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de la théorie à l'expérience vécue*

sous la direction de
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SOMMAIRE

- FRÉDÉRIC LE BLAY 5
Avant-propos – Se confronter à la pensée complexe : la fin du monde, de la théorie à l’expérience vécue
- JAMES D. FLEMING 25
“At the end of the days”: Francis Bacon, Daniel 12: 4, and the possibility of science
- PIERRE SAVATON 45
La catastrophe dans les discours géologiques de Georges Cuvier et Léonce Élie de Beaumont
- DAVID BAKER 71
Scientific Doomsday Scenarios: Foresight Projections for the Near and Deep Future
- KATSUHIRO MATSUI..... 95
Long-term Evacuation Due to the Fukushima Daiichi Nuclear Power Plant Accident and Its “Invisibility”
- NAOYA HATAKEYAMA & FRÉDÉRIC LE BLAY 107
avec la collaboration de CORINNE QUENTIN – Entretien

**“At the end of the days”:
Francis Bacon,
Daniel 12: 4, and the possibility of science**

James D. Fleming*

Résumé

Francis Bacon s'est souvent inspiré de la Bible, et en particulier de la vision de l'apocalypse du livre de Daniel, qu'il interprète en fonction des nouvelles circumnavigations des XV^e et XVI^e siècles. L'Écriture laisse prévoir une croissance des savoirs à la fin des temps ; c'est à cette espérance apocalyptique que Bacon rattache sa philosophie naturelle. Il attaque l'Aristotélisme de la Renaissance pour proposer une science qui serait complètement nouvelle, mais qui — les spécialistes l'ont démontré — reste très près de l'ancienne. La solution à cette énigme passe par l'exégèse baconienne de Daniel : la fin du monde sert de méta-théorie à la science de Bacon.

Mots-clés : apocalypse, Aristotélisme, Bacon (Sir Francis), circumnavigation, Daniel (livre de), découverte, exégèse, Gaukroger (Stephen), invention.

Abstract

Francis Bacon took his inspiration from the Bible. Specifically, from the vision of the apocalypse in the book of Daniel. This Bacon interprets via the circumnavigations of the 15th and 16th centuries. The scripture predicts an increase of knowledge in the time of the end. Bacon links his own natural philosophy to this apocalyptic hope. Attacking Renaissance Aristotelianism, he proposes an entirely new science. And yet — as scholars have shown — it is surprisingly close to the old one. The solution to this puzzle lies in the Baconian exegesis of Daniel. The end of the world is the meta-theory for Bacon's scientific theory.

Keywords: apocalypse, Aristotelianism, Bacon (Sir Francis), circumnavigation, Daniel (book of), discovery, exegesis, Gaukroger (Stephen), invention.

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Throughout his natural-philosophical writings, Sir Francis Bacon (1561-1626) invokes the Apocalypse of Daniel. The Old Testament prophet, foreseeing the Last Days, proclaims “*plurimi pertransibunt, et multiplex erit scientia*”: “Many [people] will run to and fro, and knowledge will be increased” (Dan. 12: 4)¹ On Bacon’s famous interpretation of this scripture, Daniel’s “many” are the great European navigators of the 15th and 16th centuries. These, by the turn of the 17th century, have “run to and fro.” The next step must be increase of knowledge — *i.e.*, Baconian natural philosophy. Bacon’s reading of Daniel 12: 4 is familiar to scholars, but its importance for his scientific program has been far under-estimated. I will argue here that Bacon’s exegesis provides the enabling, and illuminating, condition of his natural philosophy.

Instauration and circumnavigation

Bacon turns to Daniel 12: 4 in his natural-philosophical debut: *The Two Books of the Proficiency and Advancement of Learning*, published in London in 1605. The *Advancement*, as it is usually called, is a survey of all extant knowledge, and an introduction to Bacon’s proposals for reform and renewal of the natural sciences. *Instauratio* is a Latin term Bacon chooses for this program, and so his work, and its posthumous legacy, is customarily known as the Great Instauration. The first book of the *Advancement* offers an exhortation on the general excellence of learning, and a diagnostic of its dysfunctions. The second book turns to the early-modern dialectic of disciplines and subdisciplines, each of which Bacon seeks to define, examine, and evaluate.

Some 15 pages into that second book, Bacon is considering the state of cosmography. This is a portmanteau early-modern discipline, “compounded,” as he puts it, “of Natural History in respect of the Regions themselves, of History civil, in respect of the Habitations, Regiments [governments], and Manners of the people; and the *Mathematics* in respect of the Climates, and configurations towards the Heavens.” The mention of the celestial realm sends Bacon into a passionate expostulation:

For it may be truly affirmed to the honor of these times, and in a vertuous emulation with Antiquitie, that this great Building of the world, had never *through lights* made in it, till the age of us and our fathers: For although they

¹ I cite the King James Bible (1611) throughout. The Latin is from the Vulgate.

[the ancients] had knowledge of the *Antipodes* [...] yet that might be by demonstration, and not in fact, and if by travel, it requireth the voyage but of half the Globe. But to circle the Earth, as the heavenly Bodies do, was not done, nor enterprised, till these later times: And therefore these times may justly bear in their word, not only *Plus ultra* in precedence of the ancient *Non ultra*, and *Imitabile fulmen*, in precedence of the ancient: *Non imitabile fulmen* [...] But likewise, *Imitabile Coelum*, in respect of the many memorable voyages after the manner of heaven, about the globe of the earth. And this Proficiency in Navigation, and discoveries, may plant also an expectation of the further proficiency, and augmentation of all Sciences, because it may seem they are ordained by God to be *Coevalls*, that is, to meet in one Age. For so the Prophet *Daniel* speaking of the latter times foretelleth: *Plurimi pertransibunt, & Multiplex erit Scientia*, as if the openness and through passage of the world, and the increase of knowledge were appointed to be in the same ages, as we see it is already performed in great part. (Bacon, 1605, bk. 2, p. 15-15v)²

Versions of this passage occur in all of Bacon’s main natural-philosophical texts. That is, as Steven Matthews puts it, all of “the major Instauration writings”: those of his works in which Bacon tries to lay out the overall shape and scope of his project (Matthews, 2008, p. 90). The 1605 *Advancement* is the first of these, at least in print, and by the same token the oration we have just quoted is the first of its kind. So let us call it, if only for convenience, the instauration speech.

In 1620, a modified citation of Daniel 12: 4 appeared on the title-page of Bacon’s *Instauratio Magna* [*Great Instauration*]. Here, the scripture emblazons an engraving of a ship under sail, just beyond the Pillars of Hercules — the ancient symbol of the Straits of Gibraltar, the limits of the Mediterranean world. An even more elaborate version of this emblem would appear on the title-page of the posthumous, and hugely expanded, revised edition of the *Advancement of Learning* (1640) — easily one of the most famous and influential books of the 17th century. The ancient motto of the Pillars, *non ultra*, had already been overwritten under the Holy Roman Emperor Charles V (1500-1558), whose power reached from Vienna to Mexico: *plus ultra*. And yet this hypertrophic slogan, in Bacon’s ecstatic vision, is only the first step on a rhetorical ladder that rises to the

² Subsequent citations to the 1605 *Advancement* are by book and page number only in the body of my text. The books are not continuously paginated. Emphases, except where noted, are Bacon’s. I have lightly modernized spelling. Per an early-modern convention, only recto pages of the 1605 publication are numbered. Verso pages I indicate with “v” after the recto page number.

thunderbolt (*fulmen*), and from there to the heavens (*coelum*), before concluding on the climactic Old Testament quotation.

Bacon's exegesis of Daniel 12: 4 is poorly equipped with precedents. Apocalyptic commentary in the century before the *Advancement* is voluminous, but it is also pessimistic and retrospective. Revelation and, to a lesser extent, Daniel are read as histories of the ongoing struggle between true and false churches, and as occluded biographies of the Antichrist. In England, a more hopeful apocalypticism, reflecting the vision of New Jerusalem at the very end of Revelation, comes along in the last decade of the 16th century. Bacon's tone is consistent with this millenarian flowering. But his reading it into Daniel appears to be his own idea. As for that running to and fro in Daniel 12: 4, this was typically understood reflexively: it is scripture itself through which many people will pass, gaining greater understanding of God's Word, under the aegis of the Reformation (Bauckham, 1978; Frith, 1979). Bacon's alternative reading, connecting the scripture to seafaring and natural science, would come to be widely imitated — in the latter half of the 17th century (Webster, 1975). But in 1605, it is extremely unusual, if not unique to Bacon himself.

As we have noted, Bacon approaches Daniel via early-modern "navigation." He associates the latter term, in the instauration speech, with the word "discoveries." The syntax makes clear that the two are in apposition: "Navigation, and discoveries" are aspects of the same thing. Now, Baconian science has a concept of discovery at its core. A major goal of the *Advancement* is to proclaim the need for an "art" of "invention and discovery" (2.48v) — we will come back to the early-modern semantics of those terms. For Bacon, analytic observation, assisted by experiment, can reveal the occluded phenomena that make up the world. He sets up this project explicitly over and against Renaissance Aristotelianism, in which the finding out or grasping of hidden forms is difficult to theorize. (This point, too, we will revisit.) Thus Bacon is a major figure in the epistemic breakthrough that has been called the invention of discovery — a key component in the emergence of modern natural science. The phrase "navigation, and discoveries" appears to fit this picture perfectly (Fleming, 2011; Rossi, 1996; Wootton, 2015, p. 57-109).

Except for one problem. In the instauration speech, Bacon *is not* talking about voyages of discovery — voyages that have found anything. Rather, he is talking about voyages of circumnavigation, which he presents to the exclusion of any findings. Early-modern navigators, Bacon marvels, can "*circle* the Earth, as the heavenly Bodies do" (my emphasis). (Like most people at the turn of the 17th century, Bacon assumes a geocentric cosmos.) Trumping the ancients, Bacon's contemporaries have made

“many memorable voyages after the manner of heaven, about the globe of the earth.” “*Imitabile coelum* [like the heavens]” — that is their millennial word. Bacon neither gestures nor alludes, in the instauration speech, to anything that any navigator has discovered. This after more than a hundred years during which the flora and fauna of the New World, along with the exotic names of its coasts and cultures, had flooded back across the Atlantic. Evidently, what excites Bacon about the voyages of the preceding century is not any content, but a form: terrestrial mimesis of the celestial motion.

Elsewhere in the *Advancement*, Bacon clearly does refer to early-modern voyages of discovery, as such. But his comments about them are extremely vague and slight. Discussing the seeming difficulty of achieving the kind of science he wants, he cites Livy on Alexander’s invasion of Persia: “*Nil aliud quam bene ausus vana contemnere* [it was nothing but scorning empty hazards].³ And the same happened to *Columbus* in the western Navigation. But in intellectual matters” — and he moves on (1.24).⁴ The epochal discovery of 1492 comes and goes in one laconic sentence. Later, it gets subordinated to the invention of the nautical compass, a “small Motion” without which those “vast Regions” could never even have been found (2.48v). As evidence that he and his contemporaries are entering upon a new age of learning, Bacon cites “the openness of the world by Navigation, which hath disclosed multitudes of experiments, and a Mass of Natural History” (2.108). Yet he gives not a single example.

Neither is this vagueness limited to Bacon’s natural-philosophical debut. Scholars are familiar with the moment in Bacon’s late fantasy *The New Atlantis* (1628) where the wise men of Bensalem, a natural-philosophical utopia, describe their “Merchants of Light.” These “sail into foreign countries” and “bring us the books and abstracts, and patterns of experiments of all other parts” (Bacon, 1628, p. 245). It is notable that the said merchants, apostolically numbering 12, do not seek or repatriate any items of foreign natural history; but only the products of foreign natural philosophy. More to the point, their voyages enjoy the attention of precisely two sentences (50 words) in the Bensemalites’ long description (3500 words) of a scientific program that is otherwise totally directed toward the intensive examination of locally-available phenomena. In the galleries of Solomon’s House, the imaginary original of the Royal Society founded 40 years after Bacon’s death, the Bensemalites have “the statue of your Columbus, that discovered the West Indies.” But they also have :

³ Translation from Kiernan, 2000, p. 230.

⁴ The page is mis-numbered 34.

the inventor of ships; your monk that was the inventor of ordnance and of gunpowder; the inventor of music; the inventor of letters; the inventor of printing; the inventor of observations of astronomy; the inventor of works in metal; the inventor of glass; the inventor of silk of the worm; the inventor of wine; the inventor of corn and bread; the inventor of sugars; and all these by more certain tradition than you have. (Bacon, 1628, p. 246)

The Columbian enterprise is a term in this mature passage of Bacon's natural-philosophical vision. But it is only one term among many.

In the 1605 *Advancement*, Bacon repeatedly deploys maritime metaphors for the scene of intellectual inquiry. But the one thing that never occurs in these images is anybody's actually *getting anywhere*. "The Master in the Ship," he writes, "is judged by the directing his course aright, and not by the fortune of the Voyage" (2.39v). Sailors who are impatient for land are simply "ill discoverers" (2.27). "Why should a few received Authors," Bacon asks rhetorically at the beginning of the second book of the *Advancement*, "stand up like *Hercules Columnes*, beyond which, there should be no sailing, or discovering?" Especially, he goes on, since "we have so bright and benign a star, as your Majesty" — James I, his dedicatee — "to conduct and prosper us" (2.1v). Just getting out there, being under way, surveying at a distance: activities like these seem to constitute the meaning of "discovery," for Bacon, in the *Advancement of Learning*.

And in fact, this term and its cognates, in the early-modern period, are in an excruciating state of semantic flux. Discovery *can* mean "finding," in early-modern usage; but not reliably. Rather, when Bacon's contemporaries wanted that denotation, they usually reached for terms derived from the Latin *invenire*; which, in the classical rhetorical tradition, means "finding something to say." Thus "invention," in early-modern English, typically means something close to what we mean today by "discovery." Even though, today, we hear "invention" and "discovery" almost as antonyms — making against finding, the constructed against the objective. At the turn of the 17th century, these are overlapping terms, denoting a tangled phenomenological complex that one scarcely knows how to disentangle, except by using the very terms that are at issue. To make matters worse, the semantic evolutions of both "invention" and "discovery" are inter-involved with the scientific developments — in geography, chemistry, astronomy, physics, etc. — that we would like to be able to discuss by means of them.

The Bacon of 1605 usually, although not always, follows the typical period usage. That is, his word for objective finding or encountering is usually "invention" — even though that term can also connote, confusingly, making or constructing. Natural philosophy, Bacon explains,

“hath *A double Scale or Ladder, Ascendant and Descendant*, ascending from experiments to the *Invention of causes*; and descending from causes, to the *Invention of new experiments*” (2.24v). An experiment, perhaps, is something you make up; but a cause, surely, is something you find out. “The Invention of Forms,” he writes elsewhere, “is of all other parts of Knowledge the worthiest to be sought” (2.27). Not *making* the underlying forms of natural things, but *finding* them. Sometimes, Bacon tells us, the natural philosopher will need math: otherwise, “Many parts of Nature can neither be invented with sufficient subtilitie, nor demonstrated with sufficient perspicuitie” (2.31). “To *Invent* is to discover” says Bacon, at one point (2.51v). And that pretty much says it all.

We have wandered into a philological swamp. Luckily, Bacon himself has thrown us a lifeline. In 1623, he published an expanded, Latin version of the *Advancement*, the *De dignitate et augmentis scientiarum*. This was then retranslated into English, becoming in 1640 the revised edition of the *Advancement of Learning*. In both works, we encounter revised versions of the 1605 instauration speech. Here is the relevant section in the *De dignitate*:

ita vt praesens Aetas iure in Symbolo suo vsurpare possit [...] *Imitabile Coelum*; propter Nauigationes nostras, quibus circa vniuersum Terrae Ambitum, Coelestium Corporum more, volui, et circumagi saepius concessum fuit. Atque haec praeclara, in re Nauticâ, atque Orbe perlustrando, Felicitas, de vltioribus etiâ progressibus, et Augmentis Scientiarum, spem magnam facere possit. (Bacon, 1623, bk. 2, p. 102-103)

And here, in the 1640 *Advancement*:

So that these Times may justly bear in their word [...] *imitabile Coelum* [due to] our voyages; to whom it hath bin often granted to wheele and role about the whole compasse of the Earth after the manner of Heavenly Bodies. And this excellent felicity in Nauticall Art, and environing the world, may plant also an expectation of farther Proficiencie and Augmentations of Sciences. (Bacon, 1640, bk. 2, p. 101)

The term “discoveries,” from the 1605 *Advancement*, becomes in the *De dignitate* “*Orbe perlustrando*” — that is, traversing or perhaps over-seeing the globe. And that becomes, in the 1640 *Advancement*, the phrase “environing the world.” Even for the period, this may be a somewhat tenuous extension of “discoveries.” But that, presumably, is why revision has eliminated the term.

Let us return to the instauration speech of 1605. What we have established, so far, is that when Bacon talks about “navigation,” in this

famous and crucial passage at the beginning of his natural-philosophical career, he does not seem to be talking about voyages of discovery — in the sense of voyages that find or reveal any new objects of knowledge. Rather, Bacon seems to be talking about voyages of circumnavigation, which are formally transcendent, but substantially vacant. At the same time, Bacon clearly *is* anticipating a revolutionary production of new knowledge in the 17th century, and planting his own work in the vanguard of this advance. Equally clearly, Bacon is citing circumnavigation of the earth as the basis for his epistemic optimism. Circumnavigation, as it were, indicates instauration. However, the two moments in this sequence are discrete.

“Proficiency in Navigation, and discoveries,” Bacon writes, “may plant *also* an expectation of the further proficiency, and augmentation of all Sciences, because it may seem *they* are ordained by God to be *Coevalls*, that is, to meet in one Age” (my emphases). As we have noted, “navigation, and discoveries” are appositives in Bacon’s discussion. But “Proficiency in Navigation” and “augmentation of all sciences” are certainly not. They are not presented by Bacon as aspects of the same thing, but as entirely different things (“they”), which can be added (“also”), and are destined to be coeval — even, an unusual plural, “coevalls.” Only the multiple can be coeval. Only the discrete can meet. Bacon’s idea is that there is a semiotic relationship, but *not* a causal one, between circumnavigation and instauration. When those ships come sailing back in through the Pillars of Hercules, *it is a sign* that knowledge is about to be increased.

And why? Because Daniel says so. It is a fulfillment of prophecy, and not a methodological breakthrough, that Bacon perceives in early-modern “navigation.” Circumnavigation fulfills Daniel’s *plurimi pertransibunt*, and therefore allows the hope that *multiplex erit scientia*. The prophecy, and nothing else, lends the voyages their significance.

The closed book

Of course, we can still take the view that Bacon’s use of scripture is merely rhetorical. It is culturally appropriate for him to give his science a Biblical emblem, and Daniel 12: 4 has clearly fired his imagination. But that doesn’t mean he believes in it, any more than one believes in a poem, or an advertising slogan.

In the remainder of this paper, I’m going to argue that Bacon does, in fact, believe in both the prophetic validity of Daniel 12: 4, and the literal correctness of his own exegesis. Bacon perceives his own natural-philosophical project to be extremely urgent, and uniquely productive. But this view, this theory, *depends on* his apocalyptic exegesis.

One thing we need to get clear at this point is how *unremarkable* it is, in the period context, to find science mixed with, or even based on, scripture. This kind of thing is utterly typical of early-modern natural philosophy. It used to be thought that the great minds of the period’s new sciences were an exception, pointing the way toward a modernizing rule of alienation from the church. But this traditional picture no longer withstands scrutiny (Dear, 2001; Gaukroger, 2006; Harrison, 1998; Killeen & Forshaw, 2007; Martin, 2014).

Neither is there anything strange or even notable about Bacon’s attraction to one of the Bible’s *apocalyptic* books. These very generally excited the European imagination in the early-modern period. On the basis of multiple signs — confessional, geopolitical, and climatic — many people were convinced that the end of the world was imminent (Webster, 1982). With regard to the period’s emergent sciences, their relationship, if any, to aspects of the apocalyptic idea is a story that remains to be fully told. But we already have some fascinating chapters (Iliffe, 2017; Principe, 1998; Webster, 2008).

Nonetheless: there is perhaps something odd about Bacon’s dependence on *Daniel*, specifically, from within the Biblical genre that scholars call apocalyptic. Summed up in Revelation, apocalyptic has antecedents in the Gospels, and deep within the Old Testament. From the Greek for “removal of covers,” a Biblical apocalypse is a story of the world’s termination, by way of its transformation and opening-up, under the limitless power of God. Think of the lamb, in Revelation, slowly opening the seven seals of the world (Rev. 5-8); the heavens rolling away like a scroll, to reveal the reality they have always hidden (Rev. 6). At the end of days, so we are told at the end of Scripture, the true and destined nature of Creation will be shown. By that token, whenever in the Bible we get a glimpse of this kind of revelation — whenever transformative results, pointing toward the end-state of things, emerge from under their occluding manifestations — we are dealing with apocalyptic.

Isaiah, first in the sequence of Prophetic books that includes Daniel, is the major Old Testament locus for this genre. A long and hallucinogenic rant, the book defies summary. But its overwhelming motif, as the prophet tries to explain what will happen when Israel is submitted to the divine wrath, is a substitution of underlying reality for deceptive appearances. Sacrifice, ostensibly a sweet savour to God, is actually disgusting to Him (Is. 1: 11). The Covenant, seemingly restricted to Jews, is really for all people (Is. 66). Great Babylon, in its true destiny, is a desert ruin where satyrs dance (Is. 13). In an early sequence of the book, Isaiah takes direct aim at *fashion*:

The daughters of Zion are haughty, and walk with stretched forth necks and wanton eyes, walking and mincing *as* they go, and making a tinkling with their feet: / Therefore the Lord will smite with a scab the crown of the head of the daughters of Zion, and the LORD will discover their secret parts. / In that day the Lord will take away the bravery of *their* tinkling ornaments *about their feet*, and *their* cauls, and *their* round tires like the moon, / The chains, and the bracelets, and the mufflers, / The bonnets, and the ornaments of the legs, and the headbands, and the tablets, and the earrings, / The rings, and nose jewels, / The changeable suits of apparel, and the mantles, and the wimples, and the crisping pins, / The glasses, and the fine linen, and the hoods, and the veils. / And it shall come to pass, *that* instead of sweet smell there shall be stink; and instead of a girdle a rent; and instead of well set hair baldness; and instead of a stomacher a girding of sackcloth; *and* burning instead of beauty. (Is. 3: 16-24)

Piece by piece, in a grim strip-tease, the sumptuous coverings of Zion's daughters are removed — and note the use of “discover” in the King James Version, above. This is apocalypse: an uncovering or unveiling of the naked truth.

Indeed, perhaps the putative relationship between the apocalyptic tradition, and the early-modern natural sciences, is simply obvious. The 17th century, traditionally considered the age of the Scientific Revolution, is also a great age of the Bible. Apocalypse, as we have also noted, is a Biblical idea that fascinated the period. Whatever else it is, modern science is a procedure of discovery: penetrating appearances, revealing hidden truths, reducing evident phenomena to their non-evident substrata. Bacon and others, as they reach toward a new science, want a warrant for discovery that will break through the dogmas of the Aristotelian ontology. Wherever else they found it, they could have found it in the Bible. Discovery, in a sense that may well map onto the hermeneutic procedures of the modern natural sciences, pervades the apocalyptic texts.

Except Daniel. And this is what makes Bacon's use of it so odd. Daniel is clearly apocalyptic, in that it looks toward the end of the world. For that matter, the horrific imagery of Revelation (animals, monsters, horns, etc.) is manifestly derived from this Old Testament antecedent. And yet Daniel singularly *lacks* the motif of uncovering or opening-up that we have just been describing.

Recall its famous episodes of pious testing: the friends in the fiery furnace (Dan. 3), Daniel in the lions' den (Dan. 6). These are not about any hidden content coming to light, but about always-already evident manifestations of God's grace. Or recall the wonderful stories of Daniel's interpretative skill. These actually prioritize the *manifest* content of the texts

he is called upon to read. The young Hebrew rises to prominence in Babylon because he is able to tell Nebuchadnezzar *what the latter dreamed*, not just what the dream meant (Dan. 2). When the disembodied hand writes on the wall of Belshazzar’s feast, Daniel is called upon, not only to interpret the words, but first and foremost — since they are in Hebrew — to say what words these are (Dan. 5).

Bacon, in any case, has taken his device from Daniel’s final chapter, where narrative has entirely given way to poetic prophecy. The chapter presents a clear prefiguration of the Last Judgment, an angel telling Daniel:

At that time thy people shall be delivered, every one that shall be found written in the book. / And many of them that sleep in the dust of the earth shall awake, some to everlasting life, and some to shame *and* everlasting contempt. / And they that be wise shall shine as the brightness of the firmament; and they that turn many to righteousness as the stars for ever and ever. / But thou, O Daniel, shut up the words, and seal the book, *even* to the time of the end: many shall run to and fro, and knowledge shall be increased. [...] / Many shall be purified, and made white, and tried; but the wicked shall do wickedly: and none of the wicked shall understand; but the wise shall understand. [...] / But go thou thy way till the end *be*: for thou shalt rest, and stand in thy lot at the end of the days. (Dan. 12: 1-13)

The wise will understand — but we don’t know how, or what. The words are in the book, but the prophet is told to close it — and seal it. The book of Daniel ends in a state of *suspended* revelation. There will be no further information until the end times.

To sum up: Baconian science needs a notion of discovery. Apocalyptic, as a genre, provides one. And yet Bacon has zeroed in on just that apocalyptic moment — an exception to the rule — where discovery is denied. The final task of the present paper is to figure out what that means.

Revelation now

Bacon claims, in the instauration speech and elsewhere, to be engaged in a revolutionary reform of natural philosophy. The 17th century is a period of many such reforms, by many brilliant figures, seen by later historians as constituting a Scientific Revolution. By the end of the early-modern period, Bacon was seen as the English father of this movement. And there can be no doubt that he is one of the period thinkers who can be credited with placing a renewed emphasis on experimentation and innovation in natural philosophy (Jalobeanu, 2014). Beyond that, however, his contribution is less clear.

Bacon rejects the Copernican theory of geomotivity (Gaukroger, 2001, p. 211; Jardine & Silverthorne, 2000, p. 188-189). He is uncomfortable with atomism (Rees, 1996). He is non-participatory in the epistemological upgrading of mathematics — from a kind of mental calisthenics to the very code of nature — that is such a decisive feature of the new sciences in the period (Gaukroger, 2001, p. 24-26). To be sure, Bacon thinks, in accordance with a rich humanist tradition, that doing mathematical exercise is good for you (Mori, 2017). But this scarcely alters the point. Neither does the assertion that mathematics meant something different to Bacon than it has meant to subsequent natural science (Jalobeanu, 2013). Neither does the observation that Bacon calls for precise measurement in natural-philosophical procedures (Pastorino, 2011). Doubtless, that kind of pragmatic advice stands in the background of a mathematized epistemology. But it is pretty far in the background.

Bacon doesn't even bother to correspond with his scientific contemporaries, most of whom participated frantically in an epistolary community that they considered crucial to their research. For Stephen Gaukroger, Bacon contributes mostly to a new *image* of what it is to be a natural philosopher. Not bad; but not stunning, either. "In terms of substantive doctrine, Bacon does not really have a great deal to offer" (Gaukroger, 2001, p. 222). It's a long way from here to Bacon's impassioned prose, when he talks about what *he* thinks he's contributing to the Great Instauration.

Now, one way in which Bacon looks like a modernizing thinker is that he attacks Aristotelianism. This amounts to attacking the entire edifice of medieval and Renaissance academic learning. And yet, when we look more closely, Bacon's attitude to the old knowledge appears ambiguous. In the *Advancement*, Bacon is careful to associate his work with "*philosophia prima*": the Aristotelian term for metaphysics, to which he devotes a substantial discussion (1.24v; 2.24v-30v). He insists that he is not in the business of overturning antiquity, but rather wants to pay it its proper reverence (1.23v). And if Bacon criticizes the proponents of Aristotle, he reserves yet worse comments for the literary learning of Renaissance humanism — which, he reckons, caused a terrible decline in knowledge (1.17v-19). The Aristotelians, at least, were empiricists.

Indeed, when we examine Bacon's actual, positive program for natural-philosophical inquiry, it becomes very apparent that he is moving within an Aristotelian ambit. To be sure, he bitterly criticizes Peripatetic canons of knowledge, which he perceives as lying across the scientific path he wants to go down. But Bacon is unable to move these obstacles aside.

What he has to offer in the *Advancement* are not solutions, but problems. And the latter are highly traditional.

In logic, for example. Bacon wants to replace the tradition of deduction — reasoning from acknowledged rules to the particular instances that come under them — with induction: reasoning from particular instances to rules. Since induction has indeed become the working logic of the modern natural sciences, we today have to make a mental effort to recognize anything wrong with it. But Bacon lives in a painful awareness of the Aristotelian critique of induction. “*To conclude upon an Enumeration of particulars without instance contradictorie,*” he writes, “is no conclusion: but a conjecture; for who can assure (in many subjects) upon those particulars, which appear of a side, that there are any other on the contrarie side, which appear not?” (2.50)

On the basis of this logical insight — there can always be a contrary instance — Aristotelians have been “imperious and scornful toward particulars.” But, Bacon splutters, “He that shall attentively observe how the mind doth gather this excellent dew of Knowledge [...] shall find that the mind of her self by Nature doth manage, and act an Induction, much better than they describe it” (*ibid.*). Let’s note how little this counter-argument achieves. The Aristotelians say: inductive logic doesn’t work. Bacon retorts, in effect: “It does *so!*” Perhaps, charitably, we can say that Bacon is groping toward an epistemology of the *a priori* (in his hunch that the mind may be naturalized to induct). But for the moment, he is very much in the dark.

We find a similar situation with regard to the question of substantial form. In Aristotle, this is what makes any given thing the thing that it is. Frankly, rather than vulnerably, tautological, the concept arises from the fundamental Aristotelian question: What is *essential* to anything extant, persisting through all its accidents (changes)? Substantial form is the answer, but its scientific function is basically heuristic. Axiomatically, one can only ever assemble knowledge of any given form from its “qualities” — that is, its phenomenal presentations. Bread, for example, manifests qualities including edibility and tastiness and perishability and squishiness. A comprehensive arrangement of the latter, and their inter-arrangement with qualities of associated substances (such as the human body), would be tantamount to Aristotelian knowledge of bread — as close as we can ever get to understanding its substantial form. But the latter we never know directly (Charles, 2002; Des Chesne, 1996; Newman, 2006).

On various grounds, this picture is intolerable to Bacon. He rails against “the received and inveterate Opinion, that the inquisition of Man, is not competent to find out *essential forms*” (2.27). He praises Plato, for

recognizing forms as “*the true object of knowledge*,” while criticizing him for “considering of forms, as absolutely abstracted from Matter” (*ibid.*). He insists that “if any man shall keep a continual watchful and severe eye upon action, operation, and the use of knowledge, he may advise and take Notice, what are the *forms*, the disclosure whereof are fruitful and important to the State of Man” (*ibid.*) — an assertion that would sound completely unobjectionable to an Aristotelian, except that one should say “qualities” where Bacon says “form”! But what, in the end, does Bacon have to say against this “received and inveterate” understanding? This: “The Invention of forms is of all other Parts of Knowledge the worthiest to be sought, if it be Possible to be found” (*ibid.*).

We have already quoted the line, in part, for its use of the word “invention” (here a case where we would clearly say “discovery”). But now let us notice, again, that Bacon’s riposte to the Aristotelians’ *non ultra* is utterly without force. They say: “you can’t have direct knowledge of forms.” He responds: “but I *want* direct knowledge of forms!” He is banging his head against a wall.

True, Bacon has thought a lot about how to break through. His strategy is Neoplatonic: he defers the ontological level of forms. They are not to be found, he argues, among things like lions, or oak trees, or gold; but rather among things like “voluntary Motion,” “Vegetation,” “Colours,” “Gravity and Levity” (2.27v) — a tranche of phenomena that Bacon will in his later work call “simple natures.” Bacon then adopts a combinatorial analogy between reality and the alphabet. The infinity of words, he points out, reduces to a closed set of letters. How wonderful it would be if we could know the closed set of simple natures to which the infinity of Creation, perhaps, reduces (2.27v)!

It is very important to note that, from an Aristotelian point of view, Bacon is *begging the question* of inquiry into forms. And not only via redefinition — by which, as John Searle once said of Jacques Derrida, one can prove anything (Searle, 1983). More importantly, Bacon has shirked the ontological and epistemological challenge he claims to have met. For Aristotle, substantial form is more a function of a species, than a genus; more a function of an individual than a species. To ask about Socrates, but receive information about Man, is to get scientifically malnourished. Thus, retreat from the ontological level at which forms manifest their qualities does not yield a more direct encounter with forms, but eliminates even the possibility of indirectly encountering them. Neoplatonic evasions or misunderstandings of this point are as old as the medieval Western rediscovery of the Stagirite. But that is to say that Bacon’s attempt to move

beyond academic tradition in this area is little more than a very familiar move within it.

Finally, let us consider Bacon’s view of the mind. He accepts a version of the Christian-Platonic theory that human perception and cognition are fundamentally flawed. An empiricist’s dilemma; which Bacon airily sweeps aside. “It was not without cause,” he writes, “that so many excellent Philosophers became Sceptics and Academics [Platonists],”

and denied any certainty of Knowledge, or Comprehension, and held opinion that the knowledge of man extended only to Appearances, and Probabilities. [...] But here was their chief Error; they charged the deceit upon THE SENSES; which in my Judgment (notwithstanding all their Cavillations) are very sufficient to certify and report truth. [...] But they ought to have charged the deceit *upon the weakness of the intellectual powers, and upon the manner of collecting, and concluding upon the reports of the senses.* This I speak not to disable the mind of man, but to stir it up to seek help. (251-51v)

How can we make the mind, which doesn’t really work, work? Well, by trying really hard to make it work, says Bacon. In a parenthesis (not quoted), he appeals to the use of “instruments,” an idea that gets much emphasized in later Baconian tradition. But since the deliverances of technological instruments all have to be parsed through the mind anyway, it is difficult to see how this prosthetic strategy makes the slightest difference to the empty paralogism of Bacon’s cognitive psychology.

Bacon’s natural philosophy, in the *Advancement of Learning*, stands uncomfortably close to Einstein’s definition of insanity. It is a plan to reiterate procedures that have manifestly failed. Bacon is very clear as to why the kind of learning he wants has never yet been achieved: because it involves a dysfunctional mechanism — the mind — deploying an incoherent system — inductive logic — in pursuit of ephemeral objects — forms. And yet his proposals come down to the idea of trying all of that all over again. With regard to the major natural-philosophical innovations of his period, as we have seen, Bacon is very conservative. He looks, more than anything else, like a reforming Aristotelian. But he insists that Aristotelianism has never worked; even while insisting that he, somehow, is going to *make* it work.

How are we to make sense of this? Unless, following Gaukroger, we are to conclude that Bacon just isn’t giving us enough sense to make? I suggest the following.

Bacon is like a man who has been watching somebody flick a light switch. Over and over again, for a very long time. Stubbornly, consistently,

interminably, the light fails to turn on. Finally, the man steps forward and says: “You’re doing it wrong. Allow me.” And, with a flourish, he flicks the switch.

Under what conditions is this *not* a ridiculous or insane move? Under what conditions, indeed, would it be ridiculous or insane *not* to try again what has already been tried, even though, or rather precisely because, it has always failed? Under conditions, I think, like this: if the electrical mains have been off all this time, and now they are back on.

Theory, that is, may be backed up by meta-theory. Change in the latter counter-indicates change in the former. Indeed, *the only* way to test for change in the meta-theory is to apply, yet once more, the same old theory. If one knows, or thinks one knows, that the power is back on, one *rushes* to flick the switch. One disdains the people who are trying, instead, to build a lantern. One calls after the people who have gone to the store to buy candles. And so on. Everything is trumped by meta-theory change.

This, I suggest, is what Bacon thinks he knows, through his exegesis of Daniel 12: 4. This is the meta-theory for *The Advancement of Learning*. At a stroke, the Old Testament apocalypse, under Bacon’s interpretation, explains two things that are absolutely essential to his natural-philosophical program. First, why progress in knowledge has been suspended for so many centuries. It is because God decreed that it would be, until the last days. The book of wisdom has been closed all this time — shut, sealed. Every philosopher who has tried to understand nature, under these conditions, has been kicking against the pricks.

And second: Daniel 12: 4 explains why progress in science should suddenly become possible *now*, in the 17th century. It is because the book is being opened: these are the last days. As we have noted, apocalyptic expectation ran very high among Bacon’s contemporaries. In England, after the failure of the Spanish Armada in 1588, it ran even higher, while taking on an ecstatic recoloring (Bauckham, 1978). For Bacon, as we have seen, the early-modern circumnavigations are key to locating the last days in his period, and to understanding their significance for the progress of knowledge. *Plurimi pertransierunt* — they *have* gone to and fro! Just as predicted, in the very scripture where learning gets suspended. The next insight is irresistible: the suspension must now have been lifted. It must be time, ca. 1605, for *scientia* to increase. Learning, real learning, has finally become possible, not through any human innovation, but by eschatological decree. And the way to tell — the way forward into knowledge — is precisely, and only, to reiterate a version of what has always been *scientia*.

Conclusion

I have suggested that Bacon’s reading of Daniel 12: 4 seems to be his own exegetic innovation. However, this isn’t very important for my argument. Whether Bacon hit upon his interpretation by himself, or whether he found it somewhere else, what matters is its effect on him, and its usefulness for his thinking. The *plurimi pertransibunt*, connected to the circumnavigations of the 16th century, and situated within early-modern expectation of the apocalypse, opens up the possibility of Baconian science. As we have seen, the latter seems not to achieve very much. But from Bacon’s point of view — granted Daniel 12: 4 — it can achieve everything.

Bacon’s relative indifference to the scientific innovations going on all around him, in this light, is not a weakness, but a strength. If the world is newly knowable, you don’t need new ways to know it. Quite the contrary, they are liable to make you miss the point (like lantern-building, when you could just turn the light on). All you need to do, and what you *must* do, is make a renewed effort with the ways of knowing you already have.

As I have noted, English science in the later 17th century branded itself as Baconian. And, in at least some respects, it was: for example, in its relentless technologism. A line begins here that connects aspects of our own world, however distantly, to Bacon’s apocalyptic fervour. Perhaps we are only now beginning to grasp the possibility of understanding this kind of phenomenological and historical relation.

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