

Lost in the Woods: Francis Bacon's Errant Pathways in Knowledge

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Abstract: Recovering Bacon's valorization of error illuminates the history of research. A scientific method directing reliable and useful inquiry is often attributed to Bacon. Yet household experimentation in his period was already efficient and useful. Bacon extended investigation in ways that deferred immediate use and consumed resources by encouraging investigators to wander in the pathways of error. Bacon develops this view of error in his reading of the myth of Proteus in which the investigator provokes matter (Proteus) into a state of error. Bacon's reading of the myth of Proteus did gender experimentation, as Carolyn Merchant has argued, but not in the ways that Merchant claimed. By valorizing error, Bacon distinguished his approach to experimentation from heterosocial practices.

Keywords: research, Francis Bacon, gender, labyrinth, Proteus.

1. Research as Error

1.1 Vital Matter, Gender, and Experimental Labor

This essay explores erring as a valorized epistemic tool in the early modern effort for humans to come to grips with inconstancy. In so doing, it engages long-standing debates concerning the degree to which science attempts to dominate the world, and relatedly, the degree to which scientific rhetoric seeks to fix knowledge into normative taxonomies and methods. These debates, particularly in the discussion of Francis Bacon's treatment of errant nature in his interpretation of the myth of Proteus, have involved feminist arguments concerning Bacon's view of experiment as a masculine torture or constraint of a passive, feminized Nature. In this essay, I suggest that such views of science's attempt to dominate through fixity and constraint are based in misconceptions of the significance of the mechanical arts in the Scientific Revolution. With "new science" and "mechanical philosophy" treated as synonyms in these older debates, experimental science is seen from a perspective that naturalizes mechanical objectivity and mathematical certainty as presumed objectives in science. However, the recent history of alchemy, vitalism, and perfective views of nature decenters the presumed dominance of mechanical philosophy in the history of experimentalism. Thus, other values can come to the fore, such as adaptive emergence, immersion, and transformation both of experimenter and of the experimental object. These, rather, than fixity, clarity, and certainty, are the

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experimental values at play in Bacon's interpretation of Proteus, and in Bacon's somewhat idiosyncratic interpretation of the myth, they are related to error as a valorized epistemic stance. Bacon, I argue here, distinguished error as a significant stage in the human intervention into nature via experiment.

Erring, or continual departure from a predetermined pathway, was deployed both in the quick-changing, adaptive manipulation of metamorphic nature through experiment as well as in the development of purposefully tentative, open-ended, and haphazard forms of inscription of the period, such as the experimental essay and the wish list (Keller 2014, 2020a). As Pamela Smith has discussed, a "cycle of trial, failure, replication, and a responsive, adaptive approach to unexpected outcomes," is a central experimental epistemology of the period (Smith 2020). Feminist science scholars have championed error as an epistemic stance premised upon deviancy rather than upon an adherence to norms (Thylstrup 2020, 194). However, in highlighting error in the work of Francis Bacon, I do not mean to act as an apologist for his gender politics. In fact, I ultimately agree with scholars such as Carolyn Merchant (Merchant 1980) that Bacon intended to gender experimental practice, by (in his view) elevating experiment from a domestic, heterosocial practice to an act of power and to an endeavor of public significance on a par with the imperial conquest of territory. He gendered experiment, however, not by casting it as the mechanical domination of passive Nature. Rather, immersive, transformative error that provoked Nature into ever more lively metamorphoses could serve a gendering role.

Aiming for error was itself a way to distinguish between the common household manipulation of nature and the more sophisticated, risk-taking, and resource-intensive forms of experimentation that Bacon intended primarily for epistemic ends rather than for use. Instead of the shortcuts, clear directions, and claims to efficacy that one might find, for example, in the genre of the domestic recipe (Leong 2018), Bacon developed a labyrinthine approach that indulged lengthy, circuitous and oblique routes, multiple iterations, and an intensive consumption of intellectual, material, and temporal resources, that, in the end, only ever arrived at knowledge of a probabilistic sort (Cf. Werrett 2019). Labyrinths were luxuries. In his bid for greater support for experimental knowledge Bacon made the case that funds were a necessity for those who "not only wandered [*pererrant*] in those of nature, but also opened a path in the labyrinths of art" (Bacon 1623, 71).

Thus, distinct from the pressing needs of useful, household experimentation, Bacon identified a zone of experimental investigation into nature that was intensive in resources, time, and effort, which did not aim to exit the process of experimentation as efficiently as possible in order to yield useful results. Rather, it separated experimental labor from its product, involuting effort in cycles of investigation which resulted not in an exit to use, but in further investigation, in a manner comparable to the medieval folk etymology of the labyrinth as "*labor intus*" or inner labor (Doob 1990, 97). The chymical *laboratorium* of the period always aimed to produce simultaneously both knowledge and power. The labyrinth, by contrast, had no [immediate] use.

Bacon, I argue, distinguished stages of experimental investigation. He thus demarcated some experimental labor specifically to wandering around in the pursuit of errant nature. Error serves Bacon as a means of freeing investigation from imperatives to produce useful, timely, and certain results. In a manner that adumbrates basic science research today (in contrast to technology), Bacon identifies a realm of intensive, slow, difficult, iterative, cyclical, uncertain, unending, and fundamentally not immediately useful experimental labor. This is the path of erring in knowledge.

1.2 Wandering as a Strategic Deferral of Truth

As embodied by the classical labyrinth, error in the European tradition was never entirely a negative phenomenon. Knights in romances such as Spenser's *Faerie Queene* had to find their way out of the Labyrinth of Error, but what enabled them to do so in the first place was their status as a knight *errant*, that is, one that broke free from a predictable place or path in life in order to quest further afield. Thus, error is not simply a lie or the antonym of truth.¹ Rather, as a personally transformative wandering through complexity, error "has never been wholly determined by an epistemological structure of truth but has always enjoyed a certain conceptual independence" (Thylstrup 2020, 194).

David William Bates has seen this orientation towards error as particularly characteristic of the eighteenth-century Enlightenment's founding of a "probabilistic process of discovery" and of "novel epistemologies" in contrast to the seventeenth-century Scientific Revolution (Bates 2002, vii). Bates argued that the eighteenth century saw a "frank admission that error is an important aspect of human understanding," an admission that allowed for an infinite deferral of truth, thus continually expanding the horizon of knowledge and forming an ideology of unending progress based on the continual error and future discovery (Bates 2002, ix). However, work on probabilism and the nature of facts in the seventeenth century shed light on the valorization of error in this earlier era (Shapiro 1983, 1994).

As I have argued elsewhere, the probabilistic deferral of ever arriving at a final destination for knowledge typifies the approach of Francis Bacon. Here, I reinterpret that probabilistic approach as one that valorizes error, in contrast to many views of Bacon. Julianne Werlin describes the late nineteenth-century disappointment with Bacon when readers began to understand that he had constructed "an ingenious maze of words that was not, in the end, so different from the intellectual systems he denounced" (Werlin 2015, 236). According to such critics, things were straightforward in the world and they become twisted

¹ Cf. Steadman 1961, who interprets Spenser's personification of truth, Una, and the labyrinth as "logical contraries" because truth is unitary and the labyrinth is multiplex. Unitary falsehood would be the logical contrary of unitary truth. The multiplex labyrinth operates in a different epistemic landscape altogether.

through sophistic intricacies. Werlin has recuperated Bacon's labyrinthine rhetoric and defended "the potential for failure, for error and misunderstanding" as occupying "an important place in Bacon's thought." Like Werlin, but from a rather different lens, I see error as a strategy that Bacon deploys in order to effect a multi-perspectival, adaptive approach to an inconstant world. Bacon discusses erring as a desirable state to provoke in nature and to enter into as an inquirer. Such errant pathways to knowledge differ markedly from the notion of method (or "path through") so often erroneously highlighted in the work of Bacon.

Bacon often stressed the need to lengthen and complicate investigation. In *Valerius Terminus* (circa 1603), he contended that, in contrast to anticipations of the mind, senses were more reliable "not because they err not, but because the use of sense in discovering of knowledge is for the most part not immediate" (Bacon 1857, "Valerius Terminus" in *The Works of Frances Bacon*, vol. 3, 244). In the *Novum organum*, he described how a very powerful form of experiment was that of the "alternation and ups and downs" of six other modes of operations in natural bodies. Such a "series or chain of alternations of this kind [. . .] is a thing very hard to grasp but very powerful for producing works. However, men are prey to and held fast by their colossal impatience both in the investigation and practice of things of this kind, even though this is like the thread of the labyrinth as far as major works are concerned" (Bacon 2004, "Novum Organum," 441). In other words, impatience held men back from applying the extremely time-intensive chain of experiments with which they might bind nature, even though this chain could thread them through the labyrinth. This attitude explains one posthumous anecdote associated with Bacon: "The lord St. Alban, who was not over-hasty to raise theories, but proceeded slowly by experiments, was wont to say to some philosophers, who would not go his pace, 'Gentlemen, nature is a labyrinth, in which the very haste you move with, will make you lose your way'" (Bacon 1859, "Apophtegms from Baconiana" in *The Works of Francis Bacon* vol. VII, 177). Bacon worked to delay investigators and to make them circle about the object of inquiry in multiple ways.

1.3 Clues and Labyrinths

In *Science and the Secrets of Nature*, William Eamon argued that Francis Bacon and his followers developed an epistemology of the "hunter, who follows clues to an unseen quarry" (Eamon 1994, 9). Eamon's argument was inspired by two articles about clues published by Carlo Ginzburg (Ginzburg 1979, 1980). Although Ginzburg noted that hunting for clues was an ancient practice, he also suggested that following clues offers the roots of a modern "scientific paradigm." Eamon argued that what typified Bacon's epistemology—and that adopted by his followers in the Royal Society—were such clues or guiding threads leading out of the thickets of error. However, seeing the following of clues as a novel early modern intervention in scientific method undercuts the longstanding history of the clue. It also pays insufficient attention to new ways that labyrinthine error appealed as a way of knowing.

Since the ninth century, a “clue” or “clew” meant a ball of thread; since the fourteenth, this “clue” was often used to denote a thread that might lead one out of a labyrinth of error, based on such popular accounts of the Cretan myth as Bersuire’s *Ovidius moralizatus* in which Daedalus advises the use of string to unfold (*explicare*) or unravel (*extricare*) the deceptive passages or *ambages* of the labyrinth. The unbroken, unravelling clue led the inquirer step by step from ignorance and doubt into certain knowledge (Keller 2020b). For centuries, the labyrinth co-existed alongside the clue as an epistemological structure that escaped the binary fixities of truth and falsehood (Thylstrup 2020, 194). Different approaches to knowledge could valorize the clue as an efficient means out of error or could valorize the labyrinth itself as a remarkable, multiplex work of art. The position one took related to one’s perspective upon the labyrinth, which was “convertible and relative,” changing its nature dynamically with changes in perspective (Doob 1990, 1). As Penelope Doob has written, for “maze-treaders” “vision ahead and behind is severely constricted and fragmented.” On the other hand, “maze-viewers, who see the pattern whole, from above or in a diagram are dazzled by its complex artistry” (Doob 1990, 1). The ability of a labyrinth to lead one into error could thus be a praiseworthy quality to be much admired. George Sandys described the “Labyrinth” at Alexandria (which he claimed was the model for Daedalus’ at Crete) as “full of winding paths as darke as hell, and rooms within one another, having many doors, to confound the memory, and distract the intention; leading into inexplicable error [...] not possible to thred, or ever to get out without a conductor” (Sandys 1615, 113).

Bacon deploys the trope of the labyrinth many times throughout his writings. Occasionally he does so in ways that seem to promise the offering of a clue. In particular, the clue appears to be a method of investigation that leads through the woods of particular experience towards more universal and certain axioms. In the *Novum Organum*, he criticizes those who entirely erred (“*aberrauerint*”), “either by leaving and deserting experience entirely, or by getting caught up in it and running up and down as in a labyrinth; whereas a properly established order leads by a direct road through the woods of experience to the open ground of axioms” (Bacon 2004, “*Novum Organum*,” 130–1). The title of his early and abandoned unpublished manuscript, *Filum Labyrinthi sive Formula Inquisitionis*, promises a precise textual technology to lead inquiry out of the labyrinth of error through a process of decrypting nature. Like a few of Bacon’s other works, this fragment is addressed “ad filios,” that is, to the true sons of learning, or a population of adepts (Jalobeanu 2008, 205). However, upon closer examination, Bacon’s promise of transmitting a clue to his select audience proves to be a red herring, as this text, like so many others, was left in a fragmentary form. Rather than clues, what Bacon actually offers are errant forms of knowledge.

1.4 Fragments as Errant Forms of Knowledge

Bacon did not offer clues as constricted shortcuts to knowledge that offered efficient, certain pathways out of a labyrinth of error and into truth. Instead, he

loosened knowledge in provisional, incipient, and fragmentary forms. These allowed knowledge greater latitude, in terms of its temporal framework, in terms of means of participating and of numbers of participants, and in terms of risk-taking, speculation and an expanded conceptualization of possibility. He did this not least in the *Valerius Terminus* itself. He ingeniously composed the *Valerius Terminus of the Interpretation of Nature: with the Annotations of Hermes Stella*, as the work of a pseudonymous author (Serjeantson 2017). This endowed his text with an air of great wisdom and authority, as the work of an ancient sage guiding the ignorant into the greatest mysteries. This was precisely the knowledge dynamic upon which the concept of a clue was based; an authoritative adept transmitted a secure path of knowledge to an initiate. Bacon's choice of pseudonym, *Valerius Terminus*, connoted definition, fixity, and certainty, as a reference to the ancient god of the boundary, *Terminus*. Yet, this text that promised such defined access to knowledge did not pass on an unbroken clue to its readers, as it was merely fragmentary. These fragments played upon the period desire and curiosity to see ancient lacunae of knowledge filled in. In this case, these lacunae were not actually lost pieces of knowledge, but were entirely constructed by Bacon. In short, he cut the ancient clue into fragments in order to destroy the bounds of ancient, defined, discipline and authority and to open empty spaces for knowledge to come.

Bacon deployed the aesthetics of ancient fragmentary manuscripts in order to create lacunae in his account of knowledge. In so doing, he was clearing space for future work that remained unwritten because it was not yet known. Already in this early writing, he anticipated that he would not live to see the completion of the great future work he was envisioning.

For the time present, in case I should be prevented by death to propound and reveal this new light as I purpose, yet I may at least give some awaking note, both of the wants in man's present condition, and the nature of the supplies to be wished; though for mine own part neither do I much build upon my present anticipations, neither do I think ourselves yet learned or wise enough to wish reasonably: for as it asks some sense, to make a wish not absurd (Bacon "Valerius Terminus," 233).

Bacon gave the text the form of an initiatory guide proffered by an ancient sage, whose guiding thread to certain knowledge had been broken by time. In reality, he never possessed such a clue. Rather than clues to knowledge, he could only offer hand-waving or uncertain hints at future knowledge (what he calls an "awaking note"); at this early stage, he did not even feel himself "learned or wise enough to wish reasonably."

2. Bacon on Proteus and the Torture of Nature

2.1 Liberty, Error, and Bonds

As Bacon had no direct path to offer to truth, he sought to fill in the gaps with various stopgaps. He sought to delay and extend inquiry over time. Multiplying approaches to knowledge and delaying the moment when the labyrinth was ex-

ited might allow a greater degree of knowledge to be accessed than was possible when specious forms of truth were rapidly sought. Bacon thus broadened the straightforward line of inquiry or clue into a multiplex approach that struggled with a continually transforming nature, as he discussed in his interpretation of the myth of Proteus in his *Wisdom of the Ancients*. His interpretation of the myth treated human intervention into matter as a lengthy process with multiple stages.

In Bacon's re-telling of the myth, every day Proteus would "count his flock of seals and then go to sleep. And if anyone wanted his help in any matter, the only way was first to secure his hands with handcuffs, and then to bind him with chains. Whereupon he on his part, in order to get free, would turn himself into all manner of strange shapes—fire, water, wild beasts, etc., till at last he returned again to his original shape" (Bacon 1858, "Translation of the de Sapiaentia Veterum," vol. 6, 725). Proteus was matter, according to Bacon, and Proteus with his flocks can be interpreted as "the universe with its several species according to their ordinary frame and structure," that is, "the face of matter unconstrained and at liberty, with its flock of materiate creatures." A skillful "Servant of Nature" could "bring force to bear on matter" and "vex it and drive it to extremities" until it transforms "itself into strange shapes, passing from one change to another till it has gone through the whole cycle and finished the period; when, if the force be continued, it returns at last to itself" (Bacon 1858, 726).

The question is how much, in his interpretation of this myth, Bacon valorized the act of struggle in experiment. Did Bacon seek to quell struggle as soon as possible, aiming to silence and dominate matter? Or, did Bacon see mutual struggle with Proteus itself as the process through which knowledge could be gained? This question has become embroiled in a debate between Peter Pesic and Carolyn Merchant (and other feminist science scholars) concerning the extent to which experimental science should be identified as a violent and misogynist form of domination of Nature. For Merchant, wrestling with Proteus aims to dominate Nature (gendered female) and render her passive, an interpretation that rests upon a view of Bacon as a proponent of mechanical philosophy. Pesic disagrees with Merchant, as well as with Evelyn Fox Keller and Sandra Harding on this question. He argues that feminist science scholars paint too stark of a divide between an active male experimenter and the passive, female object of experiment, that Nature is also powerful, and that the struggle between Man and Nature also transforms Man.

My interpretation of the myth finds that both Pesic and Merchant are correct in some respects and incorrect in others; neither, I argue, attend sufficiently carefully to the role of error in Bacon's formulation of Proteus nor to the various stages that appear in this myth (Pesic 1999, 2000, 2001, 2008, 2010; Merchant 1980; Fox Keller 1985; Harding 1986). My interpretation differentiates between stages and ends of experimentation in ways that Pesic and Merchant do not. The stage that is most greatly valorized for experimentation, I argue, is that of error.

In *Wisdom of the Ancients*, Bacon did not refer explicitly to error. However, his account of Proteus there and elsewhere maps onto many other discussions in which he regularly differentiated between nature in three states: free, in er-

ror, and in bonds. Across many works, Bacon likewise distinguished the history of nature of three kinds, that is: nature in her ordinary course, nature erring, and nature wrought.² The first, which involved no manual intervention or experiment, he argued, commonly served as the basis upon which axioms were falsely developed. Counterintuitively, nature in error served greater epistemic ends; such error could either occur naturally, through matter running into the “violence of impediments” on its own, or through the human vexing of nature; “For like as a Mans disposition is neuer well knowen, till hee be crossed, nor *Proteus* ever changed shapes, till hee was straightened and held fast: so the passages and variations of Nature cannot appeare so fully in the libertie of Nature, as in the trialls and vexations of Art.”³ Attempting to hold nature fast with “handcuffs” as though she were Proteus did not, however, lead to the fixation of knowledge, but rather to continual metamorphosis as nature struggled to escape this hold. The series of transformations that ensued revealed otherwise hidden “passages and variations.” It was a means to artificially induce the sorts of changes through which marvels appeared. Thus, while pretergenerations are metamorphoses of nature that occur naturally, experimental history records metamorphoses that are only revealed with the aid of the arts (Bacon 2004, “Parasceve,” 463).

Merchant applied the three states of nature (at liberty, in error, and in bonds) to Bacon’s Proteus myth of the *Wisdom of the Ancients*. However, in my view, she conflates vexing nature with binding nature, whereas these are two separate stages.

² Bacon 1605, Book II, 8. Bacon 1996, “Descriptio globi intellectualis,” 100–1. “But I shall set up the partitions of natural history on the basis of the force and condition of nature itself, which we find existing in a triple condition and subject, as it were, to three kinds of government. For nature is either *free* and left to go its own way and unfold itself in its usual course, that is, nature advances by itself without being interfered with or worked on in any way [. . .] or *again* it is quite forced and ripped from its state by the crookedness and arrogance of defiant and rebellious matter, and by the violence of impediments, as in the monsters and heteroclitites of nature; or *finally* it is restrained, moulded, complete transformed and as it were made new by art and human agency, as in artificial things. For in artificial things nature seems as it were made up, and we see bodies in an entirely new guise and a kind of alternative universe of things. Therefore natural history deals with either the *liberty* of nature, or its *errors* or *bonds* [. . .] I intend and mean only that nature, like *Proteus*, is forced by art to do what would not have been done without it: and it does not matter whether you call this forcing and enchainning, or assisting and perfecting.” Bacon 1623, 79. “Aut enim libera est Natura, & cursu consueto se explicans [. . .] Aut à prauitatibus, & insolentiis Materiae contumacis, & ab Impedimentorum violentiâ, de statu suo detruditur [. . .] Aut Denique ab Arte, & Operâ humanâ constringitur, & fingitur, & tanquam nouatur, ut in Artificialibus.” Bacon 2004, “Parasceve,” 455.

³ Bacon 1605, Book II, 10. See also Bacon 1623, 84. “sed porrò ad causas rerum indagandas, & Artium Axiomata deducenda, lucidiorem Facem accendet, quàm hactenus vnquam assulit. Quemadmodùm Ingenium alicuius, haud benè nôris, aut probâris, nisi eum irritaveris; neque Proteus se, in varias rerum facies, vertere solitus est, nis Manicis arctè comprehensus; similiter etiâ Natura Arte irritate, & vexata, se clariùs prodit, quam cùm sibi Libera permittitur.”

Bacon's three states of nature were implicitly reflected in the 1609 Proteus myth [...]. Here Proteus (matter) 'unconstrained and at liberty' or 'the universe with its several species according to their ordinary frame and structure' (i.e. nature at liberty); matter which 'turn[s] and transform[s] itself into strange shapes' is nature in error; while the 'force [brought to bear on matter] by vex[ing]' it is nature in bonds (Merchant 2013, 557, footnote 14).

Elsewhere, Merchant allocates Bacon's Pan, Proteus and Prometheus myths separately "to frame his idea of the three states of nature (free, erring, and in bonds)" (Merchant 2008, 760).

Bacon's interpretation of the Proteus myth does in fact implicitly cover three states. However, what Merchant does not acknowledge is that vexing nature is a process that starts at the beginning of Bacon's treatment of nature in error, and as a means to bring nature into the state of error. The three states that appear in the myth according to my interpretation are nature at liberty, vexed (that is in error; a state that can be brought about either naturally through the violence and impediments of matter or through human experiment), and in bonds (that is, held fast through continued force in a single, artificial state). Bacon differentiates the stages of vexing nature and binding nature when he says that those who approached Proteus would "first" "secure his hands with handcuffs" and "then" "bind him with chains" (cited above). The handcuffs meant pushing matter to extremities in order to provoke motion; binding meant quelling matter's motions through artificial force.

The reason why Merchant conflates vexing with binding is that Merchant's interpretation of Bacon rested on the assumption that Bacon viewed Nature mechanically and that the goal of experiment was to dissect a dead, passive, experimental object. As a result, her interpretation of Bacon's myth of Proteus does not engage the valorization of error as a way of visualizing vital processes of metamorphosis. The goal of vexing nature was to reveal the "passages and variations" that occur already invisibly within the labyrinths of nature. Experiment is thus, as it were, a process of adaptive labyrinth construction in real time. As matter attempts to move one way or another, the experimenter throws up another barrier, thus sticking fast to matter in its twists and turns. As those intricate adaptations to the experimental setup are made responsively to observed processes in nature, the complex structures that they trace and reveal build an observable labyrinth.

It is difficult to understand why matter that had gone through a series of transformations should of necessity return to its beginning, natural state when force is maintained (as cited above, "when if the force be continued, it returns at last to itself"). In fact, I argue, Bacon does not say this. Rather, his original Latin states that it only appears to return to its original state ("*quasi se restituat, si vis continuetur*" [emphasis added]) (Bacon 1609, 52). Based on other discussions of Proteus throughout Bacon's corpus, I interpret the final, fixed identity of matter that obtains when force is maintained past the period of metamorphosis not as a return to an original natural identity, but as an imposition of an artificial state. Humans could bind nature by artificially imposing a desired static form upon

nature. This was the third state to which Bacon referred in his myth. Nature became still again, as she had been when at liberty. However, she was maintained in this stable state through the forceful imposition of human power. This third state could offer humans much power, but little knowledge. The apparent stability, passivity, and fixity of Nature in this stage was deceptive, as it required human power to maintain. Such an imposition of an artificial state would obscure, rather than reveal, the inner passages and variations of nature. It would create “a kind of alternative universe of things” (Bacon 1996, “*Descriptio globi intellectualis*,” 100–1). Through “violent motions,” bodies “do not obtain any new stable and steady consistency from them, but a transient one which is always struggling to restore itself and break free” (Bacon 2004, “*Novum Organum*,” 423).

2.2 Chymical and Mechanical Arts in Bacon’s Interpretation of Proteus

Here, Bacon steps back from one of the arguments frequently made in the chymical tradition about the epistemic value of experimentation. Opponents of chymistry argued that art, as a forceful human intervention in nature, could not lead to knowledge about nature, but rather, knowledge of art. Chymists countered that their art was not contrary to nature. They distinguished *chymia* from the mechanical arts. The latter did not engage the qualities of matter and instead sought to quantitatively force nature against its will; *chymia*, by contrast, perfected nature, assisting it in fulfilling its will, and merely revealed its true, hidden qualities (Moran 2005, 2007). It thus did not produce objects that were artificial, but rather were the acme of perfected nature.

In his discussion of Proteus, Bacon engages this debate in a complicated way. Proteus, as a chief personification of metamorphosis, often recurred in chymical literature. However, Bacon drew on the violent struggle of the myth in order to take issue with the chymical interpretation of human art as assisting and perfecting Nature.

But if anyone gets annoyed because I call the arts the bonds of nature when they ought rather to be considered its liberators and champions in that in some cases they allow nature to achieve its ends by reducing obstacles to order, then I reply that I do not much care for such fancy ideas and pretty words; I intend and mean only that nature, like Proteus, is forced by art to do what would not have been done without it: and it does not matter whether you call this forcing and enchaining, or assisting and perfecting (Bacon 1996, “*Descriptio globi intellectualis*,” 100–1).

In fact, according to period debates over experimentation, it did matter very much whether art was assisting and perfecting nature, or going against it. By thus denying a period distinction between forcing and perfecting nature, however, Bacon does not deny the epistemic efficacy of experiment, nor does he attempt to replace chymical means of intervening in nature with mechanical ones. Rather, he pointed out that the chymical tradition also made interventions that would not have occurred outside of a laboratory setting. However, vexing nature in the

laboratory served the purposes of rendering visible those metamorphoses that also occurred when nature erred through the production of monsters. These purposeful instigations of change could be distinguished from the imposition of an artificial state that obtained when nature was forcefully held fast; the former pertained more to what were generally called the chymical arts and was more epistemic, and the latter pertained more to what were generally called the mechanical arts and was more operative.

Thus, whereas the chymical tradition continually intertwined the search for knowledge and for use, Bacon disaggregated different stages and ends of human intervention into Nature. He cleared a space for what we would call research or basic science, that is, an area in which humans, through laboratory means, can follow nature in its erring paths, without attempting immediately to apply that investigation to use. Even that epistemically oriented stage of vexing nature could make use of practices that were traditionally deployed for the purpose of use in arts. However, in redeploying those arts, Bacon's goal at that stage was primarily epistemic. As he specified, his main aim was not to bring "the several arts to greater perfection" but to make "all mechanical experiments" "as streams flowing from all sides into the sea of philosophy" (Bacon 2004, "Parasceve," 465). Bacon does not here differentiate the "chymical" and the "mechanical" arts; "mechanical" here comprises both arts that seek to qualitatively transform matter and those that seek to move matter quantitatively through weight and measure. However, he did distinguish between two sorts of arts, one more epistemic and one more operative; these two sorts map onto traditional divisions between the chymical and the mechanical arts. As arts that could most serve as the "bonds and handcuffs of Proteus" he identified those that transformed the substance or quality of materials by engaging natural processes of change, such as "agriculture, cookery, chemistry, dyeing: the manufacture of glass, enamel, sugar, gunpowder, pyrotechnics, paper and the like." In their transformation and perfection of specific materials, these would have been classified by many at the time as chymical processes. Of less epistemic use for the struggles of Proteus, argued Bacon, were the arts that applied force to bodies via what were considered at the time mechanical means; these included "weaving, woodworking, building, the work of millwrights, clockmakers, and so on" (Bacon 2004, "Parasceve," 463).

2.3 The Underemphasized Role of Error in the Debate over the Torture of Nature

Neither Pesic nor the feminist authors that he criticized treat error as the desirable state for knowledge production. Pesic is more correct than his opponents when it comes to the more mutual and active relationship between the provoker and the one being brought to a state of error during the struggle with Proteus. Nature is a powerful opponent with which the human must struggle. However, he is also not fully correct on this score, in at least three ways. First, based on Bacon's interpretation of the myth, at issue is not just that human and nature must heroically struggle together. It is rather that the human inquirer must adopt an erring approach in order to keep up with an erring Nature. Furthermore, the

language that Bacon chose to describe the interaction of Man and Nature was more oppositional than it had to be. Bacon explicitly elected to deploy an idea of vexation and force rather than assistance, liberation, and perfection. Finally, in the case of the final stage of Nature held fast, Bacon delineates a relationship between human and nature that does dominate Nature more than Pestic admits by violently fixing matter into a stable, artificial form for human use.

More recent interpreters of Bacon likewise undercut the role of error in his view of experiment. Dana Jalobeanu, for example, discusses Bacon's myth of Proteus without raising the issue of error (Jalobeanu 2015). Sophie Weeks, rather than emphasizing the role of error in the myth of Proteus, stresses the role of the clue in Bacon's version of the myth of Daedalus, which is then extrapolated from a discussion of mechanical arts to a discussion of experiment in general. According to Bacon, Daedalus's simultaneous building of the Labyrinth and invention of the clue symbolized how "the mechanical arts" "have power for the most part to dissolve their own spell" (Bacon 1905, *De sapientia veterum*, 843). Weeks concludes that through the "interpretation of the Daedalus fable, Bacon explains why mechanics plays such a significant role in inquiry. The difference between nature free and nature constrained by art (mechanics) is that whereas the former affords no clue to inquiry, mechanical contrivances are themselves clues" (Weeks 2008, 138). However, Bacon's identification of Daedalus' discovery of a clue out of a labyrinth with mechanics does not necessarily mean that mechanics provides the clue for the unravelling of nature, but only for the unravelling of mechanical things. They do not hold similar power over Nature whose labyrinths are far more subtle.

When it comes to knowing multiplex nature, the pertinent myth is not Daedalus, but Proteus. In Bacon's interpretation of that myth, we find no clue out of the labyrinth, but rather, an epistemically powerful deployment of error itself. Weeks' relation of the Daedalus myth to a contrast between nature free and nature constrained ignores Bacon's third category of nature in error. It thus also overrides the distinction Bacon draws between vexing nature for epistemic ends and constraining nature in order to impose an artificial form upon it for human use (primarily in the mechanical arts).

It is not surprising that Weeks does not relate Daedalus to nature in error because Bacon does not do so—and that is a very surprising move on his part. Daedalus' labyrinth had long symbolized error, a relationship canonized by classical sources such as the descriptions of Daedalus' labyrinth by Ovid and Virgil.⁴ Despite his extensive development of the idea of "nature in error" across many works, Bacon does not mention error in relation to Daedalus (Bacon, "De Sapientia Veterum," 843). Instead, Bacon interpolates error into the myth of Proteus, rather than into the myth of Daedalus, where it properly belongs. This surprising location of error serves as a rejection of the ways that the myth of Daedalus

⁴ Ovid, *Metamorphoses*, book 8, "Ducit in errorem variarum ambage viarum" and Virgil, *Aeneid*, book six, "hic labor ille domus et inexplicabilis error" (discussed in Doob 1990, 237).

more typically functions in relation to knowledge, that is, as symbolizing the straightforward following of clues out of a labyrinth of error. The myth of Proteus has no clue, only an immersive and adaptive struggle. Rather than following a clue out of the labyrinth, Bacon redeploys the twisting and turning ways of the labyrinth into its own epistemic approach, personified by a vexed Proteus.

3. Handcuffing Proteus as Experiments off the Beaten Path

Bacon's idiosyncratic interpretation of these common myths sought to differentiate his approach to experiment from approaches of his time and to push experimental efforts off the beaten path. The "handcuffs" of the myth meant, according to Bacon, pushing nature to an extremity. This aiming for extremes is apparent in an example he gave of "a handcuffing this Proteus of nature" that was an experiment of which, he claimed, "no man has yet made trial." This was "close distillation," the prime example that Bacon offered of the "*sortes*" or "Chances of Experiment." This form of experimenting was "irrational and as it were mad." It purposefully aimed to depart from commonsensical approaches to experimentation since the wonders (*magnalia*) of nature typically "lie out of the common roads and beaten paths, so that the very absurdity of the thing may sometimes prove of service."⁵

The chances of experiment were one means by which Bacon attempted to distinguish his approach from common household experimentation. By heating matter to a degree previously unheard of through new technological setups—unbreakable vessels, more highly regulated fire, inescapable material, extremities of temperature—close distillation, Bacon imagined, might forcibly prevent the parts of distillation from separating from one another or from escaping through smoke or steam. The aim here was not to force an artificial state but to mimic the power of natural processes beyond what traditional laboratory vessels had previously been able to achieve. Bacon compared "close distillation" to the development of the fetus in the womb, "where the heat works, and yet no part of the body is either emitted or separated" (Bacon 1623). Bacon's comparison of close distillation to the development of the fetus in the womb challenges the gendered readings of his experimental approach as a masculine torture of a feminized Nature. It shows how much that reading has been shaped by an assumption of the centrality of mechanical philosophy that treated Nature as a dead object to be manipulated and controlled. A historical lens informed by the more recent history of alchemy might lead to very different interpretations of the handcuffs of Proteus. The examples that Bacon provides, such as "close distillation" recall

⁵ Bacon 1623, 245. "At *Destillationem Clausam*, (ita enim eam vocare possumus) nemo mortaliū adhūc tentavit [. . .] tūm demū hunc Materiae Proteum, veluti Manicis dententum, ad complures transformations adacturam [. . .]." Bacon 1858, "De Augmentis Scientiarum," vol. 4, 420.

laboratory ambitions not to act against nature, but to intervene in nature and recreate life (as in the case of *homunculi*) (Newman 2004).

Chymical laboratory apparatus already aimed to recreate natural circuitous routes of transformation but did so imperfectly, according to Bacon. In his *History of Dense and Rare* he offered further examples of “how we carry out distillations as in a cell enclosed on all sides,” yet matter still escaped into its regular cycle of transformations. If this could be prevented, “perhaps this will keep the Proteus of matter in handcuffs and force it to act the contortionist and get free that way.” He offered various suggestions (“Mandata”) for how experiments tending toward close distillation might be set up, although close distillation was not something that had ever been achieved (Bacon 2000, “*Historia densi et rari*,” 101).

The point of such laboratory setups serving as the handcuffs of Proteus was to recreate the labyrinths that ordinarily trace intricate routes deep within the bowels of nature, beyond the view of the human observer. Matter twisted and turned, seeking an easy escape from the experimental setup, such as in the form of smoke or steam. It found none, hemmed in by glass walls or by relentlessly rising temperatures. Instead, as the experimenter wrestled with it, continually blocking its course, matter took circuitous routes, channeling into further cycles of distillation or into greater reactions to heat (such as melting or calcination). Sometimes this struggle meant preventing matter from more ordinary transformations (such as condensation) in order to provoke more unusual or radical ones (such as the development of a fetus).

These experimental strategies allowed the human observer to witness the processes of metamorphosis that ordinarily occurred in the much finer, more hidden and otherwise inaccessible reticulations of nature. Humans usually relied upon “the shapes and positions of vessels” to check, repel, release, or direct the motions of bodies, as in alembics of various forms. Nature was far subtler and did not rely upon such gross structures for the shaping of matter. Bacon, for instance, denied Telesio’s view that the shaping of creatures in the womb occurs because of “channels and compartments” that mould matter. Eggs, Bacon pointed out, have no such interior folds yet still shape bodies (Bacon 2004, “*Novum organum*,” 435). Rather, the transformation of the fetus occurs through series of changes of matter on such a fine level that they are ordinarily invisible. Folds existed in matter on levels that were not ordinarily visible; in his *History of Dense and Rare*, Bacon suggestively proposed that between the two limits of dense and rare there was a fold of matter, through which it can fold in upon itself without a vacuum.⁶ Through the notion of “close distillation,” Bacon sought to imagine new experimental setups that could better mimic and visualize these subtler structures of nature, identifying the folds of matter that could only be discovered at the very extremities of natural states.

⁶ Bacon 2000, “*Historia densi et rari*,” 163. “Inter terminos densi et rari est plica materiae, per quam se complicat et replicat absque vacuo.” On the “*plica materiae*,” see Jalobeanu 2020.

4. "Coming to grips with nature" in Experimental Inscriptions

In a series of recent works, Dana Jalobeanu has stressed how Bacon oriented his experimental investigations towards "research" in his normative natural histories. I agree that the way Bacon mobilizes experimental investigations often distinguishes them from his source material in a way that could be called research-oriented. However, I disagree in the nature of that distinction. Jalobeanu places Bacon in the context of the Neostoic disciplining of the mind, an effort to curb it of vitious tendencies and to reduce error in knowledge (Jalobeanu 2015, 2016). Jalobeanu and other members of the Bucharest school of Bacon studies have worked to identify Bacon's "medicine of the mind" or the method of his "experiential literata" that could be extricated from his natural histories (Corneanu 2011, Georgescu 2011, Dima 2011). This effort represents a newer and much more sophisticated version of attempts to see Bacon as the author of experimental method through the disciplining of subjective passion.

In contrast to this disciplining view of Bacon, elsewhere I place Bacon in the context of a culture of undisciplining knowledge, including a rejection of method and an abrogation of traditional epistemic divides and categories (Keller 2023). Here, I have challenged the idea that Bacon aimed to avoid error and to fix knowledge by looking at Bacon's discussion of ways to provoke nature into a state of error through experiment. Alongside a mutable form of experimentation that continually deferred the ultimate access to truth, Bacon developed forms of experimental textual inscription, I argue, that were tentative, contingent, and open to varying interpretations.

Bacon's general literary practices fit this view. He wrote, Julianne Werlin has argued, in a style that intentionally opened his work up to multiple interpretations and slippage into error (Werlin 2015). He continually shifted the meaning of words away from accepted usage (Bacon 1605, Book Two, 75-60). His use of terms was highly labile. Rather than fixing knowledge, Bacon "was an inveterate reviser of his writings" (Serjeantson 2013, 1101). For instance, Bacon returns to the myth of Proteus in many different works, subtly altering the emphasis and even the subject (such as matter or Nature). In each iteration of his treatment of Proteus, Bacon constantly shifted and transformed his deployment of the myth, as he did so often with other leitmotifs that thread through his writings. His Protean rhetoric makes his approach to Proteus itself difficult to pin down.

This view of Bacon's mutable rhetoric runs counter to long-standing accounts of scientific textuality in general and of Bacon in particular as representing an effort to fix knowledge to a straight-and-narrow pathway or method in order to avoid error. Bruno Latour influentially related the fixing of knowledge into two-dimensional graphic form, as "immutable mobiles," in order for the European human to accumulate and dominate global knowledge (Latour 1986, 1987). Scholars have linked Latour's discussion about the relationship between fixing and circulating objects of study, observation, and domination back to accounts of Bacon as establishing "the progressive accumulation and collection of data" (Langman 2011, 63) and the "circulation of knowledge" (Lightman 2013, 10).

Entire genres, from questionnaires to natural histories, have been termed Baconian precisely due to their means of directing attention and fixing inscription into generic forms that can be circulated among multiple knowledge workers and recombined into larger sets of knowledge. Peter Pesic has described Bacon's prescription that "testing must not be 'blind and stupid [...] wandering and straying as [men] do with no settled course,' for which he provided Learned experience or the Hunt of Pan, including "his reformulation of the inductive method and the 'tables of instances' he proposed to organize the fruits of observation and experiment" (Pesic 1999, 83). Indeed, Bacon describes his "Table of the Coition and Expansion of Matter in relation to Space in Tangible Bodies," an impressive spread of many types of matter and specific experimental measurements, as a means of coming "to grips with nature as if in a wrestling match" (Bacon 2000, "Historia densi et rari," 49). Yet, many areas of doubt remained in connection with this subject, and he confessed that the findings in his table remained continually provisional and the wrestling continued (Jalobeanu 2015, 303). Furthermore, this was one of the easier subjects to visualize and measure; as Bacon noted, the inquiry grew tricky when it came to comparative bulks of pneumatic matter (Bacon 2000, 65).

In his natural histories, rather than fixing and disciplining knowledge, Bacon made considerable space for provisional knowledge, subjective struggle, and the deployment of passions. He cautioned that he only rarely proposed "certain imperfect attempts at the interpretation of causes." These served "more to suggest what could be than to define what is" (Bacon 2007, *Historia naturalis et experimentalis*, 14).⁷ In order to mobilize knowledge, Bacon deployed a strategy he had advertised since his 1605 *Advancement of Learning* of extending knowledge towards the new. This entailed awakening desire in individuals to join the advancement of learning by pairing much sought-after things deemed impossible (which he categorized as "optatives"), with the closest things to them that had been achieved, which would inflame his audience with possibility of realizing much desired goals and hint at possible directions for further investigation. As he specified as part of the "norm" ("*Norma*") of his history, "I set out works and things deemed impossible, or at least so far undiscovered which fall under the individual titles; and together with them I subjoin things already discovered and lying within human power, which are closest and most akin to those things deemed impossible and undiscovered, so that human industry may be stimulated and souls fired" (Bacon 2007, 17). In the gap he set up between the desired thing and the approximation lay an invitation for others to join in, often paired with an incentive to do so. For example, one optative he listed in the history of winds was a way "to forecast abundance or dearth of corn and fruit every year." Bacon suggested that this knowledge could be deployed in "speculative buying and selling" in order to corner the market on comestibles (Bacon 2007, 131).

⁷ "tanquam Rudimenta quaedam, Interpretationis de Causis [...] magis suggerendo quid esse possit, quam definiendo quid sit." I translated this more literally than Graham Rees did.

Such examples speak to the risk-taking, subjectively motivated, and imperfect forms of knowledge with which Bacon endowed his natural histories.

Pace Latour, we might call Bacon's forms of inscription "mutable mobiles." He idiosyncratically termed the provisional general statements that he developed out of his experimental histories "*canones mobiles*," not because they were fixed statements that could move among a wide readership, but because they were themselves moving targets (Bacon 2007, 124 and 346). Rather than presenting knowledge as codified and completed, Bacon's wandering, mutable style encouraged participation in an infinitely receding horizon when the advancement of learning would end and the struggles of Proteus would cease.

5. Conclusion: On Not Having a Clue

Bacon never performed a "close distillation," one of his examples of what a handcuff of Proteus might be. This was an entirely imagined experiment. In fact, one might say the same for the struggle of Proteus as a whole. The "vexations of art are indeed like the chains and manacles of *Proteus* which betray the ultimate strivings and exertions of matter," wrote Bacon (Bacon 2004, 463.) Yet, how could one ever know if such "ultimate strivings" had been reached? For example, among the "*canones mobiles*" or provisional rules that Bacon attached to his *History of Dense and Rare* was the statement, "There is a boundary or *non ultra* of dense and rare, but not in any entity known to us" (Bacon 2000, "Historia densi et rari," 163). As one endeavored to push Nature to an extremity, it could never be known where that terminus lay. With the edges of possibility unknown, the struggle with Proteus continued always *plus ultra*.

The rhetoric of Bacon advancing knowledge *plus ultra* is often interpreted as his provision of a clue for humankind to follow in order to escape the labyrinth of error found in the maze of words into an open realm of more certain knowledge, grounded in experience, and offering useful knowledge to all. This essay has offered a very different interpretation, one which depicts Bacon as clearing a space for labyrinthine investigations that tended towards, but never reached, the ultimate boundaries of possibility. These investigations resisted the pressure to exit the labyrinth and to produce useful knowledge. They did not offer certain tabulations of knowledge, but provisional, fragmentary, and moveable forms of inscription. In the myth of Proteus, Bacon imagined an interplay between humans and knowledge goals whose conclusion could only ever be in a deferred future.

This brings us back full circle to circuitous routes as a tactic of delay and deferral. This essay suggests that, pace Ginzburg, clues that efficiently cut through to knowledge production were not particularly early modern. What was novel in the early modern period was a rejection of attempts to escape from the labyrinth of the world and instead to appreciate the *ambages* themselves as a site and practice of knowledge. In so doing, Bacon offers a new perspective on error. As the struggle with matter builds an observable labyrinth, forcing Nature's twists and turns to become visible, the experimenter does not have fore-knowledge of what that structure will be. The experimenter does not view the maze

from above. Nor does the experimenter possess any clue that can act as a certain guide to unravel all the complexities of nature. At most, the experimenter possesses an uncertain “anticipation” about what might transpire. Bacon could only suggest what might be, rather than define what was. Thus, in contrast to prior distinctions between internal “maze-treaders” who felt lost in the labyrinth and external “maze-viewers” who praised its intricacies, Bacon delineates a new perspective on the labyrinth by reformulating labyrinth construction as a dynamic, adaptive struggle. The experimenter was both within the labyrinth and constructing the labyrinth, as human and nature erred together.

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