical epistemology and classical history is their relationship to the present. The historian always moves from past to present for she believes that the present is somehow already "there" in the past, contained or prefigured in it like an oak tree in an acorn. Thus, she believes that if she starts in the past, she can sprint toward the present in a straight line of explanation that parallels the linear movement of history. The epistemologist, by contrast, moves in the exact opposite direction because she rejects this sort of reverse determinism. She believes that her position *here and now* matters and thus moves, as it were, from present to past. "The historian," Canguilhem writes, "proceeds from origins to the present in such a way that the science of today is always to some degree announced in the past. The epistemologist proceeds from the actual to its beginnings such that only a part of that which passed for science yesterday finds itself to some degree *founded* by the present."[52] History and epistemology have opposing starting gates.

For Canguilhem, her reversal of the classical orientation leads the epistemologist to scrap the theory according to which the past is a translucent and undifferentiated expanse of desiccated facts and events and that historical explanations are divorced from the needs and interests of the present moment.

Histories are never, as the German historian Leopold van Ranke would hope, representations of things as they *really were*. They are motivated narratives whose content reflects their context and conditions of enunciation. More than being a reservoir of facts to be described and organized by historians, the past is an expanse of possibility to be *judged* by the epistemologist, an expanse to be "contaminated" by epistemology. Canguilhem writes:

> Epistemology shifts the focus of interest from the history of science to science as seen in light of history. To take as one's object of inquiry nothing other than the sources, inventions, influences, priorities, simultaneities, and successions is at bottom to fail to distinguish between science and other aspects of culture. A history of science free of *epistemological contamination* would inevitably reduce the state of a scientific discipline—plan physiology in the eighteenth century, say—to a summary of chronological and logical connections among various systems of propositions pertaining to various classes or problems or solutions..[53]

The past, Canguilhem goes on to say, is a "vessel of infinite capacity" that allows us to distinguish between science and its outside, but only if this infinity is subjected to an act of *judgment* that splits it down the middle into two categories: (i) the *still infinite* set of events that are irrelevant when seen from the standpoint of the present and (1) the more *limited and thus finite part* of the past that, from the standpoint of the present, embodies the past of our contemporary scientific truths. "The history of science is entitled to expect from epistemology a set of ethical criteria, by which I mean a set of criteria for judging which moves within the vast expanse of the past are legitimate and which are not."[54]

Bachelard is known for having been the first to distinguish, before Canguilhem, between *obsolete history* (*histoire perimée*) and *sanctioned history* (*histoire sanctionée*).[55] And it is this distinction that Canguilhem is alluding to when he argues that the past must be split in half according to criteria rooted in the present moment. For Bachelard, the sanctioned history of a science denotes all those developments, events, propositions, statements, actions and behaviors that, is strung together in a particular order (in a genealogical ladder), would create "an unbroken chain" of conceptual progress leading from some remote past to the living, breathing present. The obsolete history of a science, by contrast, refers to all those developments, events, propositions, statements, actions and behaviors that, while perhaps "scientific" in their day and age, bear no epistemological significance for the present's self-understanding. If strung

together, obsolete history would yield, at best, a series of unfortunate events once embraced as "true" but now scorned as "false."

Notice, however, that the kind of judgment exercised here is not the application to the past of a present standard of scientificity, a prejudicial maneuver all too common in the field of the history of science (Lakatos, for example, is guilty of this).[56] Judgment is the isolation of those past events that continue to hold normative weight relative to the present. Recurrence, therefore, not *presentism*. Presenting is the idea that the worth of all human achievements—be they social, political, ethical, artistic, economic, scientific, etc.—depends on the extent to which they mirror (or cohere with) contemporary norms and values; the belief the present is a meta-norm of historical judgment that allows to anachronistically judge the past by the present. Presentism is, in short, the neo-Protagorian conviction that "Now" rather than "Man" is the measure of all things. This is not the standpoint of historical epistemology. As Canguilhem notes,

> There is a clear difference between retrospective critical evaluations of the scientific past in light of a present state of knowledge (certain, precisely because it is scientific, to be surpassed or rectified in the future) and systematic, quasi-automatic application to the past of some standard model of scientific theory. The latter is more in the nature of an epistemological inquisition than as a historical inquiry […] Thus it is easy to distinguish between epistemological recursion (*recurrence épistémologique*) and the top-down method.[57]

Historical epistemology situates itself in the negative space between two different historical tendencies: (i) the tendency to view the present as a static container of diaphonous historical facts that can be described but never judged; and (ii) the tendency to view the past as epistemological category that can be judged but only from the perspective of its coherence with the present, only as a "precursor" to the *here and now*. Historians make a terrible mistake when they deny that they judge the past, but they make an even more horrendous one when they treat *the present* as a "meta-norm" of judgment that determines, once and for all, the intrinsic value of all past phenomena. Bachelard, Canguilhem and Foucault this tension in two ways. As epistemologists, they recognize the inevitability of judgment in historical research and belive, a new formulation of Tocqueville's dictum, that *when the present no longer*

illuminates the past, the spirit walks in darkness. But, as critics of presentism, they remind us that using contemporary norms of rationality as "the universal touchstone" of epistemological worth is a methodological blunder that "results not in projecting a powerful searchlight into the past but in blinkering our vision."[58] For them, we can say, the past must be judgment *from* rather than *by* the present, meaning that it must be judged from a present that is not "norm" but an "end." Rather than being the rule for historical measurement, the present is simply *that wherein genealogical accounts must terminate*.

This type of epistemological recurrence, I would like to suggest, is reminiscent of Hegel's moment of "recollection" insofar as both presuppose that rational order can be injected into history so as to render it "comprehensible," but only in the wake of Minerva's flight.[59] Like Hegel's "wise Man" or "sage," the historical epistemologist introduces reason (and therefore the possibility of "comprehension") into the folly of history through a triumphant and final act of judgment that renders history *rational* and *comprehensive* in hindsight. Rational histories, on this view, are written from a retrospective perspective that, as it were, *looks back* from the standpoint of the present so as to re-construct the trajectory of the present's path of formation or genesis. And this critical historical perspective is at once more subtle and more complex than the un-critical attitude of Whig historians that look back into the past only to vaccinate it with, and superimposed upon it, an anachronistically projected image of *what is to come*.

Still where we must insist on a break between the recollection of the German and the recurrence of the French is in how these philosophies interpret *the present* as a category of historical analysis. Both conceive of it as the *telos* of historical explanation, but in two radically different senses. In Hegel's corpus, the present, as *telos*, is absolute; it is a peroration that, once accomplished, brings about the infamous "the end of history." In the works of Bachelard, Canguilhem and Foucault, however, the present remains a *telos*, but only a provisional one. As Canguilhem points out in *IR*, the epistemologist's job is to establish "the order of conceptual progress that is visible only after the fact and of which the present notion of scientific truth is the provisional point of culmination."[60] According to Hegel, once the wise Man [sic] has looked back and gathered up the history of consciousness into a narrative or account, he need no longer worry about the genre of history-writing because his own act of recollection closes history up upon itself

at the same time as it discloses it as a rational totality. Once recollected, history, as a philosophical term, ceases to exist because, as a destination, it has been reached. But for historical epistemologists, history never reaches a final point of culmination. Every imaginable present *from which* a rational history is expressed is at best a temporary moment in a never-ending sequence of historical becoming, a historical layover durable enough to claim a history of its own but not so permanent as to claim the decisive end history *as such*. And this, I argue, brings us to the single most important point in our discussion of recurrence, which is this: the structural incompleteness of the historical epistemological method. Since the present (the context of deployment) affects how we judge the past and how we write a history, and since the present is a constantly shifting term, it follows that the history of a discursive domain must constantly be re-told. As soon as the present comes to past, a new "history of the present" must be written using the same three-step method described above, and nothing internal to historical epistemology (or its method) requires that the second history resemble the first or subsume it under it as a "special case." A history of rational domain G written as time T1 and a history of the same domain written at time T2 need not be identical to, or commensurable with, one another.

A Brief Hypothetical – Recurrence in the History of Biology

A concrete example may help. Imagine a particular science at a particular time, say, evolutionary biology in the 1960s and 1970s. And imagine that the conceptual armature of this science contains several key concepts with which its practitioners "operate" on the world, the most important of these being (1) the concept of *character*, (2) the concept of *selection*, and (3) the concept of the *genotypic supremacy* (i.e., the latter is the idea that phenotypes are determined solely by genotypes without the external interference of environmental factors). The question then is the following: How would we, as archeologists of biological rationality writing circa 1980, justify or account for the epistemological infrastructure of "our" biology?

Assuming "we" identify with the school of historical epistemology, the answer should be clear—we would justify our biological discourse using the tripartite method outlined above. We would delve into

the archive of the history of biology, bracket second-order judgments and track the dispersion of our most remarkable scientific concepts. In doing so, we would construct a narrative about the evolution of evolutionary theory itself, and we would trace our most critical concepts to their respective points of origin. We might trace the concept of *character* back to Mendel's famous pea experiments, the concept of *selection* to the fourth chapter of Darwin's *On the Origin of Species*, and the concept of *genotypic supremacy* to the "modern synthesis" produced by the writings R. A. Fisher, Theodosius Dobzhansky, J. B. S. Haldane, Sewall Wright, Ernst Mayr and George Gaylord Simpson, among others. Through the elaboration of this narrative we would give a non-deductive, genealogical account of how our system of biological knowledge came to embody "our" contemporary truth about the living.

But what matters for us as we attempt to highlight the logic of epistemological what is present but absent. Notice that a key name from the history of biology is entirely omitted in this imaginary ladder—the name of Jean-Baptiste Pierre Lamarck. Due to his vitalist metaphysics and his belief in the direct influence of environmental factors on the formation of animals, in 1980 Lamarck's corpus is deemed irrelevant (and, we must accentuate, correctly so) for the historical justification of biological rationality. Why? Because the conceptual network of evolutionary theory circa 1980 makes no meaningful reference either to vitalist principles or to the possibility of environmental interference in the determination of the phenotype. Thus even if Lamarck's writings, especially his well-regarded *Philosophie zoologique ou exposition des considérations relatives à l'histoire naturelle des animaux* (1809), are considered "scientific" in the context of the 1800s, the have lost this honorific in the 1900s. By 1980, Lamarck's work belongs to the "obsolete history" of biology. Its only value for the scientist is as a specimen of curious errors overcome.

But of course human history does not come to a standstill in the 1980s, and neither does the history of biology. So let us add a twist to our hypothetical scenario. Let us now imagine that new and exciting research comes to light in the late 1980s and 1990s suggesting that environmental factors can have an indirect influence on the formation of animals; that factors such as nutrition, temperature and stress can affect the organisms during embryogenesis by affecting which genes are phenotypically

expressed and which are not. Now, for present purposes, it matters that this research in no way contravenes the previously-held belief that experience cannot directly impact the genotypic makeup of an individual or problematizes the concepts of *character* and *selection* that have become well-established nodes in the conceptual networks that frames our scientific understanding of life. Still, this new research does shake up the fabric of our knowledge for it demanding a more dialectical understanding of the relationship between genotype and milieu. Perhaps the ripple effects of this shift do not precipitate a full-scale re-organizations of biological reason. But they would certainly produce, at the very least, noticeable re-shufflings in specific regions of this domain. Perhaps one of the consequences of this novel research is that leads us to re-form out concept of *genotypic superiority* or replace it with a concept of *geno-environmental parity*.

Once this change occurs, we must face the same methodological question anew: How would we, now as epistemologists of biological rationality writing circa 2000, justify the epistemological infrastructure of our new system of biological truths? How would we account for the present state of biological knowledge? Again, the method itself remains intact: archive, *epochē* and mapping. But since the context of deployment has now changed, it is in principle possible that our history of biology will look significantly different than the history written two decades earlier. It is highly probable, for instance, that in the new situation Lamarck's name will be retrieved from the void of obsolete history and legitimated as part of the sanctioned history of biology. In light of recent conceptual developments, Lamarck's claim in Chapter 7 of *Philosophie zoologique* that "circumstances" have an influence "on the actions and habits of animals" and cause "modification in [animals'] organic structure and their parts"[61] no longer represents what Canguilhem would call "biology *in its past.*" It is now part of "*the past of* biology." In this new context, Lamarck's name no longer designates a body of work that contemporary biologists would do well to dismiss as ideology. It is a work in which biologists can see the rational past of their own activity, a "stage" or "point" of conceptual development in the dialectic that culminates in the present-day notion of *geno-envrionmental parity.*

Recurrence and the Plurality of Possible Histories

This only partially hypothetical scenario of the history of biology (Canguilhem uses the example of the history of plant physiology to make the same claim) gives psychological content the otherwise purely formal calim that "rapid scientific progress requires frequent re-writing of history."[62] It shows that method of historical epistemology "has reversibility built into it"[63] and illustrates in concrete form how "an old theory, long considered outdated, gains a new (although sometimes seemingly paradoxical) actuality."[64] An epistemological history written at time T1 simply need not "square off" with a history written at time T2 *even if they are two histories of one and the same thing.*

But it is not simply different temporal contexts that yield different histories. A history, H1, of a scientific domain written at time T1 will differ from another history, H2, written at the exact same time even if they occupy the same *context of deployment.* In his analysis of the history of cell theory in *KL*, Canguilhem argues that when we dive into the archive and find ourselves face to face with an *oeuvre*, we are face to face with something that requires interpretation and, consequently, selection. When we read Darwin, Newton, Aristotle, Galileo, Pinel or any other figure from the history of the sciences, we build an interpretation not only by judging whether these belong to the history of sanctioned or obsolete history but also by determining *which* parts of their work are most germane in light of our assessment of present needs. Do we emphasize Darwin's famous concept of *natural selection* or his less frequently discussed concept of *sexual selection*? Do we emphasize Newton's famous concept of *mass* or his less frequently mentioned concept of *divine determination*? Or, using Canguilhem's preferred example in *KL*, do we bring to the fore Linnaeus's concept of *the fixity of the species* that places him in the company of pre-modern thinkers like Aquinas or his often overlooked concept of *monstrosity,* which places him closer to the post-essentialist modernity of Montaigne?

The act of writing a rational history, then, entails two moments of judgments, both of which are under-determined by the material itself. There is that first moment of judgment that splits the past into an obsolete and a sanctioned part. Then, there is a second moment of judgment that decides which elements of the sanctioned history of a science will be foregrounded in analysis. And independently of how

extensively one tries to justify this second decision, the fact remains that it *could have easily gone otherwise*. "Linnaeus's work doubtless allow[s] one to derive fixism, but, *on the basis of the entire oeuvre, one could also have taken something different.* The fecundity of a scientific work stems from the fact that it does not impose the methodological or doctrinal choice toward which it tends."[65]

That the histories of the present penned by historical epistemologist lack logical necessity means that, as readers, we cannot treat them as scientific theories that are "falsified" when alternative historical explanations yield different readings of particular figures or altogether different trajectories of conceptual development. Historical epistemology is a discourse *about* science, but it itself is not a science.[66] Hence, the question we must ask of a particular epistemological history is not "Is this narrative the only logically conceivable story to be told about this concept or domain?" but rather "Is this narrative an informative schema that augments our understanding of a discourse that, today, expresses our collective will to truth?"

The non-scientific character of historical epistemology throws in the open the complete absurdity of thinking that one can "expose" a particular historical epistemological work as "groundless" or "baseless" by showing that it fails to vanquish all competing explanations of the phenomena (as many historians tried to do with Foucault's *HoM* and *OT*). This charge hinges on a confusion that is as unassuming as it is corrosive—a confusion of the discourse of historical epistemology (a non-science) for the discourse that is its object (the sciences). When it comes to writing a history of the present, we must always keep in mind that "a particular endpoint may be related to one or more conceptually homogeneous points of departure"[67] and that, for this very reason, what matters is not whether we can conceive of alternative genealogical explanations, but whether the trajectory of the genealogy we choose take us from a more or less remote past to the present in a series of more or less comprehensible steps.

At the same time, however, the non-scientific status of historical epistemology prevents it from claiming any predictive power. Historical epistemology is a discourse about the present's past that can say nothing substantial about the future other than that it is *radically open*. There is nothing internal to the philosophy of the concept that would enable Bachelard, Canguilhem or Foucault to make even the slightest inferences about the form or content of future science. They cannot foresee the future

development of particular scientific concepts or expect the future of science to be even *minimally rational* according to contemporary standards of truth and reason. During the twentieth century, many philosophers of science expressed concern that if we cannot bind the future and demand that it abide by at least some fundamental principles (Perhaps a simple commitment to falsification? Perhaps a drive for predictive accuracy? Perhaps an interest in intra-theoretical coherence?), then the very categories of truth and rationality come undone. Can we imagine a future science that does not abide by the principle of falsification, by the striving for predictive accuracy or by the demands of intra-theoretical coherence? Can we imagine one such thing and still call it "science"? The answer, we are often told, is no. But there is no *prima fascia* why the future of science should be shackled by the limits of our present imagination. The fact I cannot possibly conceive of a non-predictive scientific enterprise tells me something about the limits of my mode of thinking, not about the modal limits of all possible human thought. Moreover, this concern only makes sense *as a concern* if we take truth and rationality to be fundamentally forward-looking categories. But historical epistemologists see them as backward-looking categories that materialize only in hindsight, in a perspective that *looks back*. And the recurrent method explains why.

[1] Merz, John Theodore. *A History of European Thought in the Nineteenth Century: Scientific thought, Vol. 1* (W. Blackwood and sons, 1904).
[2] Bachelard, MR 86
[3] Gingras, Yves. "Naming without Necessity: On the Genealogy and Uses of the Label 'Historical Epistemology.'" Revue de *Synthèse* 3 (2010): 439-454.
[4] Gingras, "Naming without Necessity," 442
[5] Rheinberger, Hans-Jörg. *An Epistemology Of The Concrete: Twentieth-Century Histories Of Life* (Duke University Press, 2010), xvi
[6] In "The Historical Apriori and the Archive," Foucault states that "discourse" is not depleted by the borders of the conventional archive. Reversing the order of what is indubitably a common sense presupposition, he argues that discourse is not defined by the archive; rather, the archive is defined by the vast space of discourse. The archive is synonymous (or identical in extensionality) with the range of "scientific discourse" available to the epistemologist. "By this term [archive] I do not mean the sum of all the texts that a culture has kept upon its person as documents attesting to its own past, or as evidence of a continuing identity; nor do I mean the institutions, which, in a given society, make is possible to record and preserve those discourses that one wishes to remember and keep in circulation. On the contrary, […] the archive is the first law of what can be said, the system that governs the appearance of statements as unique events" (Foucault, *AK,* 128). And he continues: "But the archive is also that which determines that all these things said do not accumulate endlessly in an amorphous mass, nor are they inscribed in an unbroken linearity, nor do they disappear at the mercy of chance external accidents, but they are grouped together in distinct figures, composed together in accordance with multiple relations, maintained or blurred in accordance with specific regularities, that which determines that they do not withdraw at the same pace in time, but shine, as it were, like stars, some that seem close to us shining brightly from afar off, while others that are in fact close to us are already growing pale; […] that which differentiates discourse in their multiple existence and specifies them in their own duration" (Foucault, *AK*, 129).
[7] Foucault, *AK*, 129
[8] Flynn, Thomas R. *Sartre, Foucault, And Historical Reason, Volume Two: A Poststructuralist Mapping Of History*. Vol. 2 (University of Chicago Press, 2010), **56**
[9] Gutting, Gary. *Michel Foucault's Archaeology of Scientific Reason: Science and the History of Reason* (Cambridge University Press, 1989), 252ff
[10] Hacking, Ian. *Historical Ontology* (Springer Netherlands, 2002), 76
[11] Foucault, *AK,* 190.
[12] Foucault, *AK,* 28.
[13] Canguilhem, *VR,* 59
[14] Canguilhem, *FCR*, 139
[15] Canguilhem, *IR*, 56
[16] Canguilhem, *FCR*, 140
[17] Canguilhem, *FCR*, 140
[18] Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: NLB, 1975), 177
[19] See Roudinesco, Elisabeth. *Jacques Lacan & Co: A History Of Psychoanalysis In France, 1925-1985* (University of Chicago Press, 1990).
[20] Bachelard, *FSM*, 32
[21] Bachelard, *FSM*, 32
[22] Bachelard, *NSS,* 3
[23] Canguilhem, *NP*, 214
[24] Canguilhem, *NP*, 34
[25] Foucault, *AK*, 131
[26] Foucault, *AK,* 207
[27] Gilles Deleuze, *Foucault* (New York, NY: Continuum Publishing, 1988), 34-40
[28] Flynn, Thomas "Foucault's Mapping of History," in *The Cambridge Companion to Foucault*, ed. G. Gutting. (Cambridge: Cambridge University Press, 1993).
[29] Flynn, "Foucault's Mapping," xi
[30] Canguilhem, *VR,* 52
[31] Canguilhem, *VR,* 52
[32] Bachelard, *PN,* 40

[33] Bachelard, *DD,* 63
[34] Bachelard, *DD,* 63
[35] Foucault, *OT*, xvii
[36] Foucault, *OT*, xvii
[37] Of course, the table of knowledge is merely a *formal* condition for knowledge as it does not determine the kinds of connections or the kinds of objects that appear through it. It simply creates a sphere or domain in which various objects can appear in various arrangements. Thus, the *epistemes* of the Renaissance, the Classical age and modernity are each a table of knowledge because each makes possible the appearance of a domain of things and objects *about which* one can make different types of knowledge claims. What Foucault does in *OT* is put these tables on a new table of their own, which is how these epistemes can go from being formal-background *conditions* of knowledge to being *objects* of archaeological description.
[38] Foucault, *OT,* 219
[39] Bachelard, *DD*, 63
[40] Foucault, *AK*, 37
[41] Brenner, Anastasio. "Reflections on Chimisso," In *The Present Situation In The Philosophy Of Science. Vol. 1*, ed., Friedrich Stadler (Springer Science & Business Media, 2010), 64
[42] Foucault, *AK,* 37
[43] Foucault, *AK,* 75
[44] Foucault, *AK,* 203, 10.
[45]See Andrea Cavazzini, "Archéologie des Concepts et Philosophie de la Nature," paper presented at the Conference on *Epistemology and history From Bachelard and Canguilhem to Today's History of Science* (Held by the Max Planck Institute for the History of Science, 2012), 184
[46] In *Foucault's Archaeology: Science and Transformation,* David Webb makes the parallel with Bachelard, arguing that the concept of *dispersion* is a founding element of Bachelardian epistemology (Webb, 34).
[47] The term "history of the present" is a popular concept in Foucault's work. See, for instance, Michael Roth's "Foucault's History of the Present," in *History and Theory* 20 (1981): 32-46. Also helpful in its explanation is Michael Mahon's *Foucault's Nietzschean Genealogy: Truth Power, and the Subject* (Albany, NY: State University of New York, 1992). Yet, this focus on the present is also Bachelard's. In "Reflections on Chimisso: French Philosophy of Scienceand the Historical Method," Anastasios Brenner argues that Bachelard's interest is not simply on the history science (conceived as a generality) but on contemporary science. See Anastasios Brenner, "Reflections on Chimisso: French philosophy of Science and the Historical Method" in *The Present Situation in the Philosophy of Science*, ed. Friedrich Stadler (New York, NY: Springer, 2010), 62. Meanwhile, in their introduction to Canguilhem's *WM,* Stefanos Geroulanos and Todd Meyers argue: "Canguilhem's practice in *Writings on Medicine* is a mixture of what we usually refer to by the terms 'conceptual history,' 'historical epistemology,' and the 'history of the present.' Once again, while this mixture is not unique to *Writings on Medicine*, it is carried out with particular insistence in this book […] History of the present is a term Michel Foucault proposed in his 1975 *Discipline and Punish* as his way of thinking about the link between the nineteenth-century focus of his 'genealogical' studies and the contemporary intervention he sought to make thought them. Canguilhem's essays in *Writings on Medicine* make a distinct effort to intervene in contemporary debates in medicine, sometimes through short asides citing policy proposal, but more frequently thought a constant sense that health, disease, cure, nature, and individuality are fundamentally problems whose history remains implicit and troubling in their contemporary uses" (Canguilhem, *WM,* 11ff).

[48] For an analysis of the relation between mathematics, induction and recurrence, see Henri Poincaré's *Science and Hypothesis* (Science Press, 1905). For a study of how this mathematical notion of recurrence has spilled onto the life sciences (especially biology) see John Maynard Smith's *Mathematical Ideas in Biology* (London: Cambridge University Press, 1968).
[49] See Vitaly Bergelson, "The Multifarious Poincaré Recurrence Theorem," *Descriptive Set Theory And Dynamical Systems* (2000): 31-57; and Frisch, Harry. "Poincaré Recurrences," *Physical Review* 104 (1956): 1-5.
[50] Bachelard argues that the function of the epistemologist is to produce a "recurrent history" (Bachelard, *DD*, 10) because "the revelations of reality are always recurrent" (Bachelard, *FSM*, 24). Canguilhem explicitly talks about his "method of epistemological recurrence" (Canguilhem, *IR*, 4-15). Foucault uses this concept at critical moments, especially in "Nietzsche, Genealogy, History," where he explains that what distinguishes a genealogical from an evolutionary explanation is that the former taps into the recurrence proper to historical phenomena while the latter tries to fit historical developments into a linear model of historical change. Foucault writes "From these elements [of

the archive], however, genealogy retrieves an indispensable restraint: it must record the singularity of events outside any monotonous finality; it must seek them in the most unpromising places, in what we tend to feel is without history—in sentiments, love, conscience, instincts; it must be sensitive to their *recurrence*, not in order to trace the gradual curve of their evolution, but to isolate the different sciences where they engaged in different roles. Finally, genealogy must define even those instances when they are absent, the moment when they remained unrealized (Plato, at Syracuse, did not become Mohammed)" (Foucault, "NGH," 76).

[51] Quoted in Kockelmans, Joseph and Theodore Kisiel. *Phenomenology and the Natural Sciences (Studies in Phenomenology and Existential Philosophy)* (Northwestern: Northwestern University Press, 1986), 321

[52] Canguilhem, *Etudes,* 178

[53] Canguilhem, *IR*, 3

[54] Canguilhem, *IR,* 4

[55] Bachelard, *AR*, 5

[56] Lakatos, Imre. *History Of Science And Its Rational Reconstructions* (Springer Netherlands, 1971).

[57] Canguilhem, *IR*, 12

[58] Canguilhem, *IR*, 12

[59] See Georg Wilhelm Friedrich Hegel, *Philosophy of Right*, especially the "Preface" (Courier Dover Publications, 2012).

[60] Canguilhem, *IR*, 9

[61] Lamarck JB. *Philosophie zoologique, ou Exposition des Conside´rations Relatives a` l'Histoire Naturelle des Animaux* (1809) Trans. H Elliot, *Zoological Philosophy, an Exposition with Regard to the Natural History of Animals* (London, UK: Macmillan, 1914).

[62] Canguilhem, *IR,* 16

[63] Webb, *Foucault's Archaeology: Science and Transformation*, 46

[64] Canguilhem, *KL*, 27

[65] Canguilhem, *KL,* 28

[66] Foucault, *AK*, 206; Canguilhem, *IR,* 16

[67] Canguilhem, *KL*, 6

5

A THEORY OF SCIENTIFIC RATIONALITY

TRUTH, HISTORY AND ERROR

> Is there a justification for continuing to speak of a remote, opaque, monolithic, and irrational rationality? To do so is to overlook the fact that what science sees as real actually stands in dialectical relationship with reason itself.
>
> -Gaston Bachelard[1]

Rationality has many faces. The modern theory of knowledge (Descartes, Kant, Fichte) defines it as a subjective faculty or capacity. Post-Gettierian epistemology defines it in terms of beliefs, intents and desires that admit of different degrees of strength and that can be modeled as subjective probabilities. Philosophies of language define it as a property of linguistic propositions if they are of an "analytic" orientation (Carnap, Quine, Davidson) and as the effect of broader linguistic and cultural frameworks of world-disclosure if of a "continental" on (Heidegger, Gadamer, Habermas). Meanwhile, different strands of social theory talk about rationality as a feature of the social totality (Marx, Weber, Horkheimer), whereas Anglo-Saxon philosophy of science (Popper, Kuhn, Lakatos) considers a very specific social form—namely, science—rather than the social order as a whole as the object of rationality assessments. "Rationality"—that concept that Western philosophy has for so long wielded left and right to ward off the advances of unreason and doubt—, then, turns out to be a fundamentally ambiguous notion whose meaning varies from one philosophical camp to the next according to the aims, values and presuppositions that fuel philosophical analysis and the historical influences and intellectual lineages that each camp embraces as part of its past and heritage.

But even if rationality is a creature of countless faces, the question may still be meaningfully posed here: Which of these faces is (most) reflected on the surface of historical epistemology? What does "reason" or "rationality" mean for those post-Hegelian, post-positivist and post-Freudian thinkers that

represent the unlikely progeny of Descartes, Spinoza and Pascal? What does the philosophy of the concept have to say about this central philosophical concept? How does it interpret it? How does it construe it? And what does the very concept of rationality look like after it has passed through the screen of a philosophical program that borrows no less from Marx and Hegel than it does from Kant and Carnap, after it has passed through the sieve of what Anastasios Brenner calls "an epistemology historicized"[2]?

In my view, the entire tradition of French historical epistemology ought to be understood as a theory of rationality. And the concept of rationality that historical epistemology elaborates carries many similarities to the concepts elaborated by other traditions without being, thereby, synonymous to any of them. For example, French historical epistemology treats rationality as a historical process and as a social pursuit. It stresses the point, systematically and spiritedly, that rationality always bears the imprints of action, life and history and cannot be thought outside a determinate social, historical and material horizon. On this point, French epistemology falls in line with German social theory. Yet, unlike German critical theory, which remains mired in the parlance of Hegel's system, French epistemology rejects the idea that "rationality" is a property of the social totality. For the likes of Cavaillès, Bachelard and Canguilhem, "rationality" is predicable only of a very specific fragment of the social order—the fragment embodied by the sciences. This means that it is not "the whole" that is either "true" (as Hegel affirms) or "false" (as Adorno ripostes) because truth-ascriptions make sense only *from within* the space of scientific experience, from the profundities of an exacting conceptual network or a body of ordered knowledge. The social totality is certainly an expanse that shapes this "part" in a plurality of ways—sometimes facilitating, something impeding, its development. But the totality itself is not an ocean of rationality or irrationality. It is simply a social and historical span bespeckled with, or interrupted by, imposing blotches or islands of reason from within which truth-ascriptions are launched: the islands of chemistry, physics, criminology, physics, mathematics, economics, biology, physiology, sociology, etc.

Notice that this privileging of the sciences in the theory of rationality brings historical epistemology into closer quarters with the British and American traditions in the philosophy of science that are often seen as its "analytic" foils than with the German theories that are sometimes paraded as it

cousins from the other side of the Rein since historical epistemologists take to heart Carnap's assertion in *Logical Foundations of the Unity of Science* (1991) that epistemology has for itself the sole task of "analyzing science."[3] Nonetheless, it would be a grave mistake to assume that the concept of rationality we can dig out of the former is simply a reflection or echo of the concept of rationality generated by the latter for an important difference remains. French epistemology rejects the idea, central to Anglo-Saxon philosophies of science, that the positive epistemic status of the science is a consequence of its logical or methodological content.

In stark opposition to the anticipations of logical positivism and logical empiricism,[4] however, historical epistemology takes the value of the sciences for the theory of rationality (that is to say, for epistemology) to lie not in the blueprint of their logical or methodological cores, but in the force of their discursive productions. We have already established in Chapter 2 that "scientific discourse" is the object of historical epistemology. When seen from this perspective, the concept of rationality that emanates from historical epistemology loses its connection to the concept of rationality that informs the analytic philosophy of science and takes on a *linguistic* or *discursive* hue that makes it blend more easily with the prospects of the philosophy of language. But, once again, we find that the philosophy of language cannot quite capture the dynamism of historical epistemology. For one, historical epistemology really is only concerned with *scientific* discourse and not with the larger linguistic practices and phenomena that electrify Heideggerians, Gadamerians and Habermasians. One would search in vain in the annals of the philosophy of the concept for an extended investigation of political, poetic or religious discourse. One would hardly find the term "language." So, the same thing that makes it flirt with the philosophy of science (its emphasis on the sciences) is the same thing that sours its relationship to continental linguistic philosophies.

Meanwhile, that which tends to separate continental from analytic philosophies of language (an understanding of discourse that goes beyond propositional structure) is also a feature of historical epistemology, a feature that dissociates it from the linguistic philosophy initiated by Frege's and Russell's work on the logic of propositions. The discursive productions or formations that historical epistemology

takes as its point of departure include a litany of phenomena that range from the linguistic propositions that represent the bread and butter of linguistic positivism to all those non- or pre-propositional (though epistemologically relevant) discursive practices, acts and behaviors that help disclose a scientific culture and a scientific worldview and that orthodox philosophers of language might wish to exclude from the field of epistemological concern.[5]

The historico-epistemological concept of rationality that falls out of the French philosophy of the concept, then, shares something with each of the following schools without being subsumed under any of them: German social theory, in the philosophy of science, the philosophy of language and the continental philosophies associated with phenomenology, hermeneutics and democratic theory. So the question must be posed one again and with more precision: What face does rationality adopt within the confines of historical epistemology? And if this face shares features with many other faces, what is its most striking difference? In this final chapter, I bring this project to a conclusion by dissecting how historical epistemologists, in the course of thinking and writing about the history of the sciences, manage to reconstruct the very concept of rationality. What might the meaning of *rationality* be for Bachelard, Canguilhem and Foucault? And how might this meaning affect, in turn, the meaning of other philosophical concepts closely associated with it, such as the concept of *truth*? Although my reflections here will be preliminary and in some cases generic (perhaps belonging to the order of an "afterword"), they begin from a very specific and perhaps unexpected place—from a discussion of Hegel's reception in France in the early twentieth century. And the reason is simple: because the face rationality divulges through French historical epistemology has a decidedly Hegelian "look" to it that once seen cannot be unseen.

Hegelianism(s) in France—From Subjective Moments to Social Forms

The legacy of Hegel in France is the legacy of two passages from the *Phenomenology of Spirit*.[6] First, the famous passage on Lordship and Bondage,

> Thus the relation of the two self-conscious individuals is such that they prove themselves and each other through a life-and-death struggle. They must engage in this struggle, for they must raise their certainty of being *for themselves* to truth, both in the case of the other and in their own case. And it is only through staking one's life that freedom is won […] The individual who has not risked his life may well be recognized as a *person,* but he has not attained to the truth of this recognition as an independent self- consciousness. Similarly, just as each stakes his own life, so each must seek the other's death, for it values the other no more than itself; its essential being is present to it in the form of an 'other', it is outside of itself and must rid itself of its self-externality. The other is an *immediate* consciousness entangled in a variety of relationships, and it must regard its otherness as a pure being-for-self or as an absolute negation.[7]

Second, the passage on the Unhappy Consciousness,

> In Stoicism, self-consciousness is the simple freedom of itself. In Scepticism, this freedom becomes a reality, negates the other side of determinate existence, but really duplicates *itself,* and now knows itself to be a duality. Consequently, the duplication which formerly was divided between two individuals, the lord and the bondsman, is now lodged in one. The duplication of self-consciousness within itself, which is essential in the Notion of Spirit, is thus here before us, but not yet in its unity: the *Unhappy Consciousness* is the consciousness of self as a dual natured, merely contradictory being. This *unhappy, inwardly disrupted* consciousness, since its essentially contradictory nature is for it a *single* consciousness, must forever have present in the one consciousness the other also.[8]

More than any other parts of the *Phenomenology*, the *Logic* or the *Philosophy of Right*—indeed, more than any other parts of the vast body of work of the man known to the nineteenth century simply as "the Philosopher"—these passages became the pillars upon which the edifice of "'60s French thought" would stand and turn. And the reason is this: more than any other passages, these two excerpts from the *Phenomenology* showcase what for many French philosophers stand out as the two most important elements of Hegelian project: (i) the idea that the formation of subjectivity presupposes the violence of an encounter with "otherness," an encounter that blurs the line between life and death; and (ii) the idea that the subject that comes out alive on the other end of such an encounter is not a being whose unity has fully restored, but an unhappy and disturbed being that can no more suppress the trauma of its past than it can "suture" the ontological fracture on which its very identity has come to rest. It was largely through reading and re-reading, debating and re-debating these passages, that thinkers as varied as Sartre, Bataille, Irigaray, Beauvoir, Merleau-Ponty and Derrida began to ponder the radical alienation of consciousness under modernity and the relationship between the inside of conscious experience and its enigmatic "outside."

When these passages are treated a privileged entry points into the Hegelian philosophy, however, they generate a very specific Hegel: a *subjectivist* one whose philosophical curiosities meet their own limit at questions of experience, consciousness, and, of course, alienation; a Hegel that treats the philosophy of experience and subjectivity as the starting point for the elucidation of history, rationality and truth. This is the Hegel most widely disseminated in France in the first half of the twentieth century and the one consecrated in the three "milestones" of the French school of Hegelianism: Jean Wahl's *La Malheur de la Conscience dans la Philosophie de Hegel* (1929), in Jean Hyppolite's *Génèse et structure de la Phénoménologie de l'esprit de Hegel* (1946) and in Alexandre Kojève's *Introduction a la lecture de Hegel* (1947).[9] These works, as Foucault says at one point, pave the way for the "indigenization"[10] of the Hegelian project as a whole and, I add, for a philosophical approach that took fundamental philosophical categories (truth, objectivity, reason) to be functions of the laws involved in the manufacture of "the Subject." It is only perfectly natural that the discourses that most repeatedly lean on the content of the Hegelian philosophy in France during the crucial post-war moment are none other than existentialism, phenomenology and psychoanalysis—the French sciences of subjective experience.

But this subjectivist portrait of Hegel, imposing as it was, was not the only one to come out France since from the 1930s to the 1980s another discourse—yes, French historical epistemology—pays tribute to a different Hegel with an anti-subjectivist bite. This other Hegel, which once could easily describe as a more *Germanic* Hegel, is the one that moves the seat of philosophical inquiry from the plane of subjective experience to the plane of objective reality; the one that, in a direct remonstrance against the modernities of Descartes, Kant and Fichte, puts subjectivity behind objectivity on the philosophical scale; the one that, as Herbert Marcuse argues in *Reason and Revolution: Hegel and the Rise of Social Theory* (1941), remains us that Reason is not "achieved" in and through a logic of subjective unfolding but "*in and through social institutions*" instead.[11]

This "social" Hegel radiates out of the second half of the *Phenomenology* (especially out of the sections on "Reason," "Spirit" and "Religion"), not the first. And it maintains that the individual exists in the element of truth only when her existence is mediated through a social form larger than herself, that is

to say, when she sees herself reflected and indeed constituted in and by a set of social structures, in and by a community at large. In *Reason in the Age of Science,* Gadamer tries to capture the essence of this Hegel, to whose fate Gadamer's own hermeneutical philosophy is tied. "The thrust of the [Hegelian] theory of the objective spirit is that not the consciousness of the individual but a common and normative reality that surpasses the awareness of the individual is the foundation of our life in state and society," he says.[12] Gadamer's, as well as Marcuse's, Hegel, in *externalizing reason*, succeeds at interrupting the "tendency of introspection" that defines modern philosophy after Montaigne and Descartes.

It is true that Cavaillès, Bachelard, Canguilhem and Foucault reject (and in this they can be compared to their compatriats who identify with the existentialist, phenomenological and psychoanalytic movements) important features of Hegel's nineteenth century project. They hate its evolutionary model of history, despise its explication of the cognitive process in terms of the metaphysical movement of a single and monolithic "Idea" [Gr. *Begriff*], and have nothing but contempt for its drive toward the unification of all knowledge. They also don't seem to be particularly charmed by the manic insistence that underpins so much of Hegel's work: the insistence the trajectory of history is necessarily enjoined to the requirements of speculative philosophy. Even so, all four reveal themselves to be neo-Hegelians the moment they adopt from Hegel the idea that a robust theory of rationality must feed on the study of social structures and social forms (e.g. art, law, science, religion, morality, politics, etc.) rather than the study of subjective moments and states (e.g. bondage, unhappy consciousness, law-testing, guilt, etc.).[13] That they end up investing all of their philosophical capital in the investigation of only one of these social forms does not change the fact that their orientation, at least in one (and mainly German) reading of Hegelianism, Hegelian.

With this move toward the social and away from the purely phenomenological, these epistemologists step out of the subjectivist wave of Hegelianism produced in France by the rise of phenomenology, existentialism and psychoanalysis, and they give a hitherto unheeded Hegel a voice in the French intellectual establishment of the '40s, '50s and '60s.[14] The most famous of the French thinkers,

Foucault, once admitted that if he had encountered the works of German neo-Hegelians earlier in his career, he would have probably left Paris for Frankfurt.[15]

But similarity in orientation does not equal convergence in commitments, and we must be very careful not to conflate the historical epistemology of the French with the social theory of the Germans since, as Foucault will be the first to observe, "certainly distinctions exist." One important distinction is that German social thought accentuates, thanks to the enduring influence of Marx's reading of Hegel, a political rather than epistemological interpretation of reason in which reason's concept is defined by freedom rather truth.[16] For Marx, Weber and their later allies in Frankfurt, reason is actualized when individuals' social and political existence can be described as *freedom preserving* under a particular political regime. "Reason," in short, is a normative category that guides the study of society in the interest of attaining freedom. For Bachelard, Canguilhem and Foucault, however, this is not the case. What matters most for them in the determination of reason's concept is truth, and this means that reason is actualized when the cognitive process can be described as *truth-preserving* under a particular epistemic regime (Foucault will often speak of "regimes of truth"). True, the concept of reason has political and ethical ramifications. But reason is, first and foremost, an epistemological category that guides the study of forms of knowledge in the interest of safeguarding truth. In effect, it is from its epistemological power that reason also derives is social and political force.

A second distinction, which falls out of the first one, is that since the Germans are interested in the study of society, they treat all social forms as, in principle, equally relevant for the theory of rationality[17] and hold that the irrationality of a single element of the social totality negates the rationality of the whole and thus the actuality of reason itself. By contrast, the French (whose chief interest is the study of knowledge) privilege one specific social form, science, above the rest and declare that the actualization of reason depends not on the status of the social totality but merely on the status of the relevant social form. Those affiliated with the Frankfurt Institute for Social Research write about all kinds of social forms, from art and law to morality and science because, for them, the advent of reason requires the rational status of every part of the social whole.[18] By contrast, once again, those affiliated with the

tradition of French science at the Sorbonne write primarily about the sciences because they believe reason belong properly to a specific part of the social whole, i.e., the sciences. Thus, for the Germans reason actualizes itself as freedom via the right organization of the social totality, while for the French it actualizes itself as truth via the right organization of the sciences.[19] This shift from the whole to the part explains why historical epistemology is often described as a "philosophy of science," but never as a "social theory"—because its object is not the social realm in which individuals build and share a common world of collective action, but the space of scientific experience where truth is discursively forged.

Now, if historical epistemology rejects the totalizing tendencies and the concept of freedom that according to so many Hegel scholars form the soul of the idealist system, why insist on a neo- or proto-Hegelian interpretation of it? The neo-Hegelian cast of historical epistemology is worth preserving because it filters out from the Hegelian corpus a rather unique Hegel, a Hegel that is less subjective (and more scientific) than the Hegel of Wahl, Hyppolite and Kojève and less practical (and more theoretical) than the Hegel of Adorno, Horkheimer and Marcuse. This "other" Hegel, I argue, cares less about the formation or deformation of a mature subject or about the creation of an ethico-political community, and more about the elaboration and realization of truth in time. This Hegel cares about what in the "Preface" Hegel himself calls "the systematic development of truth in scientific form."[20]

With Hegel, historical epistemologists believe that "truth finds the medium of its existence in notions or concepts alone." Indeed, the French term "*concept*" that is the centering element of historical epistemology is the standard philosophical translation of the German "*Begriff*" that ground Hegel's work. From one perspective, Hegel's entire philosophy can be described as a meditation on the movement of "the Concept" [Gr. *Begriff*] in history, on that movement that "constitutes the nature of the scientific procedure in general."[21] It is not a stretch to say that, at its very core, French historical epistemology is a commentary on the way Hegel interprets the concept of the concept and a critique of the way he construes its movement. [22] Hence, if I insist on the Hegelian label this is because this label teaches us something about historical epistemology (and perhaps about Hegel too), and it creates an interesting trajectory that allows us to find in Hegel, as much as in Cavaillès, a theoretical and philosophical impetus that gets

exploited by Bachelard, Canguilhem and Foucault—an impetus that rests reason with the temporal unraveling of concepts and truth. But there is another reason to preserve this Hegelian mold. I would argue that only by looking at its Hegelian tones can we appreciate the sense in which historical epistemology itself represents not quite a "social theory," not quite a "theory of knowledge" and not quite a "theory of science," but something else altogether: a "theory of rationality."

A Theory of Rationality, The French Wager Revisited

Like so many continental philosophers, historical epistemologists presuppose a theory of rationality that they never make explicit. Their claim, originating in Comte, that knowledge can only be adequately understood if grasped in its historical development,[23] their claim that science has no object outside of its own activity[24] and their claim that a scientific domain has a special epistemic "dignity" that separates it from other domains (lived experience, common sense, etc.)[25]—all these claims point in the direction of a conception of rationality. But what is this conception? What is their take on rationality?

In my view, French historical epistemologists implicitly define rationality as a property of epistemologically aligned social forms, i.e., social forms that are both *knowledge-seeking* and *truth-oriented*. To be called "rational," a social form must embody a form of thinking that satisfies three desiderata:

1. *It must be more than Sense Certainty—it must have concepts.*
   In its pursuit of knowledge and truth, a social form or epistemic framework must go beyond the realm of information processing and phenomenological description (the "this is now" and "this is here" from the first stage of Hegel's *Phenomenology*). To do this, it must relate to the world actively and have at its disposal an arsenal of concepts that allow thinking to transcend the order of the given. As we learn from Kant, these concepts must regulate experience without being themselves given in experience. The first requirement for rational thought, as Marcuse points out in *Reason and Revolution*, is that thinking be "guided by conceptual knowledge."[26]

2. *It must be more than Understanding—it must allow concepts to change.*
   Conceptual content only lands thinking in a table of categories, and we do not want to call "rational" a thinking that mechanically applies rules to a manifold. As we learn from Johann Georg Harman's meta-critique of Kant's *Critique of Pure Reason*, it is not enough for thinking to have access to norms. Thinking must also be able to reflect on these norms and allow them to change in light of shifting circumstances. Schelling and

Pierce, too, worried that the eternal and static character of the Kantian table would render reason historically un-fit and maladapted to its object. Thus, to be rational thinking must be guided by conceptual knowledge at the same time as this conceptual knowledge is itself guided by the protean logic of its object.

3. *It must be more than Reflexivity—it must be able to give an account of conceptual change.*
   A dialectical relationship between concepts and world is a sign that a form of thinking, an epistemic form of life, is capable of reflecting upon its norms of judgment. This capacity begins the trajectory toward rationality. But it does not, by itself, complete it. To live up to the prospect of rationality, thinking must do more than recognize *that* its conceptual armature requires or undergoes change; it must also be capable, in principle, of giving an account of this change as rational. Even if this account if provided by a third party, it is critical that one give a reason that explains *why* reason itself has come to have the conceptual architecture it does.

These three requirements—normativity, historicity and accountability—give us a good sense of what it might mean for a social form to be considered "rational." To be rational, a social form must be capable of grasping itself as normative in the midst of its own evolution. I like the term "accountable" in particular because it brings to the fore two features of a rational form: (i) the fact that it is *accountable* to the logic of its object and (ii) the fact that it itself can be *accounted for* in an account (*logos*). A normatively equipped social form that is committed to the generation of knowledge and whose commitment to this generative process is guided by the concept of truth is considered "rational," then, if and only if this social form is accountable and accounted for in the two senses just described.

My thesis is that French historical epistemology treats science as rational under this definition. In Chapter 2 I have demonstrated that science is a social form outfitted with normative ammunition; in Chapter 3, that it alters its normative frame in light of new circumstances; and in Chapter 4 that we can give a reasoned account of the history of these alterations. This theory of rationality gives us an image of the sciences as normatively exacting practices that are oriented toward the production of truth, as practices that tie their own fate to the shepherding of truth. But if this is correct, we must take a moment to reflect on what "truth" might be in this context and what consequences it might have for how we think about the epistemological relevance of the philosophy of the concept.

Is There Truth in Reason?

In "The Folly of Trying to Define Truth," the American philosopher Donald Davidson points out that since *truth* (much like *cause*, *knowledge* and *the good*) is one of our most primitive concepts and the best way to approach it is by looking at the way in which it is mobilized in language rather than by trying to define it in terms of even more basic categories. "We must accept the fact that what makes these concepts so important must also foreclose on the possibility of finding a foundation for them which reaches deeper into bedrock."[27] Inspired by Davidson's cautionary warning, I would like to reflect on the concept of truth that crosscuts historical epistemology without pretending to define it. How is this concept, I wonder, mobilized in the writings of Bachelard, Canguilhem and Foucault? And how does the image of truth that is produced by this mobilization differ from other images of truth that repeatedly make their presence felt in epistemological controversies?

Pertinent to this question is the fact that historical epistemologists identify truth with discourse, especially scientific discourse. In "Science and Truth," for example, Étienne Balibar quotes a television interview from 1964 in which Alain Badiou asks Canguilhem whether he thinks the expression "scientific knowledge" is a pleonasm, to which Canguilhem replies:

> You have understood me perfectly. That is what I want to say. A knowledge that is not scientific is not a knowledge. I will maintain that 'true knowledge' is a pleonasm; 'scientific knowledge' as well; 'science and truth' as well; that all this is the same. That does not mean that for the human spirit there is no aim or no value outside truth, but it does mean that you cannot claim that to be knowledge which is no knowledge, that you cannot give that name to whatever way of living which has nothing to do with truth, that is with rigor.[28]

Three years later or so, in 1968, Canguilhem tells a group of students at the Sorbonne that his answer to Badiou's question in that television program remains a good description of his philosophical position. For him, science is the mainstay of truth.

> One day it seems I have scandalized all the students of philosophy that participated in a television emission. The students, and many of their professors, because I said this: there is no truth than scientific truth, there is no philosophical truth. I am perfectly willing to take here upon me what I have said elsewhere. But saying that there is no truth than scientific truth, or that there is no objectivity than scientific knowledge does not mean that philosophy has no object […] There is no philosophical object in the sense that there is a scientific object which is precisely the one that

> science constitutes theoretically and experimentally […] but then I mean not saying that there is no object of philosophy.[29]

In *Etudes,* Canguilhem points out that he is not the only, or the first, to interpret truth as an exclusively scientific trademark since Bachelard had already developed an entire philosophical empire built upon this very supposition. For Bachelard, scientific discourse is a veridical activity that captures truth at the same moment as it creates it. "By truthful," Canguilhem says, "Bachelard does not mean that scientific laws simply tell a truth permanently inscribed in objects or intellect. Truth is simply what science speaks."[30] Scientific discourse is the discourse of truth.

Meanwhile, Foucault is less scientistic in his assessment of truth. For example, in his last course at the Collège de France, posthumously published as *CT,* he departs from "the study of epistemological structures" that characterizes his early works, choosing to investigate instead non-scientific modes of "truth-telling" connected to the ancient practice of *parrhēsia*.[31] Even so, Foucault emphasizes that the concept of truth he activates in his writings on antiquity is inseparable from the concept of truth that structures his writings on scientific rationality.[32] Like these early archaeological texts, his late ethical writings deal with "those discourses [that] claim to be and are accepted as *true* discourse,"[33] even if the spectrum of these discourses has been enlarged to include the politically-ladened speech acts of *parrhēsiastes* such as Socrates and Diogenes of Sinope. Truth remains a discursive construct that is thrown into relief by systems of discursive practice that have a certain type of regularity to them and that can become objects of epistemological analysis. And at no point in his career does Foucault retract his original claim that scientific discourse is a critical platform for the articulation of *true* claims, even if his late works remind us that it is not the only one. Truth, at bottom, is essentially discursive. And, for that very reason, it is also terribly fragile.

If we limit ourselves to thinking about the implications of this conception of truth for epistemology and the philosophy of science, we realize that it stands in direct opposition to three dominant philosophical conceptions of truth. First, historical epistemology rejects the *methodological conception of truth* characteristic of reliabilist theories of science. Reliabilism describes the philosophical

position that the truth of a proposition, *P,* depends not on how it "fits" into a larger body of beliefs or how it "hooks" onto the world, but on the quality of the truth-seeking procedure or method by means of which *P* is attained. French epistemologists work against this conception of truth by denying that there is such a thing as a trans-historical, truth-producing scientific method; by denying, in other words, that there are universal norms of scientific methodology of the kind sought by Popper in *On The Logic of Scientific Discovery*[34] and Charles Sanders Pierce in "The Fixation of Belief" and "How to Make Our Ideas Clear."

Admittedly, Bachelard, Canguilhem and Foucault ardently deny the anarcho-epistemological thesis that in science, as Paul Feyerabend scandalously argues in *Against Method: Outline of an Anarchist Theory of Knowledge* (1975), "anything goes." But the scientific-epistemic norms they see as governing scientific praxis are always, and carefully so, described in epistemological rather than methodological terms. This is because they explicitly reject the idea that there exist methodological precepts that are logically or transcendentally presupposed by the structure of scientific inquiry itself. What often passes for *the* method of science is, at best, a fertile technique that corresponds to a particular historical thought-style or, at worst, an ill-fitting straightjacket imposed on science by a philosophy out of touch with scientific reality.[35]

Second, historical epistemology also rejects the *ontological conception of truth* embraced by correspondence models of epistemology. Because discourse is the only medium for ascertaining truth, it is impossible to imagine the sort of unmediated, discursively unaltered access to the truth conditions of empirical beliefs. According to the correspondence theory of truth, the truth of a proposition *P* depends on whether or not *P* accurately mirrors the world. As such, this theory necessitates the realist assumption that science has direct communication with objects have an extra-epistemological (i.e. ontological) existence, with objects that exist outside of any and all frames of reference. But historical epistemologists deny that science can mirror the world in this manner or commune with an unfiltered reality independently of the linguistic, cognitive and, of course, epistemological systems that make science itself a reality. As Jürgen Habermas writes in *Truth and Justification*,

> The reality facing our presuppositions is not "naked," but is itself already permeated by language. The experience against which we check our assumptions is linguistically structured and embedded in contexts of action. As soon as we reflect on the loss of naive certainties, we no longer face a set of basic propositions that are "self-legitimating." That is there are no indubitable "starting points" beyond the bounds of language, no experiences that can be taken for granted within the bounds of reason.[36]

All scientific experience is saturated by norms and background assumptions (some of which are discipline-specific, some of which pertain to all contexts of human action) that determine what counts as "real" and what counts as true relative to "the world." Our claims about the world are true not because they accurately "represent" or "reflect" a state of affairs but because, under the proviso of an epistemological framework or conceptual network, they resist efforts to invalidate them. A proposition *P* is true if and only if *P* can prove its epistemic resilience under well-defined domains of discourse that, as Foucault notes in "Truth and Power," are not themselves either true or false.[37] Truth is not an ontological but an intra-theoretical or, better yet, an intra-epistemic relation, i.e., a relation between the elements of a given conceptual network. If for Nietzsche truth is an army of metaphors, for Bachelard, Canguilhem and Foucault it takes the form an army of scientific-epistemic norms.

Third and finally, historical epistemology also rejects the *epistemological conception of truth* that anchors coherentist epistemologies in which truth is seen as coherence within some specified linguistic or epistemological frame of thought. One of the reasons, explored in Chapter 2, is that historical epistemology rejects the linguisticism that often accompanies coherence theories of truth. It negates the idea, illustrated in Quine's philosophy of language, that truth is merely a relation between propositions in a linguistic system. But historical epistemology rejects all epistemological conceptions of truth as coherence, independently of whether their success depend on the linguistic ascent of the Quinian philosophy or not. Coherence theories all fail because they treat truth as a purely synchronic relation between the elements of domain. They interpret truth as a synchronic relation, which overlooks the extent to which the truth of a scientific judgment, *S*, depends on how *S* fits into a constellation of judgments, beliefs, propositions, concepts, ideas, etc. that are contemporaneous with it but *also* on how *S* relates to its own past. For historical epistemologists, truth depends on two variables: (1) adequacy relative to a system

of knowledge and (2) rectificatory power relative to a determinate conceptual past. And of these, only (1) is properly synchronic. Coherence theories all too frequently turn a blind eye to the second of these conditions. Correspondence and methodological theories turn a blind eye to both. In the words of the Polish philosopher of science Ludwik Fleck, who presents these two principles in reverse order: "Truth is not a convention, *but rather (1) in historical perspective, an event in the history of thought, (2) in its contemporary context, stylized thought constraint*."[38]

A Hamartic Theory of Truth—On the Positivity of Error

The principal virtue of the concept of truth that sprouts from the writings of historical epistemologists is that it reassesses in a dramatic way the relationship between truth and error. Against Pierre Duhem's theory that all errors are deviations from the rational path of truth, Bachelard, Canguilhem and Foucault embrace a *harmatic theory of truth* (from the Greek ἁμαρτία, meaning "to err or to miss the mark") in which the dialectic of truth is inseparable from the dialectic of error, in which "error is no longer an accident on the road, but an essential, necessary and driving moment of knowledge."[39]

There are various ways to think about the relationship between error and truth. The easiest and most straightforward one is simply to note that a scientific truth is comprehensible *as a truth* only if it can be grasped as the correction and rectification of a previous historical mistake. Every Einstein has his Newton and his Galileo, and every Darwin his Aquinas and Cuvier. But we get a better angle on this dialectic of truth and error if instead of posing the relationship between truth and error as a temporal one ("Which past errors does this truth vanquish?") we pose it as an epistemological one ("How do we come to recognize that we are *in the true*?"). In taking this approach here, I will propose that we think of error in terms of "checking" and that we think of checking as our sole pathway toward the *recognition* of truth.

When we "check" something, we adopt a critical attitude that looks for possible mistakes either in the observance of a rule or the performance of a task. Often we check "for" specific types of mistakes such: run-on sentences, errors in mathematical calculation, coloring outside the line, etc. But at times we

check without knowing, ahead of time, what kinds of breaches, violations or infringements we are expecting. In those cases, we begin from a general sense of what is correct and identify as incorrect what deviates from it. In my view, when Bachelard, Canguilhem and Foucault claim that the logic of truth is unthinkable apart from the logic of error, what they mean is not that truth and error are somehow one (an preposterous claim) but that the logic of truth is unthinkable apart from the logic of *checking*.

In the twelfth and final chapter of *FSM,* "Scientific Objectivity and Psychoanalysis," Bachelard brings the objectivity of scientific truth claims to rest not on some magical Archimedean point that stands outside all frames of belief, but on a complex practice of subjective and inter-subjective *checking*. In the simplest of terms, Bachelard believes that the formation of the scientific mind demands two forms of checking: subjective and inter-subjective. In order for individuals to assume the subject position of the "scientist" and situate themselves *in the true*, they must learn to "check" their private tendencies toward error and learn to check and be checked by others. Only through this epistemic vigilance can their individuals acquire that all-important but elusive quality of being "true." Let us analyze the subjective and inter-subjective dimensions of the pragmatics of checking back to back.

On the subjective end of things, Bachelard claims that the first movement a subject makes towards an object is necessarily non-objective because the realm of "primary experience" is shot through with "pre-scientific concepts" and "subjective *a prioris*" (i.e. epistemological obstacles) that, if unrestrained, put thinking on a direct path to un-truth. Our primary experience of the world, the kind of experience we have when we move go about the everyday, is infested with conceptual traps that inhibit the advent of objective knowledge by making the *familiar* and *comfortable* appear *rational* and *necessary*.

> In our opinion, the following postulate must be accepted in epistemology: the object cannot be designated as an immediate 'objective'; in other words, movement towards an object is not initially objective. It must therefore be accepted that there is a very real *break* between sensory knowledge and scientific knowledge.[40]

Sensory knowledge is crammed with philosophical conclusions that we are often unaware of. When I see a tree falling on a house, I don't just see an event that in principle s open to scientific explanation. I see a

picture or an *image* replete with pre-scientific *value*: there is my bucolic attachment to the realism of its colors—the beautiful greens, the shades of red and purple; there is my commonsensical understandings of causality and my commitment to the independence of time from space. All these convictions sit unconsciously right beneath the surface of subjective experience as build-ups of common sense, human psychology and acculturation, and they represent subjective errors that often wreck the search for objective truth. These theoretical principles that seep into every capillary of my everyday experience, Bachelard says, are fortified by "*inward satisfaction* not *rational evidence.*"[41] But, of course, rational evidence will sometimes cut directly against the grain of my satisfaction. "At one go, the colour goes out of the world, our food is deodorized, and all our psychic natural momentum is broken, reversed, misunderstood and despondent."[42] And to remain, as scientists, *in the true* we must be flexible enough to be taken up by vectors of scientific abstraction that, often, take a stab at our most deeply-held convictions, at our most cherished possessions. We must be willing to, as it were, *let go of ourselves in order.* This act of letting-go of oneself is what Bachelard at one point calls "the de-psychologization of knowledge," at another "the will be rational" (*der Wille zur Vernunft*).[43]

Subjective experience (which includes any experience rooted in the standpoint that says "I," from the empiricism of Hume and Locke to the anti-empiricism of Bergson and Husserl) gives us at best only a "*first* approximation" of the object of knowledge. Yet, what we need to reach objective knowledge about an object is a "secondary approximation" that enacts "a very real break" from the fetters of subjective expectation, a break that occurs only when we keep our subjective errors in *check* with the aid of techniques, apparatuses and *dispositifs* of control that enable us to think outside and beyond ourselves. When we learn to *control* the object in ways that surpass the possibilities proffered by subjective experience (as happens in a laboratory), we *check* those epistemological obstacles that, like deadened appendages, stand in the way of the true.

> Generally speaking, control is understood as 'the checking, limiting (and) regulation of the constructive processes'. It is hard to find an equivalent French word for the English concept of *checking*, but it can be usefully linked to a similar sounding word in French, *échec*. *Échec* means failure, not checking, so how can we say they are linked? Failure is in fact a prerequisite of the

> checking of [subjective] stimulation. Were there no failure [in subjective experience], stimulation would be *pure value*. It would be thrilling and intoxicating and therefore a huge subjective success, which would make it the most unrectifiable of objective errors. Thus, those who have the impression that they *never* make mistakes are, in our view, always mistaken.[44]

The critical force of this passage might be lost on someone who views it simply as a summons to epistemology in the name of fallibilism. This passage goes beyond fallibilism in one important way. It suggests that all those scientific truths that can, of course, be revised in light of future of experience register as truths because they themselves are already revisions of the failures of subjective experience. "There is no objective process without consciousness of a first, inward error," such that every truth presupposes not only the vanquishing of an old scientific mistake, but also "a real confession of our intellectual sins."[45] On this theory, truth is three-dimensional figure that depends, as we saw in the previous section, on relations of coherence within a network of norms and on a rectification of past scientific beliefs, but also on the checking of the standpoint of the "I."

With this discussion of the importance of instrumentalization, Bachelard transitions to the inter-subjective dimension of his theory of objective truth. If we look at the truth-error dyad in terms of the activity of *checking*, we have no choice but to adopt an *inter-subjective notion of objectivity* in which objectivity depends "on other people's control." The argument that leads Bachelard in this direction is the claim that all technologies of control that enable the checking of private errors are at the same time technologies of "socialization" whose deployment can only occur against the background of social normativity. Checking is a skill we pick up from our social milieu and not a capacity we are naturally endowed with on account being human beings or rational agents. It is only by seeing how others check our errors and each other's errors that we learn to check our own errors and those of the people around us. Thus the practice of checking through which the categories of truth and error gain currency in scientific epistemology is social through and through. Bachelard writes,

> At the risk of being accused of going in a vicious circle, we propose that *objectivity* be based on the behavior of other people. Putting it another way so as to make our paradoxical turn of thought abundantly clear, we wish to choose other people's eyes—always the eyes of others—to the form—the well and truly abstract form—of the objective phenomenon: tell me what you see and

> I'll tell you what it is. Only by this rather circuitous and apparently nonsensical route can we be sure of having totally disregarded our first perceptions.[46]

For Bachelard, to speak *in the true* we must jettison the obstacles of subjective experience. And the way to do this is to learn to control objects according to objective norms of scientific control. Yet, we cannot know, in the privacy of our solitude, whether we have managed to circumvent the dangers of subjective prejudice. Thus, to find out whether we are indeed applied scientific norms of control *correctly* and thus elevated ourselves from "our intellectual sins," we must looks through the eyes of other people.

This argument from social normativity is complex because it presupposes, in a proto-Wittgensteinian fashion, that we cannot know whether someone is following a rule or not (in this case a scientific-epistemic norm) *unless* it is possible, in principle, for others to check our behavior and identify mishaps and misfortunes.[47] As Peter Winch argues in *The Idea of a Social Science and its Relation to Philosophy*: "A mistake is a contravention of what is established as correct; as such it must be *recognizable* as such a contravention […] For it is in contact with other individuals which alone makes possible the external *check* on one's actions."[48] Truth is a social condensation.

I call this entire theory of truth *hamartic* because the true is not simply the absence of the false. It is not that in committing intellectual sin, we "turn away" from the true. Rather, it is precisely by committing intellectual sin that we come to know the true and that we come to recognize it at the level of practice.[49] Scientists recognize the theory of evolution and the second law of thermodynamics as scientific truths because they are haunted from all angles by a constant process of checking. They check themselves and their private errors and also check their checking through the checking of others. And because of the ubiquity of checking, it is impossible to explain the dialectic of truth except through the dialectic of error. Here, truth is not an essential property that propositions have in virtue of mirroring nature (ontological). Truth is a momentary and ephemeral property judgments and propositions have in virtue of having proven their worth by overcoming their past and showing resilience in the face of multiple epistemic obstacles.

[1] Bachelard, NSS, 8-9
[2] Brenner, Anastasios. "Epistemology Historicized: The French Tradition." *New Directions in the Philosophy of Science*. Springer International Publishing, 2014. 727-736.
[3] Carnap, Rudolf. *Logical Foundations Of The Unity Of Science* (Cambridge, Mass: MIT Press, 1991).
[4] See "Appendix 1"
[5] Compare the historical epistemological conception of "discourse" discussed in Chapter 2 with the more limited understanding of language that comes out of Carnap's logic of science. Carnap makes this comparison easy by clarifying that the scope of the analytic philosophy of language can issue the logic of science only by limiting itself to the study of scientific "statements," which are construed in a narrow and unyielding manner. "We come to a theory of science in another, sense if we study not the actions of scientists but their results, namely, science as a body of ordered knowledge. Here, by 'results' we do not mean beliefs, images, etc., and the behavior influenced by them. That would lead us again to psychology of science. We mean by 'results' certain linguistic expressions, viz., the statements asserted by scientists. The task of the theory of science in this sense will be to analyze such statements, study their kinds and relations, and analyze terms as components of those statements and theories as ordered systems of those statements. A statement is a kind of sequence of spoken sounds, written marks, or the like, produced by human beings for specific purposes. But it is possible to abstract in an analysis of the statements of science from the persons asserting the statements and from the psychological and sociological conditions of such assertions. The analysis of the linguistic expressions of science under such an abstraction is logic of science" (Carnap, *Logical Foundations*, 393).
[6] Of momentous importance for the French reception of Hegel was the publication of a special issue of the *Revue de métaphysique et de morale* on the 100-year anniversary of Hegel's death. This issue included contributions by Nicolai Hartmann, Victor Basch, Martial Guéroult, Jean Wahl, Alexandre Koyré and seven pieces by Jean Hyppolite.
[7] Hegel, G.W.F. *Phenomenology of Spirit*, trans. A.V. Miller (Oxford University Press, 1997), 113-4
[8] Hegel, *Phenomenology,* 126
[9] Mudimbe, V. Y., and A. Bohm. "Hegel's Reception in France." *Bulletin de la Société Américaine de Philosophie de Langue Française* 6.3 (1994): 5-33. Still, we may recognize some differences internal to this grouping. In the "Preface" to Jean Hyppolite's *Logic and Existence*, Leonard Lawlor argues that Hyppolite moves French thinking away from the "anthropological" readings of Kojève and brings into the sphere of theoretical relevance the critical connection between phenomenology and logic. But this, as Lawlor grants, does not break away from the subjectivist reading of Hegel. It merely de-anthropologizes it and sets in motion an anti-humanist sentiment reminiscent of Heidegger's "Letter on Humanism" (See Lawlor, Lawlor. "Preface" In *Logic and Existence*, by Jean Hyppolite [New York: SUNY Press, 1997], viii-ix).
[10] Quoted in Mudimbe and Bohm. "Hegel's Reception in France," 9
[11] Marcuse, Herbert. *Reason and Revolution: Hegel and the Rise of Social Theory* (Humanity Books, 1999), 256
[12] Gadamer, Hans-Georg. *Reason in the Age of Science* (Cambridge, Mass.: MIt Press, 1982), 31.
[13] I take the idea of a "social form" from a man who would come to have a "French" destiny of his own thanks largely to the efforts of Pierre Hadot, who held the Chair of History in Greek and Roman Thought at the Collège de France from 1982 to 1991: Ludwig Wittgenstein. and I use it to denote human practices or games that are internally regimented and have a determinate *sense*. For an analysis of what Wittgenstein means by "form of life," see Hunter,

John FM. "Forms of Life in Wittgenstein's" Philosophical Investigations," *American Philosophical Quarterly* 5 (1968): 233-243.

[14] In 1947, for instance, Bachelard directs Althusser's *diplôme d'études supèrieures* "On Content in the Thought of G.W.F. Hegel," while the following year Canguilhem publishes an influential study on French Hegelianism in the illustrious *Revue d'histoire et de philosophie religieuses,* where he shows that the reception of Hegel's work in Europe occurred against a historical background of "conflicting nationalisms" that climaxed in the French-German war of 1870. (See Canguilhem, Georges. "Hegel en France," *Revue d'histoire et de philosophie religieuses* 27 [1948]: 284). For an analysis of Foucault's Hegelian tendencies, see Muldoon, James. "Foucault's Forgotten Hegelianism," *Parrhesia* 21 (2014): 102-12.

[15] "When I recognize all these merits of the Frankfurt School, I do so with the bad conscience of one who should have known them and studied them much earlier than was the case. Perhaps if had read those works earlier on, I would have saved useful time, surely: I wouldn't have needed to write some things and I would have avoided certain errors. At any rate, if I had encountered the Frankfurt School while young, I would have been seduced to the point of doing nothing else in life but the job of commenting on them. Instead, their influence on me remains retrospective, a contribution reached when I was no longer at the age of intellectual 'discoveries.' And I don't even know whether to be glad or to feel sorry about it" (Foucault, *RM*, 119-20).

[16] See "Appendix 1."

[17] This is especially evident in the writings of Frankfurt theorists, who write at length about the rationality (or lack thereof) of everything from law, technology and morality to the educational system, religion and political economy.

[18] Jay, Martin. *The Dialectical Imagination: A History Of The Frankfurt School And The Institute Of Social Research, 1923-1950* (University of California Press, 1996).

[19] Even when the object under consideration is one of those non-ideal sciences (at least when compared to mathematics and physics) such as psychiatry and medicine, the object remains a discourse with a discernably scientific frame, with what Foucault calls a "solid scientific armature." (Foucault, *PK*, 109)

[20] Hegel, *Phenomenology*, 3

[21] Hegel, *Phenomenology,* 3

[22] We can glean the effects of this commentary and this critique simply by looking at how these French philosophers appropriate Hegel's "concept" and give it a fundamentally new life. First, unlike Hegel, who speaks of the "*the* Concept" (*der Begriff*) in the singular, they emphasize the plural declension of the term. Second, they un-couple the epistemological and the metaphysical content of the concept of the concept and preserving only the former. In Hegel's system, the Concept appears as an epistemological principle that gives us an adequate notion of the whole, but also as a metaphysical meta-norm that siezes the necessary features of all possible existence (from the German *grifen*, "to seize"). In historical epistemology, concepts lose their metaphysical import and exist only as epistemic conditions for the production and expression of scientific knowledge. Finally, these figures re-locate or re-temporalize "concepts," moving them from their Hegelian abode in the realm of ideal time to the more concrete temporal realm of the history of the sciences. It is the history of the sciences rather than ideal world-history that, as it were, houses the concepts that make possible the elaboration of truth. With this, we arrive at a first approximation of the historical epistemological concept of "the concept"—*a concept is an epistemological principle that inheres in the history of scientific thought and regulates rational thought.*

[23] Dews, Peter. "Foucault and the French tradition of historical epistemology." *History of European Ideas* 14.3 (1992): 348

[24] Bachelard, *MR*, 41

[25] Canguilhem, *Etudes,* 19

[26] Marcuse, *Reason and Revolution*, 254

[27] Davidson, Donald. "The Folly Of Trying To Define Truth." *The Journal of Philosophy* 94 (1996): 263-278.

[28] Balibar, Etienne. ''Science et verite´ dans la philosophie de Georges Canguilhem.'' In *Georges Canguilhem, Philosophe, historien des sciences* (Paris: Albin Michel, 1993), 58.

[29] Rheinberger, H.J. "Reconsidering Canguilhem's Epistemology" In Gary Gutting's *Continental Philosophy Of Science* (John Wiley & Sons, 2008).

[30] Balibar, "Science et verite," 59

[31] In this work, there is little talk about the epistemological thresholds or the scientific-epistemic norms that characterize *OT* and *AK*. But there is a heightened awareness about the complex ways in which the subjects that constitute themselves as "tellers of truth" via "alethurgic" (truth-producing) acts are fundamentally transformed by these very acts,

[32] Foucault, *CT*, 344

[33] Foucault, *CT*, 2
[34] See Karl Popper's *On the Logic of Scientific Discovery* (London: Routledge, 2002)
[35] In "The Philosophy Of Science Of Georges Canguilhem: A Transatlantic View," Marjorie Greene shows that one of the reasons the historical epistemology of Canguilhem was so abhorrent to British and North-American ears is because it flat-out rejected what may very well be the foundation of all mid-twentieth century analytic philosophy of science—the idea "that there must be something called *the* scientific method, a single technique that was in essence the same everywhere and forever and this was what philosophers of science had reverentially to examine and analyze" (Greene, 50). In *Epistemology and Marxism*, Domonique Lecourt says: "One might say that if epistemology is the description of the general procedures, the methods and results of 'Science' or 'Reason in the Sciences', Canguilhem never produces any" (Lecourt, 166). In a similar spirit, Bachelard argues in *FSM* that not general, transferable, inter-scientific method can explain the formation of the scientific mind. On the one hand, the sciences of the twentieth century have become too specialized to share much procedural common ground. Each science has its own norms and although some of the elements and rules of these norms can "travel" from one discipline to another, there is nothing internal to the scientific project that requires that they remain the same across fields. On the other hand, each science is an adventure that requires constant risk-taking. Thus, even if a science had something like a stable core that we could call its "method," this method would be continually risked and, therefore, frequently lost. Because the history of a science bears witness to revolutions in even the most basic concepts of a discipline (including revolutions in what counts as explanatory adequacy), it is incoherent of a concrete scientific methodology as a logical or transcendental presupposition of scientific inquiry as such.
[36] Habermas, Jürgen. *Truth and justification* (John Wiley & Sons, 2014), 36
[37] Foucault, *PK,* 118
[38] Fleck, Ludwik. *Genesis And Development Of A Scientific Fact* (University of Chicago Press, 2012), 100
[39] Lecourt, *Marxism and Epistemology,* 55
[40] Bachelard, *FSM,* 237
[41] Bachelard, *FSM,* 238
[42] Bachelard, *FSM,* 239
[43] Bachelard, *FSM,* 244
[44] Bachelard, *FSM,* 238
[45] Bachelard, *FSM,* 240
[46] Bachelard, *FSM,* 238-9
[47] There is book to be written by somebody else about the relationship between historical epistemology's conception of truth and error and Wittgenstein's position on rule-following in the *Philosophical Investigations*. According to Wittgenstein, all rules are "comprehended" only by being internalized through practice, which means that there is a pragmatic normativity at the root of all rule-governed behavior. What is often forgotten about Wittgenstein's account, and what Peter Winch tries to emphasize in his reading of Wittgenstein in*,* is that we cannot determine whether a person is following a rule or not simply by looking at their behavior once or a few times. We must observe their behavior "over a matter of course" because only in this light is it possible for a third party to *discern,* in principle, the rule being observed.
[48] Winch, Peter. *The Idea of A Social Science and Its Relation to Philosophy* (London: Rutledge, 2008), 30.
[49] In "Can Knowledge Be Reached?" Arm Næss argues that there are two types of theories of truth a philosophical program can implement: *homifungal* and *homipetal.* The former make no reference to human life, human history or human action. The latter admit that truth depends on certain practical or praxis-driven achievements of humanity. Using this vernacular, we may say that historical epistemology embraces a *homipetal* (as well as *hamartic*) theory of truth in which the very use of the truth-predicate is itself a human achievement. Without human activity—in this case scientific labor, broadly understood—the concept of truth dissolves into non-sense since every truth is an *overcoming* (of the past) and an *authorization* (by the present). This fallibilistic but non-proceduralist theory of truth demands a *cautionary*, rather than *expectatory*, use of the truth-predicate since truth is not a regulative ideal toward which the cognitive process tends but a fragile human striving built in the forum of scientific discourse, a striving that expresses itself as a momentary, but absolute, suppression of error.

APPENDICES

APPENDIX 1
A CENTURY IN SIX FRAMES

This appendix supplements the analysis provided in Chapter 1 of French historical epistemology's *historical conditions of emergence* with a study of its *contemporaneous conditions of existence*. It situates this tradition it the general landscape of early twentieth century philosophical life so as to compare and contrast its reaction to the crisis of the nineteenth century with the reactions of some of its most recognizable contemporaries. My interest here lies not in thinking about the social or the political climate in which historical epistemology takes root, but in describing the philosophical climate in which it presents itself. My two questions are: What other philosophical discourses are being disseminated from 1940 to 1980? And how these they respond to the crisis of historical normativity that, in my reading, represents the primal scene of the twentieth century?

Frames One and Two - Neo-Kantianism and Phenomenology

Neo-Kantianism and classical phenomenology react to the disintegration of epistemology that occurs in the late nineteenth century by trying to recuperate the normative mission philosophy lost after 1831. Like Kant and Hegel, who are (along with Descartes) their most notable philosophical influences, neo-Kantians and phenomenologists believe that all human knowledge is subject to the constraining force of a normative, philosophical meta-language whose formulation depends on the transcendental-logical analyses of the philosophers. Neither lineage denies that science is a normative enterprise that operates according to legislative principles. What the adamantly negate is the idea that the research process itself may be capable of grounding the principles it operates with. Only the philosophers' vocal cords have the range needed to forge, frame and disseminate the principles that regulate the bounds of all possible scientificity. As such, at heart, neo-Kantianism and phenomenology are essentially *regressive* philosophies insofar as they assert that the only way to rehabilitate philosophy at the start of the twentieth century is by, as it were, returning it to its eighteenth and early-nineteenth century throne.

In the case of neo-Kantianism, this rehabilitation is achieved vis-à-vis a return to the critical philosophy Kant. Neo-Kantians—let us here use Cohen and Cassirer as representatives—reignite the normative posture of philosophy by directly, though not naïvely, importing some of the normative principles of epistemology that appear in Kant's *magnum opus* into the theoretical context of the twentieth century. Of course, the fault line separating the historical context in which Kant penned the *Critique of Pure Reason* and the context in which the neo-Kantian school develops renders impossible a full appropriation of Kant's normative principles, especially since the advance of the sciences after Kant has throttled many of these principles. Post-Newtonian physics, for instance, has oppugned the Kantian category of *substance*[i] and called into question the idea that *space* and *time* must be considered universally valid forms of intuition.[ii] The neo-Kantians from Marburg, I argue, resolve the tension between the Kantian project they cherish and the post-Kantian reality that stands as an obstacle to it by essentially cherry-picking elements from the Kantian project and incorporating into their respective systems of knowledge only those that do not infringe upon well-established scientific truths. In this process of selective appropriation, only portions of the "Transcendental Analytic" are preserved while the entire content of the "Transcendental Aesthetic" is axed. Still, what matters here from our perspective is the impetus of this selectivity: to re-live an old fantasy in which a sovereign philosophical subject can use a transcendental meta-language to rule scientific knowledge from without.

This impetus, I argue, is what moves classical phenomenology. Like Marburg neo-Kantians, Husserl hopes to replenish philosophy's normative stock by articulating a regulative meta-language, except that in his case this meta-language is achieved in the first few decades of the twentieth century by a different kind of "return"— a return not to the transcendental philosophy of Kant, but to the skeptical one of Descartes. Instead of appealing to ongoing relevance of certain logical categories inspired by Kant's epistemological work, Husserl appeals to the normative authority of those "pre-logical validities" that, in his view, ground scientific concepts and constitute their (sub-)propositional content. As early as *Ideas* and *Cartesian Meditations,* Husserl knew that the key to capturing these pre-logical or pre-thetic norms of experience and knowledge lies in the possibility of renovating pure theory and rescuing the

notion of the "non-deductively given" from psychology. In his view, there exist genuined norms of experience and cognition that science is answerable to and that can only be accesses by a philosophical agent, but these norms cannot be pinned down by the *deductive* methods of rationalist philosophy or by the *inductive* methods of the empirical sciences. These norms are only given as "non-empirical intuitions" vis-à-vis the *phenomenological* method. The latter allows the philosophical subject to transcendentally intuit the fundamental norms that "ground" all experience (including scientific experience) and make up that pre-scientific horizon that in his mature works Husserl calls "the lifeworld." For Husserl, as Habermas has shown in some of his writings about phenomenology, "scientific knowledge has its transcendental basis in the pre-scientific world."[iii] And this pre-scientific world is the most fundamental of epistemological categories because it houses, as it were, the pre-thetic and pre-logical norms that justify the objective worldview of the sciences.[iv] "The knowledge of the objective-scientific world," Husserl writes in the *Crisis,* "is 'grounded' in the self-evidence of the life-world."[v]

What unite the neo-Kantian and the phenomenological movements are not the details of their respective theories of scientific normativity, but their shared assumptions that (a) the grounding of scientific norms is the beginning and end of all respectable philosophy and (b) that this grounding operation can only be carried out from within the standpoint of a "philosophy of consciousness." Most affiliates of the Marburg school and most of Husserl's phenomenological descendants agree that the normative principles that scientific knowledge must necessarily presuppose are structures of subjectivity or features of consciousness. This *subjectivism*, I contend, is what causes the return to Kant and the return to Descartes of the twentieth century to leave unresolved the problem of the historical objectivity of scientific rationality that scandalizes thought at the end of the nineteenth century.

In "The Actuality of Philosophy," Theodor Adorno notes that Husserl's "reduction of concepts to the thinking subject"[vi] begets a dreadful, post-Kantian antinomy of subjectivity/objectivity that prevents phenomenology from making sense of objectivity, especially the objectivity of scientific judgment.[vii] For Husserl, objectivity is always subject-relative (i.e., subjectively-objective) and, therefore, not objective at all. By reducing all theoretical knowledge to the intentional, world-constituting and meaning-generating

acts of a transcendental ego and by locating the non-psychological validities that "ground" science in the egological realm of the mind's immanence to itself, Husserl collapses the objective under the subjective. In the phenomenological framework, science lives solely off of the fodder that transcendental subjectivity throws its way so that scientific normativity can only be conceived as secondary and derivative, as a reflection or refraction of something more fundamental than, and external to, itself. And since this fodder is conceived as *transcendental,* it is lies outside the empirical realm, meaning that it cannot be modified or altered by the empirical achievements of science. Science receives transcendental norms from philosophy such that its "progress" can only unfold within the bounds prescribed by these norms.

At the core of the phenomenological position, then, there an anti-scientific prejudice that presents science as a bad conscience that actively forgets its origins, represses them and flees from them. This anti-scientific prejudice, I argue, vitiates the rationality of science and the autonomy of its history. And it is so deeply engrained in the self-understanding of philosophy that its ugly head at every turn in Husserl's own development and in almost every major phenomenological development after him. It is there, for instance, in Merleau-Ponty's assertion that scientific rationality is an "abstraction"[viii] from lived experience and in Heidegger's now-famous and bloated allegation that "science cannot think."[ix]

This criticism applies to neo-Kantianism as well. Unlike Husserl, neo-Kantians reject the idea that the foundations of science are found in the historically saturated horizon of lived experience. But, like Husserl, the rely on a philosophy of consciousness that makes it impossible for them to recognize science as an autonomous enterprise. Their fidelity to Kant leads these figures to believe (i) that the complete spectrum of scientific knowledge is made possible by a set of categories rooted in the subject and (ii) that this set remains self-identical over time. Whether conceived as "a priori laws of the understanding" (Cohen) or as "symbols" (Cassirer), the norms that Marburg neo-Kantians invoke as the new foundations of scientific epistemology are posited as knowledge's eternal conditions of possibility. Like the pro-logical validities of Husserl, the logical validities of the neo-Kantians do not change. As Adorno points out,

> The Neo-Kantianism of the Marburg School, which labored most strenuously to gain the content of reality from logical categories, has indeed preserved its self-contained form as a system, but has thereby renounced every right over reality and has withdrawn into a formal region in which every determination of content is condemned to virtually the farthest point of an unending process.[x]

From Adorno's perspective the only "process" that determines our access to reality is the transcendental activity of the categories. The research process itself plays no role in this determination. At its best, the research process exemplifies the type of knowledge accredited by philosophy's meta-language. At its worst, it oversteps the boundaries of these norms and is rejected by philosophy as an un-grounded aberration.

Phenomenology abuses the immanent rationality of science by annulling its claim to self-normation and invalidating its history's claim to autonomy. Neo-Kantianism performs this abuse in the same fashion—by undermining scientific self-rule and leaving its history entirely outside the bounds of theoretical relevance. Both of them are theoretical frames that try to move thought beyond the impasse of the late nineteenth century but that, on account of their investment in the fantasy of philosophical dominance that begets the modern theory of knowledge from Descartes to Kant to Hegel, fail to understand historical rationality of science; that cannot make sense of the normativity of scientific judgment except vis-à-vis the lens of transcendental philosophy; and that cannot, and will not, accept the possibility that this normativity may be a function of science's own history.

Frame Three – Rudolf Carnap's Logical Positivism

A group of logicians from the University of Vienna respond to the crisis of scientific rationality that neo-Kantians and phenomenologists fail to resolve by taking a blowtorch to the platform on which these other figures stand: the philosophy of consciousness. Inspired by the philosophical writings of August Comte and Ernst Mach, rebuff the subjectivism of Kant and Hegel and dismiss as "absurd" (read: metaphysical) idea that reality is somehow "constituted" by a subject. In their view, our primary point of access into reality is not the ideal, world-building activity of a transcendental ego, but the concrete world-

disclosing reality of the research process.[xi] For the logical positivist, subjects vanish completely from the theoretical stage,

> The subjects who proceed according to these rules lose their significance. Their deeds and destinies belong at best to the psychology of the empirical persons to whom the subjects of knowledge have been reduced. The latter have no import for the immanent elucidation of the cognitive process. The obverse of this restriction is the development through which logic and mathematics become independent, self-sufficient formal sciences, so that henceforth the problems of their foundation are no longer discussed in connection with the problem of knowledge.[xii]

In this view, which takes itself to be the first and final step toward the de-idealization of philosophy, our knowledge about the world is held in place not by architecture of subjectivity but by the form and structure of the sciences themselves, linguistically understood "as systems of propositions and procedures."[xiii]

This anti-subjectivism has far-reaching consequences for the philosophy of science. To begin, it occasions the first major "break" from the theory of knowledge that dominates philosophical discourse in the eighteenth and nineteenth centuries. In sacking the figure of the subject from the realm of knowledge-generation and conceding the Second Enlightenment's teaching that science generates its own epistemic norms, logical positivism pays homage to the autochthonous objectivity of scientific reason and, in a clear departure from German idealism from Kant to Fichte, refuses to "reduce" the objectivity and normativity of the scientific establishment to something external to itself, such as the ideal forms of subjectivity or the pre-logical structures of lived experience. Indeed, if there is any reductionism at play in logical positivism, it works in the exact opposite direction of the neo-Kantian and phenomenological projects. In the latter, the theoretical findings produced by the scientific process are reduced to the activity of a transcendental subject, whose cognitive apparatus generates (through the dynamism of its rules and synthetic functions) all possible objects of scientific knowledge. In the former, to the contrary, it is the transcendental subject that gets "reduced"—reduced, that is, to its empirical correlate and then dismissed from considerations of the genesis of knowledge. The transcendental subject is reborn in the positivist frame as a merely empirical being that holds theoretical significance for sociology or psychology but not

for the philosophy of science. With this de-subjectification of philosophy, positivism transforms epistemology from a *theory of knowledge* to a *theory of science*.

A second consequence of the rise of logical positivism is that its anti-metaphysical orientation alters the meaning and function of philosophy. It re-writes the philosopher's job description. Recall that the reason phenomenologists and neo-Kantians relegate science to a subordinate role and hail subjectivity as science's transcendental condition of possibility is because they believe that the epistemological coronation of the subject enables philosophy's return to the throne. If science cannot underwrite its own normative frame but requires philosophy to preform this foundational task, then philosophy can be reinstated as the queen of the sciences; as "the science of science" (Husserl), "the highest form of culture" (Cassirer), "the logic of pure knowledge" (Cohen). But when ideal subjectivity is expunged from the picture and science is recognized as an independent and self-sufficient undertaking that is not grounded by anything other than itself, philosophical discourse no longer has the right to design the logic of science. It only has the capacity to analyze it.

Under the neo-positivism of thinkers such as Rudolf Carnap, philosophy is not only *not* restored to its aristocratic position but its also subjected to the greatest of humiliations: its own resources (especially logic) are put to work to ensure that philosophy itself remains precisely where the long century left it, at the rank of what John Locke calls an "underlaborer." In *The Idea of A Social Science and Its Relation to Philosophy* (1958), Peter Winch defines this "underlaborer conception" of philosophy as follows:

> Philosophy cannot contribute any positive understanding of the world on its own account; it has the purely negative role of removing impediments to the advance of our understanding. The motive force for that advance must be sought in methods quite different from anything to be found in philosophy; it must be found, that is, in science.[xiv]

What philosophy can contribute to the study of knowledge is not a transcendental set of skills that rule create norms, but a method for "eliminating linguistic confusions" and "removing contradictions" from the self-founding realm of scientific discourse.[xv] Philosophy becomes a negative activity.

Its refusal to capitulate to philosophical fantasies of governance separate logical positivism from many of its contemporaries and give it an aura of progressivism that, in my reading, explains its sociological dominance in the twentieth century, especially in Austria, North America and Great Britain. Surely, an advance is made by this philosophy—which is anything is a return to Comte rather than Kant or Descartes—that is foreclosed to other philosophical traditions. Logical philosophers like Carnap and Popper take seriously the idea that science is a social form that issues forth its own conditions of validity and its own standards of corroboration, and that the relations scientific ideas enter into within a scientific domain are not the relations these ideas enter into inside the mind of the subjects who entertain them.

Yet, the value of this advance in the direction of an objectivist theory of science is tampered by a regression into a-historicism. While logical positivism is the first twentieth century philosophical movement to respect the originality of scientific rationality, it makes the dreadful mistake of filtering this rationality through the sieve of an anti-historicist formalism that extricates any trace of time from the logic of science. Like the categories of the Kantian architectonic, the rational principles that regulate scientific language and scientific procedure—Carnap's "syntactical rules" and Popper's "rules of method," for example—are conceived as unchanging features of science's logic that are wholly alien to the mutilating force of time. Thus, logical positivism stumbles as much as phenomenology and neo-Kantianism stagger, but for different reasons. In the former, it is the history of science rather than its normativity that suffers from an objectionable philosophical *coup de force*. A good example of how history is surrendered in neo-positivism is the logical philosophy of Rudolf Carnap.

In the "Foreword" to *The Logical Syntax of Language* (1937), Carnap states:

> In our "Vienna Circle", as well as in kindred groups (in Poland, France, England, U.S.A., and, amongst individuals, even in Germany), the conviction has grown, and is steadily increasing, that metaphysics can make no claim to possessing a scientific character. That part of the work of philosophers which may be held to be scientific in nature—excluding the empirical questions which can be referred to empirical science—consists of logical analysis. The aim of logical syntax is to provide a system of concepts, a language, by the help of which the results of logical analysis will be exactly formulable. *Philosophy is to be replaced by the logic of science*—that is to say, by the logical analysis of the concepts and sentences of the sciences, for *the logic of science is nothing other than the logical syntax of the language of science*. That is the conclusion to which we are led by the considerations in the last chapter of this book.[xvi]

Glock (2008) explains that Carnap wants "a logico-linguistic analysis of those propositions which alone are strictly speaking meaningful, namely those of science."[xvii] Influenced by the logicism of Frege and the formalism of Hilbert, Carnap applies the tools of logic and the philosophy of language to the truth-functional expressions that make up the first-order discourse of the sciences in the hope of extracting the "logic" of these expressions and engraving it in a second-order meta-language. He performs this extraction via an exercise in reductionism that has become the chisel stamp of logical positivism—he reduces all these sentences that to indubitable propositions about what is given in experience as immediate sense data (the infamous "protocol sentences") and unleashes the tools of logical analysis on these propositions.[xviii]

In the *Logic of Scientific Discovery* (1934), Karl Popper argues, however, that this effort to justify science via the formalization (or, to use Carnap's own term, "rational reconstruction") of its "language" is sabotaged by its abstract and anti-historicist alignment. On the one hand, Carnap is too much of a Hegelian, not on account of any idealism (which he rejects) but on account of his unificatory and totalizing view of science. Perhaps blinded by Comte's original vision of science as a unifiable totality, Carnap treats science as One. Granted, in the anti-metaphysical philosophy of the logical syntax, this unity is not rooted in a transcendental table of categories, in a dialectical teleology of ideal history or even in a set of subject-relative symbolic functions. Nonetheless there is a sense of unity in the constancy of what Carnap calls "*the* language of science."

But Popper points out that the history of science, especially in the late nineteenth cenuty, proves this unity and this constancy to be figments of philosophy's imagination. By the time Carnap proclaims the replacement of transcendental philosophy by the logic of science, the balkanization of scientific reason and the dis-unification of knowledge are irrefutable facts of history. By 1937, it is hard to deny that different scientific disciplines employ different, and often clashing, styles of expression that are independent of one another. And there is no reason, other than wish fulfillment perhaps, to expect all these styles of reasoning to congregate in the space of a meta-language or converge at the level of a

universal grammar. There is no such thing as "the language of science." There are only regional scientific dialects. And it follows from this that Carnap's technique of logical analysis is ill fated from the start because it stakes its claims on a non-existent object. Since there is no language of science *as such*, there can be no syntax that manifests the "logic" of this language. This is Popper's first line of attack.

His second line of attack comes from his assertion that there is a profound historical panic at the heart of Carnap's philosophy. Carnap assumes that the only thing the philosopher has to do to justify science is apply the tools of logical analysis to the sciences *of today*. Thus, Carnap treats the history of science as something that has run out of steam, as something that has found in the language *of present science* its final resolution. This presentism overlooks the possibility that the history of science might have a role to play in its justification or the possibility that the language of science might constantly un-do itself via revolutions and upsets. So, even if one were to assume that there is such a thing as "*the* language of science" and that this language holds the key to understanding the rationality of the scientific project, it would still be unclear whether this language would be static or stable enough to exhibit an unchanging linguistic core or display a logical syntax. At best, I argue, this language would have a "historical sense" that evolves with time, and it would be the job of the philosopher to become to trace the genealogy of this sense. But this is not something Carnap is prepared to accept.

In the "Introduction" to *The Logic of Scientific Discovery,* Popper attributes the anti-historicism of Carnap and his followers (whom he refers to as "goats") to their being blinkered by the lure of classical logic. Logic promises to raise philosophical discourse above the rambling conjectures of nineteenth century metaphysical speculation and bring about, as the title of a 1932 article published by Carnap in the journal *Erkenntniss* indicates, "the elimination of metaphysics through [the] logical analysis of language." But, in a strategy reminiscent of Hegel's critique of Kant, Popper asserts that the apparatus of classical logic carries with it a danger—the danger of leading philosophy down a hyper-abstarct and formalistic path that takes it farther and farther away from the actuality of science. Indeed, the lure of this apparatus causes the descendants of Comte and Mach to hurl themselves headfirst into a vast sea of logical symbols and logical contraptions whose connection with real science is anything but clear, to lose themselves in a

"vast system of minute gadgets"[xix] that allows thinking to compartmentalize and pigeonhole scientific discourse but not to understand and elucidate the inner life that animates this discourse.

The positivists are so overwrought by their attraction to the logical method and the desouled effigy of science this method engenders that they lapse into a neo-Kantian denial of history and "miss the most exciting problems of the theory of knowledge—those connected with its *advancement*."[xx] Popper writes,

> Language analysts regard themselves as practitioners of a method peculiar to philosophy. I think they are wrong, for I believe the following thesis. Philosophers are as free as others to use any method in searching for truth. *There is not method peculiar for philosophy.* A second thesis which I should like to propound here is this. The central problem of epistemology has always been and still is the problem of the growth of knowledge. And the growth of knowledge can be studied best by studying the growth of scientific knowledge. I do not think that the study of the growth of knowledge can be replaced by the study of linguistic uses, or of linguistic systems.[xxi]

Thus, whereas Carnap makes a definite advance over the phenomenological and neo-Kantian projects by recognizing the need for an anti-subjectivist theory of science, Popper makes an advance over Carnap by observing that the theory of science cannot validate itself as epistemology if it cannot explain the advancement and growth of science, if it cannot explain how science slips in and out of frame at different historical times.[xxii] Because the raw force of history has shown science to grow and change, the theory of science must surrender its personality as a theory of scientific language and morph instead a theory of scientific change. This surrender requires a fundamental disturbance of the very meaning of epistemology.

Frame Four – Karl Popper's Logic of Discovery

What allows Popper to take a decisive step over the caprine philosophy is that he shifts the vernacular of philosophical reason from syntax to method, from the logic of "scientific language" to the logic of "scientific discovery." According to him, it is the reliability of the scientific method rather than, say, the tenacity of its syntax that captures the logic of science. Hence, if the philosopher wants retain a

modicum of relevance in the age of science, she must at once abort her infatuation with the logical grammar and re-channel her energies to the study of the scientific method. She must, in other words, transpose the foundations of epistemology from the syntactical "formation rules"[xxiii] that regulate scientific expressions to the methodological "rules of procedure"[xxiv] that nourish scientific discovery. "In accordance with my proposal," Popper writes in Chapter Two, "epistemology, or the logic of scientific discovery, should be identified with the theory of scientific method."[xxv]

Unfortunately, Popper cannot shed the skin of his positivist upbringing and repeats, perhaps in a subtler manner, Carnap's flagrant error. His ostensibly historical criticism of Carnap's philosophy is sanctimonious. He accuses Carnap of projecting onto theory an idealized image of science that is incongruous with the reality of scientific history. The history of science tells us that science is not a monolith; that everything in it is, in principle, susceptible to falsification and subject to change. "The game of science is, in principle, without end," he says.[xxvi] Yet, the only kind of change Popper consents to in this game is incremental, never revolutionary, change. For him, scientific change occurs only when theoretical claims about the world are conclusively falsified by the empirical method and are replaced by other theoretical claims that, having been tested and corroborated by the appropriate scientific procedures, "have proved their mettle."[xxvii] Change, therefore, is always constant, aggregative and piecemeal.

But this is also at odds with the lessons of scientific history. The history of the nineteenth century attests to the fact of scientific change, but it also to the fact that this change often happens in sudden bursts of revolutionary violence that disturb the complete anatomy of a scientific domain. In these moments of crisis, which Thomas Kuhn has described perhaps better than anyone else, it is not specific theories that are "falsified" and removed from the lexicon of science. It is the whole infrastructure of scientific epistemology that is thrown into a state of conceptual disarray and deracinated from the inside out. Why does Popper simply rule out this kind of change by philosophical fiat? Why does remain unyielding in his belief that the history of science is a constant and linear progression that never turns back upon itself?

In an article published in the *Parisian Review* in 1959 with the title "Karl Popper and the Problem of Historical Laws," Herbert Marcuse attributes this "opposition to history"[xxviii] to Popper's political philosophy. In his more explicitly political works, such as *The Poverty of Historicism* (1957), Popper opposes all forms of revolutionary change, defending instead a liberal framework of political action in which all change is by nature merely reform. *The Logic of Scientific Discovery* is the child of a political theory turned epistemological, a theory that gives itself the responsibility of muting the sounds of revolutionary change that loom in the historical horizon. It is not Carnap's anti-historicism, Marcuse concludes, but radical historicity that is "Popper's real *bête noir*." And why should we be shocked that Popper's theory of science is founded upon the thesis of the linearity of all change? What else should we expect from a reactionary that finds gratification (in the Freudian sense of the term) in the preservation of authority? Politically, Marcuse says, the road "from Luther to Popper" is not as long as one may think. And, epistemologically, it may even be shorter than that.

But Popper, now going beyond Marcuse's reading, apes the mistakes of his teacher in another way. He casts off the abstract formalism of language only to clear space for the formalism of procedure, thus voicing a new reductionist program in the theory of science. If Marburg neo-Kantians reduce science to subjective categories and phenomenologists to the structures of lived experience, Popper reduces it to the structure of its method, to "[the] logical skeleton of the procedure of testing."[xxix] While his theory is not "foundationalist" in the classical sense of being specified *a priori*, the rules of procedure of the falsificationist doctrine are pure form without content. They do not tell scientists what to believe or what to value; they merely tell them how to act and behave so as to not "remove themselves from the game." As such, they are purely external rubrics that do not capture the rich, inner life of scientific reason. This proceduralism, I am convinced, only deepens the anti-historicism of his progressivist narrative.

In *A Nice Derangement of Epistemes: Post-Positivism in the Study of Science from Quine to Latour,* John Zammito explains that Popper's proceduralism disfigures the rationality of scientific discourse by dissolving the logic scientific discovery into a mechanical rule-following activity. Popper gives birth to new set of terms in the theory of science that underscore the need to abandon

foundationalist approaches to justification and infallible conceptions of knowledge. But, because it cannot break free from its own fetishization of procedure and form, it cannot "uphold rationality in those terms."[xxx] In the same way that Kant, in Hegel's view, neglects the spiritual dimension of ethical life (*sittlichkeit*) by collapsing the moral universe to the imperative of a categorical rule, so too Popper maims scientific reason by diluting the spiritual life of scientific investigation with the squandered skeleton of its methodology. Science is not, as Popper's thought might lead one to believe, an abstraction with *in*determinate content, a Hegelian "positivity" that resides in the element of "untruth." In effect, the opposite is the case. Science is a rational dynamism replete with normative content; it is an impulse animated by something more powerful, more meaningful and more substantive than the crude compulsion of external rules of procedure. The difficulty, of course, lies in articulating what this "something" might be.

Frame Five – Frankfurt Critical Theory

An unflinching critique of the type of content-less rationality that seeps into every capillary of the Popperian philosophy appears in Europe in the 1930s and '40s in German critical theory. Stimulated, above all, by Hegel's petition that reason be substantive rather than merely formal, critical theorists such as Theodor Ardorno, Max Horkheimer, Erich Fromm and Herbert Marcuse, along with other figures allied with the Institute for Social Research, want to bring human life under the authority of a more robust concept of rationality that can go beyond empty formalists and underwrite determinate content.

In an essay entitled "Bisected Rationality: The Frankfurt School's Critique of Science," Axel Honneth argues that critical theorists are aware (i) that "the unifying link that had still held both branches of knowledge [science and philosophy] together during the nineteenth century in the wake of Hegel, was torn asunder with the decline of idealist philosophy"[xxxi] and (ii) that this sundering resulted in science (guided by the empirical method) losing contact with the power of reflection and in philosophy (guided by the speculative method) losing contact with the material world. They know perfectly well, in other words, the legacy of the long century; they know that the crisis in the theory of knowledge and the crisis

of positivism introduced a split between a research process bereft of self-understanding and incapable of self-critique (science) and a philosophical spirit suspended in the ether of transcendental contemplation, disconnected from the real world (epistemology).

Unfortunately, Honneth states, because "they were taking their bearings from the Young Marx," critical theorists try to repair the old bond between theoretical and reflective reason at the level of practical reason. For them, it is social theory and social praxis rather than the theory of science that provides philosophy with the resources to grapple with the primal science of nineteenth cenutry and regain a concept of rationality more substantive that the one proffered by positivist thought. Because of the influence of Hegel, they reject formalistic theories of rationality. But because of the influence of Marx, they end up embracing a primarily *political* rather than *epistemological* conception of rationality in which *freedom* rather than *truth* determines the content of reason's concept. According to Marcuse, for example, the materialist content of critical theory sees "the interest of freedom" (emancipation) rather than "the will to truth" (knowledge) as "the foundation of the philosophy of reason."[xxxii]

In my reading, this Marxist interest causes Horkheimer, Adorno and Marcuse to take two theoretical turns, one constructive and one destructive. Constructively, they take a turn in the direction of a more critical stance than their predecessors toward the increasing irrationality of Europe and toward the increasingly procedural and mechanical character of life under capital. For them, it is the dystonic logic of alienation that permeates even the most seemingly innocuous aspects of contemporary existence that presents an obstacle to the realization or actualization of rationality in human affairs.[xxxiii] Destructively, they take a turn to social theory and *away* from the theory of science. This turn is most evident in these thinker's contention that the meta-epistemological concept of "justification" must be commandeered exclusively by social and political theory rather than by epistemology. Within the jurisdiction of Frankfurt-style theory, social forms (science included) can be legitimated only if they help deliver the species from alienation to freedom, rather than from error to truth. Social practices and institutions can be justified only on political grounds, i.e., based on the material objectivity of the interests they serve within the social totality and based on the extent to which they contribute to the rational organization of human

relations, which are construed as irreducibly historical in nature. Here, as Marcuse concedes in "The Concept of Essence," there is no room for an "epistemological validation"[xxxiv] of social practices and social forms. There is only room for a materialist validation of them. This is why Honneth is very careful in his choice of words and speaks of critical theory not as a *theory of knowledge* or as a *theory of science* but as an *anthropology of knowledge*—because its conceptual framework bars the possibility of science being justified on epistemic grounds.

Even though critical theory is originally born as a social scientific investigation of the relationship between society and personality, it takes an extreme anti-epistemological turn over time that peaks in the assertion the validity of science is a function of its social and political effects. In this anthropological theory of knowledge, "the conditions of validity of scientific knowledge" and its "objectification of reality" are treated as extension of social interest, as elements that (like all other elements of the social totality) "are determined by the requirements of labor."[xxxv] That labor is a determinant *in the last instance*, as Althusser would say, explains why critical theorists often dismiss scientific knowledge as manifestations of bourgeois ideology and as the expression of an instrumental and technical rationality that reifies inter-subjective relations and decimates the natural world—because they cannot admit the possibility that internal machinations of the scientific process might exist, as Honneth puts it, "independently of all connection to [labor]."[xxxvi]

It is here that we discover the truth of Frankfurt critical theory as a special case of reductionist philosophy, as a philosophy that reduces scientific rationality to the means-end rationality of capital. It is hard to extract a theory of science from this social theory in which science figures as anything other than a carbon copy of the interests of the ruling class, as a palimpsest of the dominant ideology. In *Negations*, for instance, Marcuse claims that present science is the culmination of antagonisms inherent to the capitalist processes of production and that, as a social form, science is comparable to the most egregious pathologies of capital—including the military, protestant morality and the marketplace.[xxxvii] This argument is repeated in *One Dimensional Man* (1964), where Marcuse imputes the flattening of sensibility and sexuality under capital to the type of rationality that, in his view, is "justified" and

"exemplified" by the discourses of the sciences. In similar fashion, Adorno and Horkheimer argue in *Dialectic of Enlightenment* (1944) that the scientific attempt to categorize and capture nature's manifold in a conceptual net essentially *is* that cunning of reason that produces the scleroses of capital and gives autonomy meaning only as domination. For them, the link between capitalism and science is genetic—both are the natural outcomes of a drive to subsume the manifold of sensibility under concepts so as to render this manifold fit for human control. Adorno is particularly persistent on this point. Even though he grants that the sciences have moved well beyond the naïve naturalism and empiricism of the nineteenth century and even though he admits that in many cases they have also successfully "annexed the contents of cognitive criticism," [xxxviii] he insists that their "rationality" is the climactic achievement of Enlightenment's regressive ideology. Thus, he concludes that epistemology will remain immersed in the element of "untruth" as long as it champions any measure of "scientificity," either as an object to be studied or as a goal to be achieved.[xxxix]

This reductionist vulgarization changes with the rationalist social theory of Habermas, but only slightly**.** At its worst, Habermasian social theory mimics the anti-scientistic prejudice of first-generation critical theory by negating the rational content of science altogether on the grounds that science has become an ideological frame of legitimation, a sort of Weberian "rationalization" that perpetuates the depoliticization of public space and abolishes the all-important distinction between *the practical* and *the technical*. Taking his lead from Marcuse's analysis of the political content of the concept of technology in *One Dimensional Man* (1964), the early Habermas worries that science exhibits a purely strategic form of rationality that arrests thinking at the level of "purposive-rational activity" (i.e. activity that is rational relative to means-ends relations) and prevents it from elevating itself into the realm of "substantive practical activity" (i.e. activity that reflects on ends). In *Toward a Rational Society: Student Protest, Science and Politics* (1968), he continues this worry and, conflating scientific and technological reason, depicts scientific reason as that can spread throughout social life and, like a virus, decimate its host. "The reified models of the sciences migrate into the sociocultural life-world and gain objective power over the

latter's self understanding," he writes.[xl] When seen in this light, little can be said of Habermas's interpretation of science that has not already been said of his predecessors'.

But at its best, Habermas leaves behind the neo-Marxist interpretation of science that permeates the works of his colleagues from Frankfurt and, in what amounts to an in-house "great refusal," rejects Adorno, Marcuse and Horkheimer's materialist interpretation of scientific reason. Building on the thought of Otto Apel, he holds that "the spectrum of scientific rationality is not exhausted by the single dimension of the instrumental interests involved in knowledge."[xli] The rationality of science, instead, is a function of its status as *discourse*, i.e., as a specialized form of communicative action. When scientists engage in the activities that define their professional lives—i.e., when they carry out research, when they undergo specialized forms of training, when they concoct experiments and run tests to determine the viability of theoretical conjectures, when they attend conferences and prepare articles for publications, etc.—they become fellow members of a linguistic community that, like all communities, is defined by an internal point of view. And this internal point of view comprises the soul of scientific action.

Whereas Popper's theory of science limits itself to taking an external point of view of scientific normativity (in which all that matters is that scientists abide by the rules of procedure laid out before them by tradition), in the internal point of view theory of Habermas (which I take he borrows from the legal philosophy of HLA Hart) what matters is not simply that members comport themselves according to scientific norms and principles, but also that they accept the rules they encounter as *legitimate* codes of conduct and thought. When scientists "do science," they are engaging in a style of inquiry and in a form of symbolic interaction that goes beyond surreptitious means-ends rationalization. Science—"that most intensive rationality,"[xlii] he says—is a full exercise in intersubjective communication endowed with more than a cunning rationality. Its rationality is the upshot of its commitment to the Enlightenment ideals that, according to Habermas, personify the "pragmatic-transcendental" foundations communicative action itself: (i) consensus building (ii) rational argumentation and (iii) communication untrammeled by domination. Thus, when understood as a social-discursive practice, science can no more be condensed

into the pauperism of a "logicist" reading (a la Carnap) than it can be blown up under influence of a reductive political determinism (a la Marx).

The value of this communicative interpretation of science (which must not be confused with the linguistic interpretation of science popularized by the neo-positivists in which science is seen as a cluster of propositions that have been deemed cognitively meaningful under verificationist or falsificationist theories of meaning) is that it highlights the irreducibly social nature of scientific inquiry and makes explicit the proto-transcendental presuppositions of its discourse. But the problem with it is that while it acknowledges the rational content of the scientific process, it cannot accept the specificity of this content. Habermas's philosophy views the rationality of science not a something peculiar or particular to the scientific worldview but as a manifestation of a much more general phenomenon—the phenomenon of rational communicative action. As Barbara Fultner argues in her "Introduction" to the 2003 edition of Habermas's *Truth and Justification*, "the theory of communicative action situates the roots of rationality in the structures of everyday communication and regards the critical power of reason to be immanent in ordinary language."[xliii]

Still hypnotized by the powerful spell of German Idealism, Habermas posits a "subterranean unity of theoretical and practical reason"[xliv] at the level of communicative action and suggests that all exercises in inter-subjective communication—be they moral, political or scientific—are "rational" only to the degree that they live up to the same standard: the standard set by the pragmatic-transcendental foundations of rational argumentation itself. Discourse is rational if only if it adheres to "the principle of public discourse," that is, the requirement that it be ruled by the regulative ideal of a medium divested of relations of domination. Fully articulated in *Theory of Communicative Action* (1981) and reiterated in *Justification and Application* (1991), this principle is first introduced in *Toward a Rational Society: Student Protest, Science and Politics* (1968), where Habermas writes:

> Of course it makes a difference whether we are discussing standards that, as in science, establish the framework for descriptive statements or standards that are rules of communicative action. But both are cases of the rationalization of a choice in the medium of unconstrained discussion. In very rare cases practical questions are decided in this

> rational form. But there is one form of political decision-making according to which all decisions are supposed to be made equally dependent on a consensus arrived at in discussion free from domination—the democratic form. Here the principle of public discourse is supposed to eliminate all force other than that of the better argument, and majority decisions are held to be only a substitute for the uncompelled consensus that would finally result if discussion did not always have to be broken off owing to the need for a decision. This principle that—expressed in the Kantian manner—only reason should have force, links the democratic form of political decision-making [*Willensbildung*] with the type of discussion to which the sciences owe their progress.[xlv]

Notice that although Habermas specifies that it "makes a difference" whether one is talking about political or scientific discourse, this specification hits a flat note as soon as it is expressed since this difference ultimately belies a clandestine unity between scientific and non-scientific styles of rationality. The principle that ensures "progress" in the sphere of practical action is the same principle that ensures the success of the purposive-rational activity of science. It is to this principle, as Habermas himself puts it, "to which the sciences owe their progress."

This "postempiricist philosophy of science"[xlvi] yields two unsavory consequences for the theory of scientific rationality. First, if Habermas is correct in thinking that the rationality of science is the effect of its communicative encasement, we are left in a situation similar to the one we found ourselves in under the Popperian theory of science, that is, in a situation in which scientific rationality, being purely formal, lacks determinate content. The rules of discourse that Habermas outlines (and which he implicitly opposes to Popper's rules of method) enumerate the minimal conditions for the *understandability* and *acceptability* of scientific statements. These rules, however, cannot ensure that the pronouncements of the scientist are "rational" in any substantive sense of the term. They find their utmost limit at the level of *linguistic validity*, which forsakes the problem of truth.

Second, this view paradoxically turns out to be the obverse side of Carnapian neo-positivism. We have seen that, for Carnap, scientific discourse is the only social enterprise capable of underwriting cognitive content. To speak of the rationality of art or the rationality of morality, for Carnap, amounts to a category mistake. These forms of non- or extra-scientific discourse might carry emotive, aesthetic or practical significance for cultural life and human flourishing, but they do not carry the type of cognitive

content that matters for the theory of rationality. With Habermas, this is no longer the case. Science is divested of its special epistemic status and equated, epistemologically, with non-science. There is no rationality proper to science, no "science of science." There is only a universal, form of rationality that "appears" in scientific, ethical, political and even aesthetic discourse. While for Carnap rationality is embedded in scientific activity, for Habermas scientific activity is embedded within a more global form of rational action understood as "communication."

Unfortunately, this global form of rational action remains only nominally rational because it raises the question of epistemic legitimation without being able to deliver an answer to it. Like first-generation critical theorists, Habermas works himself into a theoretical impasse in which he cannot do justice, from within the standpoint of his own philosophy, to what Honneth calls "the rationality *immanent* in science." All he can do is register science's formal conditions of assertibility and acceptability[xlvii] while leaving wholly unaffected the issue of the legitimacy of its content.[xlviii]

Frame Six – The Sociology of Knowledge

A school of thought that shares critical theory's neo-Marxist orientation and that also flourishes in the twentieth century is the sociology of knowledge program that falls out of the so-called "Edinburgh School" of social analysis formed by the likes of Barry Barnes, David Bloor, Donald MacKenzie, John Henry and Harry Collins. In some interpretations, Thomas Kuhn and Paul Feyerabend belong to this style of thought. This school understands itself to be developing in a systematic fashion the rational consequences of the sociological method founded in the late nineteenth and early twentieth centuries by Emile Durkheim and Karl Mannheim and as prompting a "sociological" turn in the philosophy of science that explains assent to scientific beliefs in terms of social factors.

In "Socializing Epistemology," the British philosopher of science Mary Hesse argues that the keystone of Durkheim's sociological theory is the belief that most social institutions and phenomena can and must be analyzed with the sociological method. But in Durkheim's (and also in Mannheim's) work, as Hesse sees it, there is a critical omission since the institution of science is exempted from the principle

of sociological explanation on the ground that it is a "special object" to be set aside for purely philosophical analysis. The worry that leads to this omission is the fear that if the sciences are brought under the scope of sociological explanation, then sociology itself would be subjected to its own explanatory principle and its assent to this principle would itself lose any claim to validity, being explainable by reference to purely sociological factors. The exemption of the sciences from the sociological method, therefore, is a kind of compromise whereby sociological theory loses some of its explanatory reach in exchange for exempting itself from the charge of circularity.

According to Mary Hesse, the sociology of knowledge program is born in the second half of the twentieth century as a rejection of this *scientific exeptionalism* and as a conceptual enlargement of sociology. The exclusion of the social and natural sciences from the object domain of sociology, this school asserts, cannot be justified from within the standpoint of sociology itself for this exclusion is at odds with any consistent application of the principles of sociological reason, which prevent any institution from being unchained from the analytic reach of the sociologist. As long as sociology is defined, as per Durkheim's own definition, as the "science of institutions, their genesis and their functioning," there can be no legitimate motives for denying sociology explanatory access to the genesis and functioning of the natural and the social sciences, which are institutions. Even sociology itself must become subject to its own principle of explanation, such that any explanation of sociological accounts must itself be a sociological account. If the old sociological tradition saved itself from circularity at the cost of giving up the sciences as possible objects of inquiry, the new sociological movement rejects this compromise as a sham designed to curtail the power of the sociological method. The new movement reaches over into the previously unreachable domain of scientific beliefs even if this means accepting the accusation of circularity, which it embraces as a valid but inconsequential charge.

There are two different versions sociology of knowledge program: a "weak" and a "strong" version. The strong subdivision of the sociology of knowledge ("SSK") intervenes in debates about epistemology by holding that the only explanation of scientific rationality available to the thought process is sociological rather than epistemological in form. This position, which was popularized by the writings

of David Bloor, Barry Barnes and Steven Shapin, became popular in Europe and North America because it openly dons a relativistic theory of knowledge that, beyond expanding sociological ambitions, remonstrate against classical epistemology. SSK negates altogether the notion that epistemology has an object because it the "reasons" that "justify" the acceptance of a scientific belief are simply contingent social determinants in disguise. What causes a belief X to be accepted as true or to be rejected as error is not its epistemic rightness or epistemic lack, but a set of sociological causes and phenomena that incline thought, in the last instance, to say "yes" or "no." For proponents of SSK, the study of science must be coordinates around a few principles, the most important ones of which are: (1) *the principle of sociological causality*, which holds that there are causes behind belief-adoption but that these causes are always social and (2) *the principle of symmetry*, which maintains that these sociological causes explain *all* beliefs and inferences "without regard to whether the beliefs are true or the inferences rational."

What gives credence to this sociological theory is that its relativistic theory is supported by a plethora of examples drawn from the history of the sciences, examples that show the sociological origin of all scientific belief and the constant meddling of social interest in the formation of knowledge. In *The Enigma of the Aerofoil: Rival Theories in Aerodynamics, 1909-1930* (2011), for instance, David Bloor claims that debates in aerodynamics and engineering in the early twentieth century had more to do with "social determinants" (issues of institutional loyalty, nationalist pride, philosophical commitments) than with "epistemic determinants" (issues of verification, corroboration and empirical adequacy). In *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (1985), he makes the same argument about the debate between Thomas Hobbes and Robert Boyle about the air-pump in the 1700s, in which theory-choice is fixed by extra-scientific variables such as political views, economic values and cultural mores.

Here, we may take a minute to appreciate the relationship between the SSK and the weaker version of the sociology of knowledge. SSK affirms that all scientific beliefs can be explained in terms of the sociological forces that condition and make possible their acceptance-as-true. The weak program, by contrast, claims that only *some* scientific beliefs (those beliefs that science once accepted as "true" but

now rejects as "false") can be explained in these terms, while other beliefs (those that science still accepts as "true") must still be set aside for epistemological rather than sociological investigation. Thus, the weak program brokers its own compromise between the principle of symmetry of SSK and the scientific exceptionalism of Durkheim and Mannheim. In this compromise, sociology can only explain a limited number of scientific beliefs and its primary function is to help scientists and philosophers separate the wheat from the chaff by bringing to light the social forces (e.g. myth, racism, colonialism, etc.) that lead to the corruption of scientific knowledge scientific (e.g. astrology, craniometrics, eugenics). But the acceptance of sanctioned scientific beliefs (e.g. thermodynamics, evolutionary theory, quantum mechanics) can only be explained via epistemological and not sociological investigation. Good science has reasons. Bad science has valorizations. And sociology can discern the good from the bad.

Against this moderate sociologicism, SSK refuses to see any difference between the wheat and chaff and dismisses the distinction between them as a "failure of nerve and will" on the part of the weak program. As Bloor contends in *Knowledge And The Social Imaginary* (1991), the aims of the strong program differ from the "more limited" aims of the weak program in that the former brings the totality of the scientific enterprise—mathematical truths included—"within the scope of a thorough-going sociological scrutiny."[xlix] For him, "there are no limitations [to this scrutiny] which lie in the absolute or transcendent character of scientific knowledge itself, or in the special nature of rationality, validity, truth or objectivity."[l] In Chapter 1 of that book, "The Strong Program in the Sociology of Knowledge," his leading historical example in support of this deflation of epistemology is the political underbelly of scientific debates in the Weimar Republic concerning a-causality in quantum mechanics.[li]

Like logical positivism and neo-Kantianism, SSK declares that there is a "science of science," with the all-important caveat that this science is no longer provided by philosophy but by sociology. But it is this caveat, I argue, that brings about the collapse of this school of thought (collapse, that is, relative to the problem of science's historical normativity described in Chapter 1). First, since by definition sociology is a *descriptive* rather than *normative* enterprise, SSK has no choice by to abandon the meta-epistemological category of justification altogether. Like Frankfurt critical theory, it rejects the idea that

there can be an epistemological justification of science. But since SSK does not even have the substantive Marxist commitments of Adorno, Marcuse and Horkheimer, it cannot replace epistemic justification with another kind of justification (i.e. materialist justification). So, instead, it abandons *justification* as a whole and adopts *interpretation* as the central aim of critical thinking. Science, as a social form, cannot be justified under an epistemological or political conception of reason. It can only be sociologically interpreted. All theorists can do is fix the meaning that scientific knowledge acquires in particular historical moments—"the context of discovery"—by interpreting the social causes that determine it. The so-called "context of justification" falls completely out of the vernacular.

This denunciation of the normativity of scientific reason throws SSK into the same predicament that ravaged logical positivism, but from the exact opposite end. Recall that Carnap, as we learn from Popper, tries to salvage the normativity of scientific language by turning to the idea of a logical syntax. In the process, unfortunately, he ends up forfeiting the historicity of scientific knowledge. SSK makes the same sacrifice backwards. It invests so many of its cognitive resources in establishing the historicity of science that it ends up foregoing any and all epistemological norms and, in the words of the philosopher of science Larry Laudan, "deny[ing] epistemology any legitimate normative role."[lii] This is why Laudan mocks the idea that SSK is the "science of science" and dismisses it instead as "the *pseudo*-science of science."[liii] What good, he asks, is a science depleted of norms? And what good is a science of science whose only "strength" is that it weakens and impoverishes the very concept of "science" to the point that it leaves itself as bankrupt as its object?

My thesis is that SSK ought to be interpeted as a negation of the normative and as a reduction of the rational. Like critical theory and phenomenology, SSK takes the rationality of science (however it may be understood) to be a second-tier phenomenon, i.e., a function or effect of extra-scientific operations that are more primary. For phenomenologists, these operations are the synthetic and world-constituting acts of a transcendental subject, while for critical theorists they are the ploys of the capital relation (in the case of Adorno and Horkheimer) and the workings of communicative action (in the case of Habermas). Although the social determinants hypostatized by SSK are not exactly identical to any of

these, they nonetheless play the same theoretical role—they deny the *immanence* of scientific rationality and assume that the "reasons" through with which science works (however these may be understood) are always loaned out to it by a third party. This party is no longer the transcendental ego or the capital relation but the many social causes that reduce all "being true" to "taking-to-be true."

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[i] Cassirer, Ernst. *Substance And Function And Einstein's Theory Of Relativity*. (New York: Courier Corporation, 2004)

[ii] Cassirer, E. *Philosophy Of Symbolic Forms. Vol. III* (New Haven, CT: Yale University Press, 1957)

[iii] Habermas, Jürgen. "Knowledge and Human Interests: A General Perspective." In *Continental Philosophy of Science*, ed Gary Gutting (Oxford: Balckwell, 2005), 312

[iv] "There has never been a scientific inquiry into the way in which the life-world constantly functions as subsoil, into how its manifold prelogical validities act as grounds for the logical ones, for theoretical truths. And perhaps the scientific discipline which this life-world as such, in its universality, requires is a peculiar, one which is precisely not objective and logical but which, as the ultimately grounding one, is not inferior but superior in value. See Husserl's *The Crisis Of European Sciences And Transcendental Phenomenology: An Introduction To Phenomenological Philosophy* (Northwestern University Press, 1970), 124.

[v] Husserl, *Crisis*, 130

[vi] Adorno, Theodor W. *The Adorno Reader*. Ed. Brian O'Connor (Oxford: Blackwell, 2000), 115

[vii] Adorno contends that any move from the subjective to the objective in phenomenology cannot succeed without first doing terrible violence to the principles of phenomenology. The primacy of the subjective leads any objective phenomenology (such as Max Scheler's) into the post-Kantian antinomy of subjectivity-objectivity.

[viii] Merleau-Ponty, Maurice. *Phenomenology of Perception* (New York: Routledge, 2013)

[ix] Gutting, Gary. *Continental Philosophy Of Science* (John Wiley & Sons, 2008), 144

[x] Adorno, *Reader*, 25

[xi] Adorno, *Reader*, 25

[xii] Habermas, Jürgen. *Knowledge and Human Interests* (Boston: Beacon Press, 1972), 68

[xiii] Habermas, *Knowledge and Human Interests*, 68

[xiv] Winch, Peter. *The Idea of a Social Science and Its Relation to Philosophy* (New York: Routledge, 2007), 4

[xv] Winch, *The Idea of a Social Science,* 5

[xvi] Carnap, Rudolf. *Logical Syntax Of Language* (New York: Routledge, 2000), xiii

[xvii] Glock, Hans-Johann. *What is analytic philosophy?* (Cambridge University Press, 2008), 37

[xviii] Ayer, Alfred J. *Language, Logic and Truth* (New York: Dover Publications, 1952), 100

[xix] Popper, Karl. *The Logic of Scientific Discovery* (New York: Routledge, 2002), xxiv

[xx] Popper, *Logic*, xxiv

[xxi] Popper, *Logic*, xix

[xxii] Popper could be said to delve deeper into the logic of anti-subjectivism, which he thinks even Carnap does not entirely overcome. Carnap's focus on "protocol sentences" as the unexplained explainers from which the scientific worldview is derived still relies too much on a subjective element. The rut of subjectivity lingers in philosophy, he claims, "even if we change the term 'experience' into 'protocol sentence.'" And he proclaims: "I wish to *distinguish shaprply between objective science on the one hand, and 'our knowledge' on the other*" (Popper, *Logic*, 79).

[xxiii] Carnap, *Logical* Syntax, 53-78, 83-100

[xxiv] Popper, *Logic,* Chapter Two

[xxv]Popper, *Logic,* 27

[xxvi] Popper, *Logic,* 32

[xxvii] Popper, *Logic,* 32

[xxviii] Marcuse, Herbert. *Studies in Critical Philosophy*. Trans., Joris de Bres (Boston, MA: Beacon Press, 1972), 198.

[xxix] Popper, *Logic,* 8

[xxx] Zammito, John. *A Nice Derangement of Epistemes: Post-Positivism in the Study of Science from Quine to Latour* (Chicago, IL: University of Chicago Press, 2004), 94
[xxxi] Honneth, Axel. "Bisected Rationality: The Frankfurt School's Critique of Science," In *Continental Philosophy of Science*, ed Gary Gutting (Oxford: Balckwell, 2005), 296
[xxxii] Marcuse, Herbert. *Negations* (Boston: Beacon Press, 1969), 77
[xxxiii] For Critical Theorists, the clearest denunciation of the Hegelian dictum that only "the true is whole" is the wretched condition of life under capital. Under industrial capitalism, there are "parts" of the whole (i.e. the proletariat) that are mired element of untruth (alienation), and whose existence showcases the necessity of engaging in the labor of immanent critique. Although the whole can, in principle, be made "true" and "rational," this can only happen if all the paradoxes, inconsistencies, antinomies and contradiction of the social order are subsumed under a communal moment of "reconciliation." But, in its present state, the whole is enfeebled. "The whole," as Adorno puts it, "is the false."
[xxxiv] Marcuse, *Negations,* 77
[xxxv] Honneth, "Bisected Rationality," 297
[xxxvi] Honneth, "Bisected Rationality," 299
[xxxvii] Marcuse, *Negations*, 70
[xxxviii] Adorno, *Reader*, 29
[xxxix] Adorno *Reader*, 131
[xl] Habermas, Jürgen. *Toward A Rational Society: Student Protest, Science, And Politics* (Boston: Beacon Press, 1971), 113
[xli] Habermas, "Knowledge and Human Interests: A General Perspective," In Gary Gutting's *Continental Philosophy Of Science* (John Wiley & Sons, 2008), 305
[xlii] Habermas, *Toward A Rational Society*, 56
[xliii] Habermas, Jürgen. *Truth and justification* (John Wiley & Sons, 2014), viii
[xliv] Habermas, *Toward A Rational Society*, 7
[xlv] Habermas, *Toward A Rational Society*, 7
[xlvi] Habermas, *Truth and justification*, 9
[xlvii] Habermas, *Truth and Justification*, 8
[xlviii] Late in his life, Habermas become aware of this problem. See *Truth and Justification.*
[xlix] Bloor, David. *Knowledge and social imagery* (University of Chicago Press, 1991).
[l] Bloor*, Knowledge and Social Imagery,* 3
[li] "Finally, mention must be made of a fascinating and controversial study of the physicists of Weimar Germany. Forman (1971) uses their academic addresses to show them taking up the dominant antiscientific 'Lebensphilosophie' surrounding them. He argues 'that the movement to dispense with causality in physics which sprang up so suddenly and blossomed so luxuriantly in Germany after 1918, was primarily an effort by German physicists to adapt the content of their science to the values of their intellectual environment' (p. 7). The boldness and interest of this claim derives from the central place of acausality in modern quantum theory." (*Knowledge and Social Imaginary, 7*).
[lii] Laudan, Larry. *Science And Relativism: Some Key Controversies In The Philosophy Of Science* (Chicago: University of Chicago Press, 1990), 106, 135
[liii] Laudan, Larry. "The Pseudo-Science Of Science?" In *Scientific Rationality: The Sociological Turn* (Netherlands: Springer, 1984), 41-73.

APPENDIX 2
SCIENTIFIC NORMATIVITY, A CLOSER LOOK

In his 1963 essay entitled "L'Histoire Des Sciences Dans L'Œuvre Epistemologique de Gaston Bachelard," Canguilhem applauds his friend and colleague (who died the previous year, in 1962) for having been "the first French epistemologist who thought, wrote and published at the chronological and conceptual heights of the sciences he dealt with"[i] and for introducing into French culture an idea long forgotten by the naïve children of existentialism and phenomenology—that philosophy must concede that science is "normative in its use of categories."[ii] In his first major work, *NSS*, Bachelard argues that the rationality of science makes sense only under the assumption that scientific discourse is beholden to normative concepts or rules that aid the scientific mind in the elaboration of judgments. These "judgments of scientific thought," which are made possible by a "a sum of rules and laws,"[iii] are the objects that "the philosophy of science is concerned [with]." If philosophy wants to grasp the inner life of these objects and "judge the effectiveness of a thought," it has no choice but to "adopt a normative point of view."[iv] Thus, when Canguilhem claims that the discourse of the life sciences is structured by "normative concepts" and that epistemology must track the "history of [these] categories of scientific thought,"[v] he is continuing a way of thinking initiated by Bachelard that recognizing the normative content of scientific discourse. Already in an early work entitled *Traite de Logique et de Morale,* Canguilhem states that all theoretical functions, "in so far as they orient thought toward the search for truth," obey methods and rules [*règlements*] that "one calls 'rational.'"[vi] "No correct study of these functions," he then says, "can separate [science] from these rules."[vii]Using the term "propositions" rather than "judgments" and the terms "concepts" rather than "rules," he argues that scientific discourse is a form of human communication that is structured and conditioned by "concepts"[viii]

It is interesting that Bachelard's and Canguilhem's philosophies follow a similar trajectory. In their early works both slip into psychologistic language reminiscent of the infamous "A" deduction of the first *Critique*. Bachelard at times speaks of the normative parameters that govern science as stemming

from a "psychology of rules,"[ix] whereas Canguilhem (especially in *Traite de Logique et de Morale*) speaks of them as having a "psychological essence."[x] But, like Kant himself, both eventually move away and renounce this psychologism, landing on a new philosophical position that emphasizes the s *epistemological (*rather than *psychological)* and as *objective (rather than subjective) character of these norms*. Bachelard goes to great lengths to drop any hints of psychologism and to show that the rules of scientific cognition "exceed" all the faculties of Man,[xi] a thesis that also frames Canguilhem's mature work.

We have textual reasons, anchored in the primary and secondary literatures, to think that Foucault's work begins from the same assumption. In the "Preface" to *OT*, for instance (although this move is found as early as *HM*[xii]), Foucault develops Bachelard's and Canguilhem's theory by noting that scientific discourse—which he describes as the set of recorded or archived set of communicative, linguistic, technical and symbolic acts that at different moments in history and under different systems of thought—is a normative activity that unfolds in accordance to determinate rules and criteria of rationality. Those who occupy positions of epistemic authority produce "statements" by applying determinate criteria or "norms"[xiii] that delimit the bounds of scientificity within a particular historical horizon. In *AK,* Foucault writes,

> But in almost all its dimensions, the enterprise [of archaeology] is related to the sciences, and to analyses of a scientific type, or to theories *subject to rigorous criteria*. First of all, it is related to the sciences that are constituted and establish their norm in the knowledge archaeologically described; for the archaeological enterprise, these sciences are so many *science-objects*, as morbid anatomy, philology, political economy, and biology have already been. It is also related to scientific forms of analysis, but is distinguished from them either in level, domain or methods.[xiv]

This notion of "science-objects" neatly encapsulates the object of Bachelard, Canguilhem and Foucault. A science-object is a discursive formation that bears the name "science" precisely because it separates itself non-science by means of a series of maneuvers—the intensification of verificationist and falsificationist practices, the regimentation of language, the imposition of truth constraints, etc. And the fact that these figures ultimately take different science-objects as their primary points of departure takes nothing away

from their shared conviction that these objects all are discursive formations that are of a scientific order that, as Foucault indicates, follow "their own norm."

In *Foucault's Archaeology: Science and Transformation*, David Webb brings to light the Kantian undertones of Foucault's archaeologies by noting that in the concluding pages of *OT* Foucault calls for a "second critique of pure reason," showing that he has not abandoned the basic Kantian aspiration of highlighting the normative elements that make scientific knowledge possible, even if he has entirely skirted the Kantian fascination with interpreting these elements along transcendental lines. As Foucault explains in an interview with Alessandro Fontana and Pasquale Pasquino, the question archaeology intends is a normative one, it "is a question of what *governs* statements, and the way in which they *govern* each other so as to constitute a set of propositions which are scientifically acceptable, and hence capable of being verified or falsified by scientific procedures."[xv]

A second text that is important is Gary Gutting's *Michel Foucault's Archaeology of Scientific Reason*, where Gutting emphasizes the irreducibly normative character of Foucault's understanding of scientific discourse by stressing, against critics, that Foucault "does not move his archeological critique of scientific norms in the direction of a debunking of scientific rationality as such."[xvi] Exactly the opposite is true. "[Foucault] allows a certain level of objectivity and truth"[xvii] in the history of the sciences, even in the case of the so-called "dubious" disciplines of psychiatry, medicine and the rest of the human sciences.[xviii] In none of his works does Foucault argue for absence of normativity or objectivity in science. In each case he struggles to show that scientific discourses (even the "sciences of the self" treated in this late works) are *immanently* governed by rules and norms that archaeology and genealogy can disclose. This is the reason that, as a philosophical project, archaeology is not synonymous with the history of ideas. Innocent of epistemological (i.e. normative) ambitions, the latter is merely "the analysis of opinions rather than knowledge, of errors rather than of truth, of types of mentality rather than forms of though.t"[xix]

Finally, in her influential work, *Foucault's Critical Project*, Beatrice Han contends that when Foucault analyzes history of different human sciences such as criminology, sexology and psychiatry, his first step is to try to discern the dispersion of these rules, which he describes as "concepts," "positivities,"

"regularities," "schemata," or simply "rules of sentence formation." His concern with these normative constraints is anything but surprising since archaeological and genealogical projects are impossible to enact in the absence of norms. If the discourse of psychiatry in *HM*, of medicine in *BC*, of criminology in *BP* can be subjected to a Nietzschean-inspired genealogical method, this is only because they are not lawless configurations of thought or amorphous amalgamations of facts and statements with false aspirations to reason. They are principled discursive formations that have reached different thresholds of scientificity and are governed by different, domain-specific norms that institute epistemological, phenomenological and logical linkages between things and words.[xx]

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[i] Canguilhem, *Etudes*, 185
[ii] Canguilhem, *Etudes*, 200
[iii] Bachelard, *PN,* 67
[iv] Bachelard, *FSM,* 17
[v] Canguilhem, *IR*, 10
[vi] Canguilhem, *OC1*, 638 (my translation)
[vii] Canguilhem, *OC1,* 638 (my translation)
[viii] Guillaume Pénisson, *Le Vivant Et l'Épistémologie des Concepts: Essai Sur le Normal Et le Pathologique de Georges Canguilhem* (Paris: L'Harmattan, 2008), 17
[ix] Bachelard, *AR*, 15
[x] Canguilhem, *OC1,* 639
[xi] Bachelard, *MR*, 1
[xii] Already as early as *HM*, that expansive study of the "science-object" of psychiatry that spans over six hundred pages, Foucault was convinced that normativity breathes life into "scientific knowledge" and that there are rules that must be fulfilled at different points in time in order for a particular subject to come to occupy the authorial and authoritative position of the scientific knower (i.e. the psychiatrist, the doctor, the medical expert)In this tome, he traces the history of the concept of madness from the Renaissance to the Modern period and places the discourse of psychiatry within a larger epistemological framework for thinking about "madness" as the "Other" of Reason and "the mad" as a subject about which reason must, in the language that is most properly its own, speak. Later, in *AK*, Foucault specifies that the object of *HM* was the study of a particular scientific discourse, a practice "possessing scientific status and scientific pretensions" (Quoted in Gary Gutting's *Foucault's Archaeology of Scientific Reason*, 250)
[xiii] Foucault, *AK*, 207
[xiv] Foucault, *AK*, 206-7
[xv] Foucault, *Reader,* 54
[xvi] Gutting, *Foucault's Archaeology of Scientific Reason*, 255
[xvii] Gutting, *Foucault's Archaeology of Scientific Reason,* 255
[xviii] Gutting, *Foucault's Archaeology of Scientific Reason,* 255
[xix] Foucault, *AK*, 137
[xx] Han, *Foucault's Critical Project,* 54

APPENDIX 3
CONCEPTUAL DISAVOWALS

In *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society* (1964), Herbert Marcuse presents "the Great Refusal" as the sole possibility left in the post-industrial age for political resistance to the engulfing logic of capitalist sequestration. French historical epistemology, I argue, stages a form of philosophical resistance (not against capital but against the history of philosophy) by means of a series of refusals or disavowals that say "no" the false possibilities it inherits from its past. These disavowals are dismissals of previous theories of conceptuality that eliminate the epistemological content of scientific concepts and thus undermine the articulation of a Cavaillésian "dialectic of the concept."

Linguisticism: Scientific Concepts are Not Words

This disavowal is important from a historiographical vantage since that is how Bachelard, Canguilhem and Foucault dissociate themselves from the "linguistic turn" inaugurated, arguably, by Saussurean linguistics in the 1920s.[i] As inheritors of Cavaillès's formalist philosophy of the concept, these thinkers were afraid that the essentially *epistemological* (i.e. having to do with the rationality and validity of knowledge) character of this philosophy would be occluded by the merely *linguistic* (i.e. having to do with the truth and reference of utterances) nature of the new philosophical trends.[ii]

Concepts are not linguistic units or words. When a physicist, for example, summons the term "electron" in her discourse, she is invoking more than just a noun in a natural language, more than semiotic sign or linguistic symbol. She is employing a scientific idea or concept that is replete with epistemological and historical content. Here, we see the influence of the Russian-born historian and philosopher of science Alexandre Koyré, who famously proclaimed that "a word is not a concept."[iii] According to Koyré, who was a student of Brunschvicg like Bachelard, epistemologists must learn to differentiate between the system of signs that constitutes a natural (or artificial) language and the system

of epistemic concepts that forms the rational domain of a particular science. The word "word" and the word "concept" are not synonyms, and neither are their respective concepts.

The problem is that words are indeterminate elements whose conceptual reference relation (i.e. the concept they manifest or convey) is not stable. Thus a purely linguistic analysis of the history of scientific discourse can be led astray because linguistic patterns can conceal differences, or eclipse similarities, in notional content. The same word can express different concepts and the same concept can be denoted by different words. In *Galileo Studies,* Koyré uses an example from the history of physics to make his case. Even though Aquinas and Galileo both use the word "impetus" in their writings on nature, he says, the Thomist concept of impetus is not the same as the Galilean one. By the time of Galileo, the concept of impetus had become inexorably linked to other scientific concepts (especially the notion of inertia) that were non-existent in Aqiunas' time. As a result, the meaning of the concept underwent a fundamental alteration. Between 13th and the 17th centuries everything changes from the standpoint of epistemology so that by the time the new science ascends to dominance in the West, borrowing Bergsonian language, "one pronounces the word, but one does not think of the thing."[iv] The word "impetus" remains, but the concept has changed.

The disavowal of linguisticism find its roots, therefore, in Koyré's contention that the archive of history can be of value to the epistemologist only if the latter mines from this archive the conceptuality of scientific discourse and refrains from making the amateurish mistake of equating the words scientists use and the concepts through which they think. Citing as different historical examples of the gap between word and concept, these thinkers advance the same thesis regarding the non-linguistic (and thus non-conventional) nature of the norms that regulate the creation of scientific truth. What they care about are the epistemological norms that regulate thinking, not the words that facilitate scientific writing and scientific speech. Playing with the French title of *OT,* in *AK* Foucault encapsulates the significance of this disavowal by claiming: "From the kind of analysis I have undertaken, *words* are as deliberately absent as *things*."[v]

The Disavowal of Sociologism

Although concepts are histories, they are not conventions. Their force is not merely the effect of the accumulation of memory and time. Concepts are objective terms that secure the truth of a proposition in a particular historical period. And any theory of conceptuality that reduces concepts to cultural objects passed down solely by the force of habit and tradition will inevitably vacate concepts of their normative character. In one of his most hostile and uncharitable moments, Canguilhem claims that Kuhn's commitment to sociology and social psychology "accounts for the embarrassment evident in the appendix to the second edition of the *Structure of Scientific Revolutions* when it comes to answering the question of how the truth of a theory is to be understood."[vi] Sociology, as Canguilhem sees it, has access to descriptions of fact but not to pronouncements of truth. As a result, a sociological approach to the theory of science simply effaces what should be underscored: the rationality and validity of scientific claims, the objectivity of scientific discourse. On this point, Bachelard is in agreement with Canguilhem. In Section II of *Épistémologie*, entitled "Les catégories majeures de l'épistémologie," Bachelard explicitly opposes "structural" (not to be confused with structural*ist)* to "sociological" approaches to the study of science and argues that the former supersede the latter.[vii] Thus, although he never had the chance to write about Kuhn's work directly, we have reasons to believe that he would have distanced his project from Kuhn's *Structure* much in the same way Kuhn would try to distance himself from what he perceived as Bachelard's excessive heed to Kantian categories.[viii]

Foucault's criticisms of Kuhn follow almost identical circuits, at least as far as the abjuration of sociology goes. "Archaeology," he writes in *AK*, "is neither a psychology nor a sociology."[ix] Part of the story behind this discrimination, to which we return when dealing with question of method in Chapter Four, is that, unlike sociology, "archaeology is not a science."[x]Qua historical method, it lacks predictive power and is limited to recursive descriptions of historical phenomena. But aside from this point, the reason that an archaeology of scientific history is not comparable to a historical sociology of science (whether Kuhnian in spirit or not) is that when it comes to such historical phenomena, it is the latter that turns out to be handicapped by its methodology. Sociologies of scientific history may be able to unearth,

through careful historical research, what scientists *said* (if their orientation is linguistic) or what scientists *said they did* (if their orientation is behaviorist), but they simply cannot unearth the epistemological forces that shaped the way scientists thought.

The concepts and rules of formation that embody the historical *a priori* of the different human sciences are inaccessible to an empirical science because they are "never given in a formulation,"[xi] according to Foucault. They float around in epistemic space and form the collective unconscious of a scientific community. Only the archaeologist of reason who is armed with the resources of historical research *plus* the toolbox of the philosopher—i.e. a more nuanced notion of the relationship between history and ideology, a more finely-tuned interpretation of history and contingency, and a substantially more developed conception of the unconscious—can bring these norms to the surface. This is precisely why, in a move that is anything but unexpected, Foucault lists Marx, Nietzsche and Freud (in that order) as the fist figures to truly "de-center" the linear views of history that was later further dislocated by "the *epistemological acts and thresholds* described by Bachelard […and] the analyses of G. Canguilhem."[xii] At any rate, all three are willing to grant that scientific-epistemic norms have a sociological effect (in so far as they shape the ways in which specialized communities traffic in rationality as a collective), but they will emphatically deny that they have a sociological nature. These norms transcend the empirical generalities that permeate the purview of the social psychologist or sociologist.

A Disavowal of the Theory/Fact Philosophy of Positivism

According to historical epistemologists, when scientists identify a "fact" of nature or refer to a certain "theory" that is supposed to help us gain nomological knowledge, they are dealing with the tools through which science makes sense of itself to itself not with the objects that concern the epistemologist interested in the normativity of scientific discourse. Norms are not identical to empirical facts, which are often given through a combination of observation and construction depending on one's theory of science.[xiii] Furthermore, they are not theories, which explain natural events and legalize predictive propositions about future states of affairs.

Concepts are not theories because they *appear* in theories. Often, they appear in theories unequivocally as "theoretical terms," "kind terms" and "taxonomic modules." But sometimes they appear in them obliquely as organizing background assumptions.[xiv] Either way, scientific concepts are elements of scientific rationality that make possible the articulation of scientific theories. For example, when Darwin articulates the theory of evolution via natural selection in 1859, the concept of *species* appears in it quite explicitly since Darwin uses the term "species" repeatedly, talks about it and even devotes entire sections of his work to untangling its meaning. But the concept of *milieu* that this theory presupposes and that affects the overall structure of the theory, as we learn from Canguilhem's analysis of the epistemology of biology in *Etudes*, is not reflected on the surface of that structure. In the "Introduction" to *FCR*, Canguilhem argues that theories are built from concepts, even if they are ultimately supported by facts. Whether "implicit or explicit"[xv] concepts play a role in theory. And although most concepts tend to be domain-specific, some are "theoretically polyvalent"[xvi] meaning that they appear in multiple theories at the same time. In *FCR*, we are told that the concept of *reflection* appears in the theoretical terrain of the corpuscular theory of light as well as in the terrain of the undulatory theory,[xvii] while in *IR* we read that the concept of *excitability* appears in scientific controversies about pathology as well as in scientific controversies about the structure of the nervous system[xviii] These concepts, which Dominique Lecourt calls "scientific loans,"[xix] live multiples lives depending on the theoretical contexts in which they unleash their normative power.

Recall that the positivist theory of science explains scientific knowledge primarily in terms of the interaction of two factors: empirical facts and scientific theories. Historical epistemology upsets this framework by enlisting a third factor into the dynamic: scientific concepts. Of course, historical epistemology does not reject the idea, now common among analytic philosophers of science, that facts and theories are important features of scientific rationality nor the idea that the relationship between facts and theories is a bidirectional one whereby facts affect theories (either by falsifying or supporting them) and theories affect facts (the theory-laden conception of observation). Where historical epistemology breaks from the positivist programs, old and new, is in contention that there is more to science than facts

and theories. In addition to these, there are also concepts that, *qua* scientific-epistemic norms, make possible the identification of scientific facts and the articulation of scientific theories. Lecourt says that historical epistemology imposes the prescription "to move from the concepts to the theory and not vice versa."[xx]

We may render the relations between these different terms by saying that scientific-epistemic norms, as schemas of scientific experience, condition our perception and appreciation of facts. Facts, in turn, lend support to theories while theories are enunciated vis-à-vis the same norms that condition facts. In short, norms that are categories of thought that pre-exist both the enunciation of theories and the location of the facts that are used to lend support to them. Like the theories they are called upon to prop up, facts are unintelligible in the absence of a background of norms over and against which they acquire a properly scientific sense.[xxi] Due to this conditioning-relation, we must qualify Yves Gingras's claim that French historical epistemology deals with "scientific theories, problems, concepts or categories of thought"[xxii] as a grouping fallacy for one of the terms in the equation (scientific theories) is unlike the others (problems, concepts or categories of thought) and stands in a conditioned-conditioning relation to them.

Alongside this refusal to reduce science to a playful permutation of "facts" and "theories" we detect the essentially post-positivist slant of French philosophy of science. The hallmark of positivist philosophies is that the empiricist assumption (a new dogma of empiricism?) that there is nothing in scientific knowledge that is not first, in one way or another, given to the senses via sense data. In the positivist camp, science is exhausted by empirical facts that are given over to thought through the sensuous observation of nature and even theories are subjected to this reduction because they are ostensibly nothing more than lawful generalities induced from these very facts. In this picture, there is no room science for non-empirical elements that befuddle this raw empiricism. In both the practice and the philosophy of science, as far as the positivist philosopher is concerned, categories or concepts (which are not empirical) are nothing but residual leftovers of old metaphysical ignorance. In *A Nice Derangement of Epistemes: Post-Positivism in the Study of Science from Quine to Latour*, Zammito attributes this

prejudice to the vicar of positivism: "nothing was more odious to Comte than recourse to transcendent or metaphysical categories, in other words, to anything which postulated the reality of what could not be confirmed by sensory observation."[xxiii] The myopia of this obsession with *the empirically given* led Lecourt to mock the positivist agenda as a "conceptual desert" in *Marxism and Epistemology*.[xxiv] Historical epistemology, I claim, gives life by brings the language of "the concept" back into the philosophy of science after its apparent death with the collapse of the last great normative discourse—German Idealism.

[i] In AK, Foucault implies that structural linguists, with their emphasis on structure and its persistence in time, allow "the living, fragile, pulsating 'history' to slip through their fingers" (Foucault, *AK,* 11)
[ii] Zammito argues that this is the crux, later in the twentieth century, of Laudan's critique of Quine (Zammito, *A Nice Derangement*, 32ff).
iii Koyré, *Galileo Studies*, 75
[iv] Bergson, *Creative Evolution,* 39
[v] Foucault, *AK,* 48
[vi] Canguilhem, *VR,* 46
[vii] Bachelard, *Epistemologie*, 109
[viii] Bachelard met Kuhn in 1940 when Kuhn came to see him in Paris upon the recommendation of Koyre. Sill, he never wrote about this work. In fact, reflecting upon their meeting later, Kuhn himself explained their philosophical differences in terms of the gap between his own investment in a sociologico-empirical understanding of the history of the sciences and Bachealard's more objectivist and proto-idealist theory of science. "He was trying to put it in too much of a constrain […] He has categories, and methodological categories, and moved the thing up an escalator too systematically for me" (Qouted in Castelão-Lawless, Teresa. "Kuhn's missed opportunity and the multifaceted lives of Bachelard: mythical, institutional, historical, philosophical, literary, scientific." *Studies in History and Philosophy of Science Part A* 35.4 (2004): 873-881)
[ix] Foucault, *AK*, 139
[x] Foucault, *AK* 206
[xi] Foucault, *AK* 147
[xii] Foucault, *AK* 4
[xiii] Canguilhem, *KL,* 4-5
[xiv] In the first paragraph of the "Introduction" to *FCR*, as he is gearing up for an in-depth study of the concept of *reflex movement* in the history of medicine and physiology, Canguilhem warns the reader against two fairly common prejudices [Fr., *deux prejugés assez répandus*] that could impede the progression of analysis. One of them, internal to the life sciences, is the assumption that only theories of a mechanistic sort can lead to the acquisition of new scientific knowledge. The other, applicable to all the sciences, is the is the idea that "a concept cannot be born *but* in the context of a theory." (Canguilhem, *FCR, 3*)
[xv] Canguilhem, *FCR*, 5
[xvi] Canguilhem, *FCR,* 6
[xvii] Canguilhem, *FCR*, 6
[xviii] Canguilhem, *IR*, 45
[xix] Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: NLB, 1975), 81
[xx] Lecourt, *Marxism and Epistemology,* 172
[xxi] Lecourt, *Marxism and Epistemology,* 166
[xxii] Gingras, Yves. "Naming without necessity." *Revue de synthèse* 131.3 (2010): 439-454
[xxiii] Zammito, John H. *A Nice Derangement Of Epistemes: Post-Positivism In The Study Of Science From Quine To Latour* (Chicago: University of Chicago Press, 2004), 7
[xxiv] Lecourt, *Marxism and Epistemology,* 167

APPENDIX 4
A HISTORY OF NETWORKS

As an autonomous area of study, network theory came into its own roughly in the 1950s. In 1950, the Austrian biologist Ludwig von Bertalanffy published an article in the *British Journal for the Philosophy of Science* entitled "An Outline for General Systems Theory" that came to be seen as the manifesto of this new way of thinking. In the post-WWII intellectual moment, Bertalanffy argued, various disciplines underwent a methodological revolution (a "parallel evolution," as he says) that caused them to abandon the atomistic principles of "the past centuries" in order to embrace a new, holistic frame of thought rooted in the notion of systems or wholes. In the opening paragraph, he proclaims:

> As we survey the evolution of modern science, we find the remarkable phenomenon that similar general conceptions and viewpoints have evolved independently in the various branches of science, and to begin with these may be indicated as follows: in the past centuries, science tried to explain phenomena by reducing them to an interplay of elementary units which could be investigated independently of each other. In contemporary science, we find in all fields conceptions of what is rather vaguely termed 'wholeness.'[i]

Though vague and imprecise, early conceptions of wholeness gained significant traction in the 1950s for philosophical and political reasons. Politically, they gained popularity because their future-oriented persona tapped into the yearning desire for progress that pervaded the context of post-atomic life. Indeed, from its inception, general systems theory presented itself as a revolutionary break from the past on the grounds that it allowed scientists to talk about, and carry out, their research without having to either regurgitate the organicist conceptions of the German idealists, which, by the 1950s, were seen as anachronistic relics of bygone times, or recap the industrio-mechanic conceptions of the modernists that, in the wake of Hiroshima and Nagasaki, were tantamount to collective recidivism.[ii] Early conceptions of wholeness, in other words, spread throughout the academic landscape at a rapid pace because they promised to usher in a new *Zeitgeist* that would deliver Europe from its self-incurred historical mistakes. Philosophical reasons, however, were also at the root of the success of systems theory. Aside from

portending a general transformation in the intellectual culture of the West, systems theory also promised to expand the coordinates of the scientific gaze and liberate it from the fetters of reductionism.[iii]

Equipped with the theoretical and methodological resources made available by holism, researchers in the physical, life, human and social sciences were no longer beholden or confined to a proto-Cartesian method of *analysis* that required all properties of objects to be explained on the basis of the properties of their constituent parts and their relations. Under the umbrella of a new epistemology, researchers were free to either study old objects in an entirely new light or, conversely, bring to light entirely new objects of study. In sociology, *social facts* were born; in anthropology, interpretation latched on to *structures*; in biology and physics, research was directed to the laws governing complex *systems*. "Compared to the analytical procedures of classical science, with resolution into component elements and one-way or linear causality as the basic category," Bertalanffy writes, "the investigation of organized wholes of many variables require[d] new categories of interaction, transaction, organization, teleology and so forth, with many problems arising for epistemology."[iv]

Whether because of a shifting political climate or because of its staggering philosophical implications, by the 1960s and '70s wholeness theory had become the *lingua franca* of the academic world. Publications devoted to its assumptions and consequences were hitting the press at an unprecedented rate[v] and institutes dedicated to its application were popping up all over Europe and North America. The inauguration of centers such as the International Society for the Systems Sciences (1954), the Case Systems Research Centre (1960), the General Systems Theory Group (1966) and the International Institute for Applied Systems Analysis (1972) was evidence of the institutional purchase of this new approach and of its promise to become the new *zeitgeist* of post-WWII intellectual life. By the early 1970s, Bertalanffy claims, general systems theory was, scientifically speaking, a "new philosophy of nature" and, meta-scientifically speaking, "a new 'paradigm' in Thomas Kuhn's phrase."[vi]

As the so-called "me decade" of the '70s gained steam, however, disagreements concerning the feasibility of the systems approach arose as not everyone shared Bertalanffy's zealous enthusiasm for this new scientific paradigm. Some worried that the central concept of "wholeness" that lied at the heart of

general systems theory evoked still too many images of closure, unity and totality redolent of nineteenth century German idealism. Others fretted over the residual mechanicism that lingered in early applications of systems theory. In a 1972 article entitled "General System(s) Theory: The Promise That Could Not Be Kept," Frederick Thayer echoes both of these worries, arguing that if first-wave systems theory "did not deliver" on its promise to amend the script of European science, this is because systems theory was still plagued by mechanistic and idealist *a priori* assumptions about what it means for something to be a system. Among the assumptions Thayer has in mind are: (1) the assumption that systems are stratified hierarchies that close themselves off from their surroundings, (2) the assumption that the relations between their components are deterministic and (3) the assumption that any component of a larger system is exhausted by its function relative to the whole. The "wholes" that wholeness theory was capable of theorizing, Thayer concludes, were deterministic and functionalist ones that reflected fundamentally *feudal* values and enacted, in the field of epistemology, the political and economic ideology of pre-modern Europe.

As a result of its organicist resonances and mechanistic qualities, the term "wholeness" was collectively abandoned around the 1960s and the terms "systems" and "network" became standard. Then, in the '70s, there were new efforts to think about new sorts of systems that fell outside the confines of early systems theory, that is, systems that are open rather than closed, aleatory rather than deterministic and complex rather than merely functional. From these changes, two developments followed: (1) the rise, in the '70s and '80s, of the second wave of "systems theory" and (2) the rise, in the '80s and '90s, of "actor-network theory" or "ANT."[vii] If second-wave systems theory separated itself from its predecessor by positing the complexity, openness and indeterminacy of systems, ANT separated itself from second-wave systems theory by granting systems agency. Advocates of ANT hold that systems are autonomous agents or "actants" that have the power to bring about effects. "An 'actor' in A[N]T," Bruno Latour writes in 1992, "is a semiotic definition—an actant—, that is, something that acts or to which activity is granted by others. It implies no special motivation of human individual actors, nor of humans in general. An actant can literally be anything, provided it is the source of an action."[viii]

Over the span of only four or five decades in the second half of the twentieth century, therefore, the elementary epistemology of modernity gave way to a relational one that appeared in three different stages: wholeness-theory (‘50s-‘60s), second-wave systems-theory (‘70s-‘80s) and actor-network theory (‘80s-‘90s). Although the aftermath of these stages was felt most acutely in physics, biology and sociology, it also had a profound impact on philosophy, where the spirit of anti-atomism prompted robust changes in method and outlook.[ix] These changes were felt in analytic[x] and continental[xi] philosophy alike and they left an imprint on many branches of philosophy, including meta-ethics,[xii] the philosophy of mind[xiii] and the philosophy of science.[xiv] In the case of the philosophy of science, the spirit of anti-atomism that erupted from the 1950s to the 1990s led to two philosophical reforms: one in the philosophy of science proper and one in the epistemology of science. In the first instance, holism encouraged philosophers to reconsider how they made sense of science from a philosophical standpoint, which entailed reverse engineering old concepts (such as testing,[xv] explanation[xvi] and meaning[xvii]) and inventing new ones (such as emergence[xviii] and supervenience[xix]) in the philosophy of science. In the second, holism encouraged philosophers to reconsider how *scientists make sense of the world from a scientific standpoint,* which entailed taking a new look at how scientific ideas link up with one another so as to form what Quine would call in 1951 a “web of belief.”[xx]

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[i] See Ludwig von Bertalanffy, “An Outline of General System Theory,” in *The British Journal for the Philosophy of Science* 1 (1950): 134-165.

[ii] This is not to say that general systems theory owed nothing to the history of ideas. For an explanation of the relationship between systems theory and the history of philosophy, see Von Bertalanffy, Ludwig. "The history and status of general systems theory." *Academy of Management Journal* 15.4 (1972): 407-426.

[iii] For an analysis of methodological reductionism see Robert Keith Sawyer, *Social Emergence: Societies As Complex Systems* (Cambridge: Cambridge University Press, 2005).

[iv] Bertalanffy, “History and Status,” 423

[v] Boulding, Kenneth E. "General systems theory-the skeleton of science." *Management science* 2.3 (1956): 197-208. Kalman, R. "On the general theory of control systems." *IRE Transactions on Automatic Control* 4.3 (1959): 110-110. Kubo, Ryogo. "Statistical-mechanical theory of irreversible processes. I. General theory and simple applications to magnetic and conduction problems." *Journal of the Physical Society of Japan* 12.6 (1957): 570-586. Simon, Herbert A. "The architecture of complexity." *General systems* 10.1965 (1965): 63-76. Buck, Roger C. "On the logic of general behavior systems theory." (1956).

[vi] Von Bertalanffy, Ludwig. "The history and status of general systems theory." *Academy of Management Journal* 15.4 (1972): 407-426.

[vii] The two leading figures in the ANT movement are Michel Callon and Bruno Latour. See Michel Callon, John Law, and Arie Rip, eds. *Mapping the Dynamics of Science and Technology*. (London: Macmillan, 1986); Michel Callon, "Actor-Network Theory–The Market Test" *Actor Network Theory and After* (1999): 181-195; Michael Callon, et al. "From Translations to Problematic Networks: An Introduction to Co-Word Analysis." *Social Science Information* 22 (1983): 191-235; Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge: Harvard University Press, 1987); Bruno Latour, "Reassembling the Social—An Introduction to Actor-Network-Theory" in *Reassembling the Social-An Introduction to Actor-Network-Theory* (London: Oxford University Press, 2005); and Graham Harman, *Prince of Networks: Bruno Latour and Metaphysics* (Prahran: Re. Press, 2009).

[viii] Latour, Bruno. "On actor-network theory. A few clarifications plus more than a few complications." *Soziale welt* 47.4 (1996): 369-381.

[ix] According to Bertalanffy's account, the philosophical uptake of the new mode of thought was primarily manifested in those projects that pioneered, before the 1940s and 1950s, a systems-based approach to philosophical discourse, such as "Nicolai Hartmann's theory of categories, the doctrine of emergent evolution, Whitehead's 'organic mechanism,' and dialectical materialism" (Bertalanffy, "An Outline of General System Theory," 135)

[x] See Michael Esfeld, "Holism and Analytic Philosophy," *Mind* 107 (1998): 365-380; see also his *Holism in Philosophy of Mind and Philosophy of Physics* (Springer, 2001).

[xi] Consider, aside from the ANT of Bruno Latour, the assemblage theory of Gilles Deleuze (*A Thousand Plateaus: Capitalism And Schizophrenia Vol. 2* [Minneapolis: University Of Minnesota Press, 1987]), the "intra-worldings" of Karen Barad's work (*Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* [Durham, NC: Duke University Press Books, 2007]), and the network theories of Michel Serres (*Hermes*. Vol. 1. Éditions de Minuit, 1968).

[xii] See Richard Hare, *The Language of Morals* (Oxford: Clarendon Press, 1952). See also his "Supervenience" *The Aristotelian Society Supplementary* 58: 1-16. For an analysis of Hare's metaethics's relationship to emergence and supervenience, see Terence Horgan, "From Supervenience to Superdupervenience: Meeting The Demands Of A Material World," *Mind* 102 (1993): 555-586.

[xiii] See Terence Horgan, "From Supervenience to Superdupervenience: Meeting The Demands Of A Material World," *Mind* 102 (1993): 555-586.

[xiv] Already in 1950, Bertalanffy acknowledged that although his general systems theory would galvanize psychology, physics, economics and sociology, it was "equally important to philosophy of science" (Bertalanffy, "An Outline of General System Theory," 163). Larry Laudan documents the relevance of holism to the philosophy of science in his *Science and Relativism: Some Key Controversies in the Philosophy of Science* (Chicago: University of Chicago Press, 1990).

[xv] van Orman Quine, Willard. *Two Dogmas Of Empiricism*. (Netherlands: Springer, 1976).

[xvi] See Peacocke, Christopher. *Holistic Explanation: Action, Space, Interpretation*. Clarendon Press, 1979

[xvii] Putnam, Hillary. (1986) Meaning holism. In: *The philosophy of W.V.Quine,* ed. L. Hahn & P. Schlipp. Open Court; Harman, Gilbert. "Meaning holism defended." *Grazer Philosophische Studien* 46 (1993): 163-171.

[xviii] Stephen Pepper, "Emergence" *The Journal of Philosophy* 23 (1926): 241-245; Mark Bedau and Paul Humphreys, *Emergence: Contemporary Readings in Philosophy and Science* (Cambridge: MIT Press, 2008); Jaegwon Kim, "Emergence: Core Ideas and Issues" *Synthese* 151 (2006): 547-559; Russ Abbott, "Emergence Explained: Abstractions: Getting Epiphenomena to do Real Work," *Complexity* 12 (2006): 13-26.

[xix] For an introduction to this term, see Jaegwon Kim's "SUPERVENIENCE AS A PHILOSOPHICAL CONCEPT*," *Metaphilosophy* 21 (1990): 1-27; "Concepts Of Supervenience," *Philosophy And Phenomenological Research* 45 (1984): 153-176; "Psychophysical Supervenience" *Philosophical Studies* 41 (1982): 51-70; "'Strong' And 'Global' Supervenience Revisited," *Philosophy And Phenomenological Research* 48 (1987): 315-326; and, *Supervenience And Mind: Selected Philosophical Essays* (Cambridge: Cambridge University Press, 1993).

[xx] Quine, Willard Van Orman, and Joseph Silbert Ullian. *The Web Of Belief*. Ed. Richard Malin Ohmann. Vol. 2 (New York: Random House, 1978)

APPENDIX 5
A FEW THESES ON THE MATERIALISM AND THE MATERIALITY OF KNOWLEDGE

> "The statement is always given through some material medium, even if that medium is concealed, even if it is doomed to vanish as soon as it appears."
> -Foucault

Like a Nietzschean beast of burden, the term "material" carries heavy cargo. It can refer to the *materiality of things*. i.e., to their being made from matter rather than spirit. But it can also refer to the *materialist underpinnings of things*, i.e., to their being entrammeled in determinate social and historical circumstances. The first of these meanings is the one privileged by the "New Materialism" movement of Bruno Latour, Donna Haraway and Jane Bennett, among others,[i] while the second is the one we inherit from the "Historical Materialism" of Ludwig Feuerbach, Karl Marx and Friedrich Engels. In the view defended here, conceptual networks are material in both of these senses. They are material in the "old" sense that, much like the capitalist mode of production described by Marx in *Das Kapital* (1867), they are born under the heels of a particular time and place. And they are material in the "new" sense that the circumstances of their genesis are tied to, and tied up with, a whole panoply of physical objects, techniques and processes that are part and parcel of scientific research and scientific thought—what, in *Meeting the Universe Halfway* (2007), Karen Barad calls "material entanglements" or "matterings."[ii] A comprehensive theory of historical epistemology's conceptual networks, it follows, will be asymptotically related to the "old" philosophy of materialism and the "new" philosophy of materiality, incorporating elements from both without being identical to either.

Historical Materialism—Marx, Althusser and Lecourt

The connection between the historical epistemology and Marx's historical materialism has already been elucidated, rather eloquently and with impressive attention to detail, in Dominique Lecourt's *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (1975). Lecourt, who studied under Louis Althusser and Jacques Derrida at the École Normale Supérieure in the 1960s, makes a strong case

for interpreting historical epistemology as a descendant of Marx's dialectical materialism. His case rests upon the claim that Bachelard, Canguilhem and Foucault recapitulate, in the arena of the philosophy of science, the materialist critique Marx leveled against Hegel's idealism in the realm of epistemology. Recall that in the *1844 Manuscripts* Marx reproaches Hegel for folding all dimensions of experience under the dialectical logic of a disembodied thought and for annulling, for the sake of the infinite, "the actual, sensuous, real, finite, particular."[iii] In a similar fashion, Lecourt argues, Bachelard, Canguilhem and Foucault rebuff classical theories of science (especially those of an idealist bent) by honing in on precisely those components of scientific rationality that these theories try to suppress, i.e., the actual, sensuous, real, finite and particular (which is to say, socio-hisotrical) determinants that condition the trajectory of scientific discourse. What separates "the epistemological tradition inaugurated by Bachelard" from more orthodox theories of science, such as Carnap's and Popper's, then, is that the former plays Marx to the latter's Hegel; that the latter remain mired in a form of idealism while the former "is ranged in the materialist camp."[iv]

Because Lecourt's argument in favor of an "old" materialist reading of historical epistemology is long and intricate, I will limit myself to discussing two aspects of it that are relevant for our purposes. The first is the importance Lecourt attaches to the thought of Louis Althusser. The second is his account of how the Marxist category of *production* is mobilized by Bachelard, Canguilhem and Foucault (as an alternative to the Kantian notion of *synthesis* or the Humean idea of *association*) to make sense of the provenance of scientific knowledge.

In his person and work, Althusser stands as a sort of missing link between historical epistemology and Marxism. Before coming into his own as one of the most prestigious and provocative Marxist theorists of the 20th century, he studied philosophy under Bachelard at the École Normale Supérieure and, after being appointed *caïman* in philosophy (Director of Studies) at the same institution in 1948, went on to teach a variety of courses on Marx that left a long lasting influence on a whole generation of French intellectuals, Foucault and Derrida among them. In books such as *For Marx* (1965) and *Reading Capital* (1965), Althusser—the Kojeve of Marx, as I like to call him—pioneered an anti-humanist, formalist and

scientific reading of Marx that, according to Lecourt, restored to European philosophy "a truth intolerable to all opportunism—that historical materialism as founded by Marx in *Capital* really is, in the fullest sense of the word, a *science*."[v] This intolerable truth "found[ed] the unity of Epistemology and the History of the Sciences, hitherto only practiced and postulated"[vi] and made overt the otherwise covert theoretical bond connecting the *science of history* (Marx) and the *history of science* (Bachelard, Canguilhem and Foucault).

By jamming epistemological disputes about knowledge and science into philosophical and partisan debates about political economy, Althusser not only succeeded in bringing the scientific to bear on the social and the historical, but he also managed to the set the theoretical groundwork needed for the reverse operation. He made possible, theoretically, the application of the social and the historical to the scientific or, what amounts to the same thing, a *social* and *historical* reading of scientific rationality. The lesson we learn from Althusser's reading of Marx, in other words, is not simply that the study of the capitalist mode of production cannot shy away from scientific considerations concerning the existence of objective laws and formal structures (which, Althusser claims, is what Lenin saw but the French existentialists oversaw),[vii] but also that *the opposite is true too,* i.e., that the study of scientific discourse cannot turn a blind eye to the determinate social and historical conditions in and under which scientific rationality unfolds. According to Lecourt, this is what Bachelard, Canguilhem and Foucault understood but Carnap, Popper and Kuhn could never grasp.[viii] If the link Marx recognizes between capitalism and structural analysis is what defines his mature work, Lecourt says, "the link [Bachelard, Canguilhem and Foucault] recognize between epistemology and the actual practice of the history of the sciences" encapsulates the *differentia specifica* of historical epistemology as a mode of philosophical engagement.[ix]

The second aspect of Lecourt's work I would like to mention is the accent he places on the categories of *production* and *labor*. Influenced by Althusser's claim in Part One of *Reading Capital* that epistemology "must abandon the mirror myths of immediate vision and reading, and conceive knowledge *as production*,"[x] Lecourt argues that when Bachelard, Canguilhem and Foucault talk about the production or formation of scientific knowledge (as in the title of Bachelard's *The Formation of the Scientific Mind*

and Canguilhem's *La formation* du *concept de réflexe aux XVII et XVIII siècles*), they are implicitly telling their audience that scientific knowledge is not founded by the associations (Hume), intuitions (Bergson) or subjective syntheses (Kant) of conscious agents, but produced by the determinations of formal systems that have determinate objective reality outside the narrow limits of a subjective mind.[xi]

Nestled between the expressive agency of a subject and her discourse, then, we find a system of rules and objects—a "means of theoretical production," says Althusser—that conditions that which appears in a subject's discourse. In the case of scientific discourse, these systems are mechanisms of epistemic production that, as analogues to capitalism, regulate the relationship between thought labor and its raw materials. The sole difference here being that while capitalism sets its sights on the thought and wage labor of the industrial working class and the raw materials that go into the production of economic goods, the systems of epistemic production that I am calling conceptual networks target the creative and world-building activity (i.e. labor) by means of which a particular category of workers (i.e. scientists) manufacture a peculiar set of abstract and concrete goods (i.e. theories, models, concepts, apparatuses, etc.) that carry a unique form of value (i.e. epistemic value).

In his influential interpretation of historical epistemology, them, Lecourt defends his materialist reading of on two grounds. Taking his lead from Althusser's structural reading of Marx, he argues first that there is an indelible bond at the level of theory between *the scientific* and *the material.* And, second, he argues that Bachelard, Canguilhem and Foucault take scientific concepts to be products of labor. They take science to be a social form. [xii] Both of these insights are used to lend legitimacy to the conclusion that historical epistemology, as a mode of philosophical thinking, "belongs in principle to […] 'historical materialism,' the Marxist science of history."[xiii] This conclusion, I hold, give us a sense of the materialist foundations of conceptual networks, which are *produced* from concrete human activity, from the very real, very messy and very empirical realm of human life.

New Materialism—Objects, Matter and Instruments

In recent years, advocates of the so-called "new materialism" movement have articulated a different conception of the material that concentrates not so much on the social and historical conditions that sculpt the physiognomy of scientific rationality (although these, too, matter) but on the technical and material variables that underwrite the constitution of knowledge in history. While "old" materialists are prone to worry about whether or not the social totality is over-determined by an ideological superstructure and by whether or not history has a *telos*, "new" materialists shift the terms of analysis and spend their time wondering instead whether physical objects and material entities might turn out to be the forgotten underdogs of the history of epistemology and whether scientific instruments and apparatuses speed up or retard the progress of science. Although still historical in nature, this conception of materiality reforms the earlier materialism of Marx and Engels by giving the realm of non-living things a newly found sense of relevance in epistemology. Of course, as cultural products conditioned by determinate labor and historical circumstances, conceptual networks are material in the Marxist sense, but since they are also constituted with the aid of physical objects, apparatuses and instruments, they are also material in the second sense just discussed. They sprout from the clash between the thrust of language (discourse) and the resistance of matter (materiality) and from the coupling (or, as Karen Barad would say, "intra-action") of theoretical frames and experimental techniques of scientific research. Hence, it is more than the discursive limits of science that are incriminated in the production of scientific truth. Also at play are what Karen Barad calls "the material limits" of discourse, "the material constrains and exclusions, the material dimensions of agency, and the material dimensions of regulatory practices" that animate scientific thought.[xiv]

Historical epistemologists pay homage to these material limits by recognizing that the physical objects and material techniques scientists employ in their professional lives are not passive "applications" of theoretical knowledge that simply make useful what already existed in, and as, theory, but theories incarnate (Bachelard says "theories materialized"[xv]) that aid and abet scientists in bringing about scientific truth. Against phenomenologists and critical theorists, they hold that a certain type of instrumental rationality is essential for the scientific mind. But this instrumental rationality is not the not the practical

reason of Odysseus and Juliette that Adorno and Horkheimer condemn in *The Dialectic of Enlightenment* (1944) or the abstract reason that Merleau-Ponty scorns in the "Introduction" to the *Phenomenology of Perception* (1945), but the inventive reason of scientific apparatuses that David Bair and Hans Reichenbach describe in *Thing Knowledge: A Philosophy of Scientific Instruments* (2004) and *The Rise of Scientific Philosophy* (2004), respectively.

In *KL,* Canguilhem emphasizes the generative power of this instrumental rationality by stating that concepts are not products of a transcendental operation of consciousness but upshots of experimental procedures that depend, for their efficacy, on the right functioning of all kinds of material tools, instruments and devices. Using the biological sciences as an example, he writes: "the issue is not using experimental concepts but experimentally constituting authentically biological concepts."[xvi] The issue, in other words, is not mechanically applying abstract schemas (form) to the order of nature (matter) in order to harvest nomological knowledge but creating, through material practices ad experimental regimes, the very schemas that make up the conceptual network of biological thought. And this means that for Canguilhem, as Méthot (2012) has claimed, "the formation, transformation, and rectification of concepts […] is intrinsically bound with the experimental, material, technical, and cultural contexts in which concepts are operationalized."[xvii]

Bachelard, who was inspired by the increasingly active role that observational apparatuses came to play in the physics of the early 20th century (especially in quantum physics and theories of relativity), also believes in the importance for concept generation of material and technical contexts. According to Schuster and Watchirs (1990), for Bachelard

> A science takes shape in some limited and strictly controlled technical-experimental context in which simultaneously, (a) phenomena are produced and systematically varied in their relevant parameters, and (b) a system of interdefining ('interfunctioning') mathematicised concepts is created which directs the material realization of the phenomena and the variation of their aspects. A science is not built from natural facts, nor deduced from a priori concepts; it subsists in the resonation or interplay of the couple (a) and (b), denoted by Bachelard respectively as 'technical materialism' and 'applied rationalism.'[xviii]

What is traditionally dismissed as the mere "hardware" of scientific rationality—the beakers, the notebooks, the computers, the microscopes, the rulers, the lenses, the balances and survey sheets, etc.—is in reality the lair of scientific conceptuality since it is in the depths of these "limited and strictly controlled technical-experimental contexts," and not in the realm of pure reason or sense experience, that scientific concepts are created. "It may well be the instruments," he writes in *NSS*, "that produce the phenomenon in the first place."[xix]

In *MR,* Bachelard deploys this experimental epistemology to stage a frontal attack on classical phenomenology. Using the term "phenomenology" to refer not only to the philosophical program launched in the first half of the twentieth century by Edmund Husserl but to any study of the logic of appearance (including scientific discourse), Bachelard argues that if phenomenology wants to do justice to the specificity of scientific experience, it must be displaced from its original seat in subjective idealism and be replaced with a "materialist phenomenology"[xx] or an "instrumental phenomenology"[xxi] that does not repress the material and technical planes in which scientific ideas are organized, composed, tested and animated. The "things" that concern the scientific gaze—i.e. the atoms of the physicists, the elements of the chemists, the cells of the biologists, etc.—do not simply *appear* to consciousness because of consciousness's own transcendental, synthetic activity, as Husserl asserts. Rather, these "things" are commanded through the manipulation, orchestration and fine-tuning of theoretical frames and instruments inside the laboratory, through the activation of science's "technical will."[xxii] In science "nothing comes of itself. Nothing is given. Everything is constructed." This is why, in what Schuster and Watchirs (1990) call an "ironic jibe at positivist dogma," Bachelard disregards the vernacular of classical phenomenology, describing scientific "things" not as "phenomena" that arise from a subjective, transcendental vector of constitution, but as but as "phenomeno-techniques"[xxiii] that are produced by the conditions of abstract thought, which are "inseparable from those of scientific experiment."[xxiv]

This shift from phenomenological constitution to technical construction is doubly instructive for epistemology. First, it tells us that the old distinction between "the rational" and "the empirical" has been superseded as reason cannot be separated, even in theory, from its application. Gone are the days "when

knowledge was compartmentalized into conceptual knowledge and applied knowledge, *a priori* principles and *a posteriori* principles."[xxv] Second, it also tells us there is a gap between *the science of experience* (phenomenology) and *the experience of science* (historical epistemology). Whereas the former posits a fundamental *continuity* between the "things" (i.e. phenomena) of everyday experience and those of scientific experience, the latter asserts a radical *discontinuity*. "In our opinion," Bachelard writes, "the following postulate must be accepted in epistemology: the object cannot be designated as an immediate 'objective' [because] there is a very real break between sensory knowledge and scientific knowledge."[xxvi] And this break between the sensible and the scientific requires that we think about the process of objectification not as the labor of a transcendental or embodied subject but as the effect of a "scene" that includes animate and inanimate players, subjects, things and apparatuses. The break, in other words, requires that we accept that the infamous "scientific city" that Bachelard talks about in almost all of his published works is less a Kantian "kingdom of ends" and more of a Latourian "democracy of things."[xxvii]

Although he does not speak of a democracy of objects, in his lectures on governmentality Foucault captures the materiality of scientific discourse by characterizing discourse as "the intrication of men and things." By "things," however, Foucault does not mean the phenomena that bombard consciousness as appearance (Hussel's "things themselves") or the unapproachable "X's" that lie dormant in the realm of the unconditioned (Kant's "things-in-themselves"), but those material objects and physical contraptions that discourse both *is* and *is about*, i.e., the things that Hook (2011) describes as discourse's "material conditions of possibility."[xxviii] These "things" include the wheel, the gallows and the stake that make up the "microphysics of power" of the eighteenth century in *DP*;[xxix] the classroom tables, fixtures and architectural layouts that administer the "discursive orthopedics" of the Victorian period in *HS*; the baths, the rotatory swings, post mortems and *lettres de cachet* that circumscribe the nosography of the Classical Age in *HM*; and the beds, scalpels and clinical questionnaires that furnace the "technical armature"[xxx] of the medical gaze in *BC*.

In "Discourse, Knowledge, Materiality, History: Foucault and Discourse Analysis," Derek Hook lambasts as banal and "ludicrous" the poststructuralist reading of Foucault popularized in the '80s and

'90s by Yale School literary theorists according to which Foucault's concept of discourse is little more than a Nietzschean free play of signifiers without signified, words on words on words *ad inifinitum*. If one tunes into the polymorphic frequencies of Foucault's discourse, Hook contends, one realizes that discourse, for Foucault, is "tied to physical and material arrangements."[xxxi] Discourse is a fusion of text and context that involves speech and language (i.e. words) and devices and instruments (i.e. things). Discourse is *les choses et les mots*. Any reading, therefore, that equates scientific discourse with only one of its components—i.e. textuality—, aside from falling victim to the mereological fallacy of confusing the part with the whole, runs the risk of "underestimating the discursive effects of the material and the material effects of the discursive."[xxxii] Hook writes:

> Without reference to materiality, discourse analysis remains condemned to 'the markings of a textuality,' a play of semantics, a decontextualized set of hermeneutic interpretations that can all too easily be dismissed. More than this, by fixing on textual effects, discourse analysis aids […] in the contemporary effacement and denial of its material effects and appears to risk a dangerous reductionism in thinking power.[xxxiii]

It is not only what scientific knowers say (*parole*) but also what they do (*praxis*), how they do it (*method*) and what they do it with (*techne*) that determines the circumference of their discourse and brings their utterances within the domain of the "scientific." The interplay of speech, action, method and instrument explains why our various knowledges in the West—our knowledge of madness, of criminality, of the living, of matter, of sexuality—are not emaciated codes without flesh but material realities one can lay one's hands and eyes on. Could anyone deny our knowledge of penal rationality is, quite literally, framed by the gallows? That the scalpel etches the outline of our clinical discourse? Or that the very law of our sexuality, for us Victorians at least, comes to rest in the confessional booth of the priest and the reclining couch of the psychoanalyst? After Foucault, would anybody deny, quoting Hook one more time, that "torture is a form of dialogue"[xxxiv]?

The point here is genetic rather than ontological. Much like for communists (Marx and Engels) the objectivity of the world of historical experience is conditioned by the technical conditions of social labor so, too, for historical epistemologists the objectivity of scientific experience is conditioned by the

instrumental conditions of scientific labor. And much like for pragmatists (Dewey and Pierce) human knowledge depends on a generalized form of instrumental action (i.e. doing)[xxxv] so, too, for these figures scientific knowledge depends on a form, this time a specialized one, of instrumental action (i.e. rational experimentation). Hence, one would miss the mark widely if one thought the gallows, the booths and the microscopes "reflect" or "implement" the abstract theories that make up the conceptual networks of criminology, sexology and biology respectively because the relation between instrumental and theoretical reason is one of co-constitution and not one of implementation, enforcement or mirroring. Conceptual networks determine the limits of scientific knowledge, instrumental possibilities included. But instrumental actualities, in turn, bring new conceptual possibilities, purely theoretical ones included, within scientific reach. For us, this entails two different consequences. First, it means that scientific instruments must be conceptualized and treated as theoretical concepts that happen to have spatiotemporal coordinates. And, second, it means that conceptual networks must be materialized and treated as constellations that "emerge" from a base that involves social and historical variables as well as technical and material determinants.

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[i] Coole, Diana, et al. *New materialisms: Ontology, Agency, And Politics* (Duke University Press, 2010); Van der Tuin, Iris, and Rick Dolphijn. "The Transversality Of New Materialism." *Women: A Cultural Review* 21 (2010): 153-171.

[ii] Barad, Karen. *Meeting The Universe Halfway: Quantum Physics And The Entanglement Of Matter And Meaning* (Duke University Press, 2007).

[iii] Marx, Karl. *Economic and philosophic manuscripts of 1844* (Prometheus Books, 1988), 64

[iv] Lecourt, Dominique. *Marxism and Epistemology: Bachelard, Canguilhem and Foucault* (London: NLB, 1975), 19

[v] Lecourt, *Marxism and Epistemology,* 7

[vi] Lecourt, *Marxism and Epistemology,* 127

[vii] In Part I of *Reading Capital,* Althusser himself makes it clear that only a scientific interpretation of *Das Kapital* allows us to make sense of "that cry of scientific conscience, […] that permanent revolutionary manifesto for *knowledge*, [that] most acute consciousness of scientificity in its lucid and intransigent rigour" that erupted in the early twentieth century: Leninism. If Lenin was possible after Marx, this is only because Marx himself paved the way for Lenin precisely by closing himself off from the anthropological humanism of his youth. See Althusser, Louis, and Etienne Balibar. *Reading Capital* (London: Verso, 1997), 31.

[viii] Lecourt, *Marxism and Epistemology,* 173

[ix] Lecourt, *Marxism and Epistemology,* 126

[x] Althusser, *Reading Capital,* 24

[xi] Althusser, *Reading Capital*, 44-46

[xii] For Lecourt, the single most important text for understanding this debt is *AK,* which has been systematically underappreciated by Foucault scholars who often dismiss it as nothing more than a self-indulgent and bastardized

version of *OT*. Against this pattern of dismissal, Lecourt insists that this book truly "represents a decisive turning-point in Foucault's work" (Lecourt, *Marxism and Epistemology,* 189) since it is in its pages that Foucault finally clarifies once and for all something that was presupposed but not explicitly recognized in his previous works—namely, that scientific discourse is first and foremost a *praxis* rooted in historico-material reality (Lecourt, *Marxism and Epistemology,* 196). The language of praxis and action that permeates *AK* and that is reminiscent of Marx discloses the similarity between Foucault's approach to historical reason and "the scientific concept of history as it appears in historical materialism" (Lecourt, *Marxism and Epistemology,* 189). "If my interpretation is correct," Lecourt goes on to say, "the task of archaeology is […] to constitute the theory of the discursive 'instance' insofar as it is structured by relations invested in institutions and historically determinate regulations" (Lecourt, *Marxism and Epistemology,* 198). This task is difficult to grasp outside a Neo-Marxist frame of reference.

[xiii] Lecourt, *Marxism and Epistemology,* 126

[xiv] Barad, *Meeting the Universe,* 192

[xv] Bachelard, *NSS*, 13

[xvi] Canguilhem, *KL,* 6

[xvii] Pierre-Olivier Méthot, "On the Genealogy of Concepts and Experimental Practices: Rethinking Georges Canguilhem's Historical Epistemology," paper presented at the Conference on *Epistemology and history From Bachelard and Canguilhem to Today's History of Science* (Held by the Max Planck Institute for the History of Science, 2012), 120

[xviii] J. A. Schuster and G. Watchirs. "Beyond The Kuhn/Bachelard Problematic" In *Experimental Inquiries*, ed. H.E. LeGrand (Dordrecht: Reidel, 1990),1-48

[xix] Bachelard, *NSS,* 13

[xx] Bachelard, *MR,* 12

[xxi] Bachelard, *FSM*, 218

[xxii] Bachelard, *FSM*, 217

[xxiii] Rheinberger, Hans-Jörg. "Gaston Bachelard And The Notion Of 'Phenomenotechnique.'" *Perspectives on Science* 13 (2005): 313-328.

[xxiv] Bachelard, *FSM*, 229

[xxv] Bachelard, *NSS*, 51

[xxvi] Bachelard, *FSM,* 237

[xxvii] Latour, Bruno. *We Have Never Been Modern* (Harvard University Press, 2012).

[xxviii] Hook, Derek. "Discourse, Knowledge, Materiality, History: Foucault and Discourse Analysis." *Theory & Psychology* 11 (2001): 521-547.

[xxix] Foucault, DP, 33

[xxx] Foucault, BC, 120

[xxxi] Hook, "Discourse, Knowledge, Materiality," 530

[xxxii] Hook, "Discourse, Knowledge, Materiality," 537

[xxxiii] Hook, "Discourse, Knowledge, Materiality," 542

[xxxiv] Hook, "Discourse, Knowledge, Materiality," 537

[xxxv] See Habermas, *Knowledge and Human Interests*, esp. chapters 2 and 5

APPENDIX 6
A FRENCH THEORY OF SCIENTIFIC CHANGE

The publication of Thomas Kuhn's *The Structure of Scientific Revolutions* in 1962 marked a watershed event in the history of the philosophy of science. Kuhn's argument that the history of the sciences is besieged by episodes of dramatic and intense conceptual change that produces epistemic incommensurability between the paradigms of "before" and "after" raised a host of theoretical problems that, in many ways, Anglo-Saxon philosophy was not prepared to address—questions about the nature and logic of history, questions about the revolutionary potential of epistemic change and questions about the limits of language. After Kuhn, however, one of the problems that surfaced as a Gordian knot in the philosophy of science was the problem concerning the "causes" and "nature" of this type change. Why does science overturn itself in radical moments of revolt? And how are these moments to be understood? I argue that well before 1962, French historical epistemologists were struggling with this issue and came up with three different "types" of change: local reformations, punctuated creations and total reorganizations. By analyzing these types of scientific change—changes in the fabric of a conceptual network—we may gain a greater understanding not simply of French historical epistemology but also about its relevance to contemporary debates in the philosophy of science.

Local Reformations.

In *PN*, Bachelard showcases the historicity of scientific notions through a close reading of the history of chemistry, whose discourse—he claims—underwent a radical reconfiguration in the late nineteenth century. During the late eighteenth and early-to-mid nineteenth centuries chemical discourse was overburdened by the substantialist assumptions and conceptualizations of Antoine Lavoisier, the "father of chemistry." In his famous *Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes moderns* (1789), which became the *de facto* origin of modern chemical knowledge as well as the basis of the nomenclature that remains in practice even today, Lavoisier tacitly

defined chemical elements as "substances" in the Aristotelian sense—that is, as *sui generis* "things" possessing an eternal and indestructible "nature." Under the aegis of Lavoisian epistemology, the concept of *the element* came to be identical with the concept of a substance. And since this particular concept was deeply engrained in the network of chemical norms at the time, occupying a central place in it, its substantialist undertones imbued the entire network of chemical discourse with a good dose of substantialist presuppositions that would come to permeate a series of other chemical concepts—such as the concept of heat, that of the electron. Indeed, Bachelard suggests that the entire normative network that constituted chemistry up until the mid 1800s was a scientific encasement of Aristotle's substance-attribute metaphysical framework. To be a chemist in the eighteenth and early nineteenth centuries, from the 1790s to the 1880s or so, meant to engage a set of concepts that were steeped in the pervasive substantialism of Lavoisier's corpus; it meant having to think through the units of that network and having to speak of, and about them; it meant to reference, annotate, circulate and index them. To be a chemical *knower,* one had to let one's thought lose itself in this particular epistemological configuration, and to let one's discourse be framed, shaped and regulated by it.

But with the rise of photochemistry in the late 1800s, an interesting thing happened. Photochemistry purged classical chemistry of its substantialist and "concretist" intonations by reforming the concept of the chemical element. This new sub-branch of chemistry (which at the time was defined as "the science of elements") made room for a more mathematical or "abstract" understanding of the nature of chemical elements. In this new epistemic setting, the meaning of the notion of the chemical element was altered in such a way that chemical elements were not longer seen as *sui generis* substances with an eternal nature (analogous to an "essence" or "soul"). They were seen as mathematical functions. By the end of the nineteenth century and the beginning of the twentieth, "a chemical substance [was] but a shadow of a number."[i]

This "sublimation" or "de-substantialization" of the concept of the chemical element represents an example of a *local reformation* of scientific network that brought about a revolution in chemical knowledge and, concomitantly, a re-formation and re-arrangement of its notions and concepts. The

change in one region of the network, in this case in the concept of the element, produced important conceptual or paradigmatic shifts in the history of chemistry. On the one hand, chemical agents ceased to be thought of as "things" with "properties" (which was the manifest effect of a historically repressed Aristotelianism) and came to be seen simply as formal relations in a formal web of abstract relations. On the other, because of the interconceptualism of scientific networks, once the concept of the element changed, other concepts that belonged to normative fabric of chemistry—such as the notion of heat, electron, and energy—changed as well in important ways. And from the ripple-effect of these changes, a new "period consciousness" was born in chemistry. Together, the local reformation of the concept and the collateral conceptual damage it produced made possible a modification in the orientation of the normativity of chemical discourse.

It is philosophically relevant that this susceptibility of chemical discourse to historical change is not presented by Bachelard in terms of a change in *normative content*, but merely in terms of a change in *normative orientation*. In other words, it is not as if Lavoisian epistemology exerted a weaker pull on the thinking of chemists in the early 19th century and this pull was strengthened with the march of history. Instead, what we see is simply a re-configuration of normativity, a re-arrangement in the norms that govern the production of truth in chemical science. We may capture this subtle though important distinction by saying that Lavoisian and post-Lavoisian systems of chemical norms were not equal in their normativity, but they were nevertheless equally normative. From an external viewpoint (the conjunctive viewpoint of 19th century chemistry *and* 20th century chemistry), the norms that defined these periods differ relative to one another and thus they constitute genuinely different systems, different frames of rational thought. But from an internal viewpoint (the disjunctive viewpoint of 19th century chemistry *or* 20th century chemistry), these systems play a similar gubernatorial function as far as the epistemology of chemistry is concerned.

Punctuated Creations

In a manner redolent of Bachelard, but using the example of natural history rather than chemistry and the figure of Maupertius rather than Lavoisier, Canguilhem shows that the history of the sciences is populated by moments of radical epistemological re-orientations introduced by what I take to be cases of another kind of network-event, *punctuated creations*. In his 1745 book *The Earthly Venus*, Canguilhem claims, Pierre Louis Moreau de Maupertuis made a critical intervention in late 18th century debates in natural history by utilizing the concept of "affinity" in order to challenge two dominant scientific theories regarding the formation of animals and the persistence of species: animaliculism and ovism. According to him, the genesis and formation of animals depended on the power of affinity that held between small parts carried in the seminal fluid of the animal's parents. This power explained the problem that had already tormented Aristotle in the 4th C. BCE—the problem of the generation of animals. According to Maupertuis, who put a lot of weight on this concept, affinity could even "explain the production of accidental variations, the line of succession of these variations from one generation to another, and finally the establishment or destruction of species."[ii] To us, this language of affinity appears to be "today no more than an empty word," Canguilhem writes, but in the epistemological context of the 18th century, this apparently vacuous notion "was an authentically scientific concept, charged with all the weight of Newtonian mechanics."[iii] Today, this concept lacks epistemic efficacy and it can no longer be invoked in scientific discourse, which has to do with the fact that other particular concepts have been invented that came to replace the concept of affinity in biological reasoning. The point here is not that the concept of affinity was reformed as we saw with the Bachelardian analysis of chemistry, the point is that the concept was put out of commission and other concepts were put into operation that took its place. But, like the local reformations we already mentioned, these punctuated moments of creation and destruction also produce rippling effects in scientific normativity and contribute to the overall shifts in scientific practice that continue to puzzle philosophers of science.

Total Reorganizations

According to Foucault, "when considered at the level of episteme"[iv] the science of labor and wealth is shown to have undergone two large-scale epistemological re-configurations in the history of thought that cannot be accounted for simply by recourse to local reformations or creations. The first of these reconfigurations took place in the transition from the 16th to the 17th centuries, from Renaissance to the Classical period. During the Renaissance, the science of money was ruled by a "network of necessities"[v] that had the logic of *affinity* and *resemblance* as its primary concepts. These concepts regulated the knowledge of wealth and engendered a "system from which [economic claims drew] their positivity."[vi]

In this 16th century network, the objectivity of the knowledge of wealth was grounded on the essential resemblance uniting two central terms of economics: metals (which were used for coinage) and wealth (which was the marker of value). By engaging in a close reading of various primary sources, Foucault establishes that in the 16th century, metals played a central role in economic transactions as signs of wealth only because there is a cosmic link between these metals and the value they signify. Metals were valid measures of prices and standards of measure because they were themselves objectively precious entities that possessed an intrinsic value that was contingent upon nothing other than the combination of their essence and existence. Come the late 17th century, however, the logic of resemblance gives way to the logic of representation and metals are no longer conceived of or thought of as material phenomena with intrinsic worth, rather their worth now was thought to come from the function they played in a complex system of exchange. Metals, in other words, no longer signified wealth because they were valuable; rather, they were valuable because they represented wealth. Foucault writes: "In order that the domain of wealth could be constituted as an object of reflection in Classical thought, the configuration established in the sixteenth century had to be dissolved."[vii] This dissolution instituted a new epistemology of money in which the *function* metals played rather than their *essence* determined their importance. And with this movement from essence to function came not only a new way of seeing money, but also a new way of thinking about wealth in general, a way that would itself be dissolved by the advent of

modernity—which found its zenith in the ambiguous "analytic of finitude" that haunted the relationship between the transcendental and the empirical, between Kant's *Critique of Pure Reason* and his anthropological works.

The point to be stressed here, without going into further detail, is that the science of wealth and labor—much like those of life and language—was under the sway of "positivities" or "rules of formation" that determined what it meant to partake and participate in economic science. And these positivities were subject to wholesale displacement in the Classical period and to another in the Modern period. From these displacements, new rules emerged that determined what it meant to be "in the rationality" of wealth. Sure several economic concepts were reformed from the Renaissance to the Modern period and many more were destroyed and created, but in these cases these reformations and creations were epiphenomena that piggy-back rode atop a more comprehensive network-event that put the entire network of the science of wealth on an entirely new footing.

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[i] Bachelard, *NSS*, 84
[ii] Canguilhem, *KL,* 34
[iii] Canguilhem, *KL,* 34
[iv] Foucault, *OT,* 180
[v] Foucault, *OT,* 173
[vi] Foucault, *OT,* 166
[vii] Foucault, *OT,* 174