

## THE WHALE UNDER THE MICROSCOPE: TECHNOLOGY AND OBJECTIVITY IN TWO RENAISSANCE UTOPIAS

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In the year 1620 an English diplomat on an embassy to Germany witnessed a demonstration of an extraordinary optical device by the astronomer Johannes Kepler. He relayed the details of its design in a letter to a man with an avowed interest in such matters: Francis Bacon.

He hath a little black tent set up, exactly close and dark, save at one hole, about an inch and a half in the diameter, to which he applies a long perspective trunk, with a convex lens fitted to the said hole, through which the visible radiations of all the objects without are intromitted, falling upon a paper, which is accommodated to receive them.<sup>1</sup>

Shortly after Bacon received this intelligence report, he had the chance to see the device in person when the natural philosopher-cum-entertainer Cornelius Drebbel arrived in London and dazzled the Jacobean court with displays of technological wizardry. In addition to chilling Westminster Hall with a primitive air-conditioner and plunging beneath the Thames for three hours in a submersible, Drebbel unveiled the apparatus that came to be known as the *camera obscura*. As Lord Chancellor, Bacon would have been in rapt attendance and very likely ventured inside the confines of the dark room himself. Four years later he would pen his utopian narrative, *New Atlantis*, in which a nation administered by a collective of scientist-sages known as Salomon's House astound a group of ship-wrecked Europeans with some of the exact same experiments performed by Drebbel.<sup>2</sup> Salomon's House has come to occupy a prestigious place in the annals of science. Often hailed as a prototype for the Royal Society, it has also been credited with anticipating the modern day research institute, N.A.S.A., the C.I.A. and the Smithsonian in one torrential brainstorm. But rather than simply unmask Bacon's

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<sup>1</sup> Wotton H., *Reliquiae Wottoniae, or, A Collection of Lives, Letters, Poems; with Characters of sundry personages* (London: 1654) 413–414.

<sup>2</sup> The connection between Drebbel and *The New Atlantis* was first proposed by Colie R.L., "Cornelius Drebbel and Saloman de Caus: Two Jacobean Models for Salomon's House", *Huntington Library Quarterly* 18 (1955) 245–260.

sources of inspiration, or marvel at his prescience, this paper examines how encounters with new innovations influenced his earth-shaking call for a scientific method that could produce truth-claims with pretensions to universal validity. The *camera obscura* offers a fascinating case-study of how early modern technology shapes Baconian epistemology.

Among the wonders of Bacon's utopia is a 'perspective house' where the scientists have assembled all the latest instruments that can distort or enhance the sense of sight. After flaunting their collection of prisms, telescopes, and microscopes, the guide boasts that they have acquired a secret means for producing 'multiplications of light, which we carry to great distances, and make so sharp as to discern small points and lines' (3, 161). This description of a device for the 'producing of light originally from divers bodies' (3, 162) virtually reads like a sales-pitch for the *camera obscura*. Though at no time does the text refer to it by name (neither does it explicitly mention the microscope or telescope for that matter), features of the 'perspective house' are clearly modeled on this contraption. By fixating on one sense while ignoring the other four, the *camera obscura* allows the natural philosopher to study the powers of human perception in isolation: an organizing principle in several of Bacon's works, such as the division of experiments in his *Sylva Sylvarum*. Moreover, Kepler and Drebbel's 'dark room' also exhibits several features found in the Benthalemite's blueprint of the ideal laboratory: 'remote alike from the sun and heaven's beams, and from the open air' (3, 156). The creation of an utterly separate arena for scientific inquiry, quarantined from the natural world, marks a sea-change in the methodology by which knowledge of that world would be pursued and ascertained.

In his provocative study, *Thing Knowledge*, David Baird argues that the standard *modus operandi* of 'examining' technological artifacts is inadequate and he urges critics to begin 'reading' them by resorting to the same deconstructive hermeneutics used to scrutinize literary texts.<sup>3</sup> The *camera obscura* makes a terrific candidate for such a reading because it is a representational, almost cinematic technology that bears a strange affinity to the mimetic practices of utopian fiction. Just as Stephen Greenblatt has famously described Holbein's 'Ambassadors' as the visual analogue to More's *Utopia*,<sup>4</sup> the *camera obscura* can throw

<sup>3</sup> Baird D., *Thing Knowledge* (Berkeley: 2004) xvii.

<sup>4</sup> Greenblatt S., *Renaissance Self-Fashioning* (Chicago: 1980) 17–24.

light, as it were, on *The New Atlantis*. The difference between the painting and the technology highlight Bacon's divergence from his literary predecessor; while painting is static, the *camera obscura* projects the image of a world *turned upside down and in motion*. In a corresponding fashion the *New Atlantis* depicts a dynamic society where power is primarily invested not in the monarch but in a meritocracy of scientist-sages. Appropriately the Benthalemites, unlike the citizens of More's ideal commonwealth who already bask on the summit of their history, subscribe to an interminable narrative of intellectual and material progress. The people of *New Atlantis* are ever expanding their knowledge of and dominion over the natural world to become, in a paradoxical phrase Bacon uses elsewhere, 'more perfect' (4, 14). Furthermore, whereas Holbein's portrait requires viewers to reposition themselves in order to un-distort the skull in the foreground, the operation of the *camera obscura* requires an absolute withdrawal from the natural world, a retreat into an entirely artificial, humanly constructed space. Temporarily interred within its walls, the natural philosopher can engage in a kind of environmental voyeurism, perceiving the outside world in serene detachment while remaining unseen by the objects under surveillance. The experience may even have spurred the obsession with invisibility that surfaces again and again in *The New Atlantis*. It is mentioned so frequently that one can almost imagine the Benthalemites writing a scientific treatise with the title of a Monty Python sketch: 'How Not To Be Seen.' The European sailors are repeatedly awed by their hosts' ability to survey them undetected: 'For that it seemed to us a condition and propriety of divine powers and beings, to be hidden and unseen to others, and yet to have others open and *as in a light to them*' (3, 140; *italic mine*). The invisibility motif also features in the description of the Feast of the Family, the travels of the Merchants of Light, and the anonymity of the island itself – allowing it to explore the rest of the world yet remain undiscovered by foreign powers. The recurrence of this fantasy in the text is, I believe, no accident. It symbolizes a more grandiose fantasy of which Bacon is often upheld as the leading apostle: namely, the self-effacement of the scientist while examining the natural world. The *camera obscura* illustrates how technology, in particular the technology of surveillance, contributes to the formation of a discourse of objectivity in Bacon's writings.

In tandem with the painting of Hamlet as the poster-child of modern subjectivity, recent criticism has sought to cast Francis Bacon as the spokesperson of scientific objectivity. The nomination, advanced by respected historians of science such as Lorraine Daston and Julie Robin Solomon, certainly makes a great deal of sense.<sup>5</sup> In the *Novum Organum* Bacon famously outlines a methodology that strives to eliminate or neutralize the theoretical, cultural, or personal bias of the scientist, and enable him through induction and experimentation to extract brute 'facts' from the flux of experience. The experiment, rather than the observer's intellect, now serves as the ultimate court of appeal: 'the office of the sense shall be only to judge of the experiment, and that the experiment itself shall judge of the thing' (4, 26). This vision of an infallible, universal science seized Bacon as early as *The Advancement of Learning* (1605) in which he cites a passage from Lucretius endorsing the natural philosopher's olympian detachment:

It is a view of delight (saith he) to stand or walk upon the shore side, and to see a ship tossed with tempest upon the sea; or to be in a fortified tower, and to see two battles join upon a plain. But it is a pleasure incomparable, for the mind of man to be settled, landed, and fortified in the certainty of truth; and from thence to descry and behold the errors, perturbations, labours, and wanderings up and down of other men (3, 317–8).

The excerpt may have supplied him with the premise of another text he would compose two decades later, *The New Atlantis*, in which the intrepid Benthalemites rescue the feckless Europeans blown off course by a storm. This work of speculative fiction essentially recounts a quest for discursive stability in natural philosophy. In other words it imagines the discovery of an objective viewpoint from which superstitions and fallacies could be denounced (not without a hint of *schaden-freude* as the passage from Lucretius suggests) and truth-claims posited and disseminated.

The fable aptly culminates in an encomium to Salomon's House, whose members engage in collaborative research. Together they constitute a kind of intellectual commonwealth in which the interests of specific individuals and social classes are sublimated in the pursuit of

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<sup>5</sup> Daston L., "Baconian Facts, Academic Civility, and the Pre-History of Objectivity", in A. Megill (ed.), *Rethinking Objectivity* (Durham: 1994) 37–63. Solomon J.R., *Objectivity in the Making: Francis Bacon and the Politics of Inquiry* (Baltimore: 1998).

one over-arching agenda: ‘the enlarging of the bounds of Human Empire’ (3, 156). The anonymous hermits the college employs in its investigations nicely embody the philosophers’ aloofness from mundane concerns that might tempt them to spin-doctor the results. With its division of academic labor involving fact-checking, the replication of experiments by third parties, the publication of results, and a rigorous peer review process, Salomon’s House has been recognized at least since the time of Thomas Spratt as a pioneering formation of the modern scientific community. Less well documented is the active role of *objects in objectivity*, the collusion of technologies like the *camera obscura* in carving out a space for disinterested observation. Although Bacon’s program is heavily influenced by the political and socio-economic tensions of his milieu, more attention needs to be paid to the function of such artifacts in the evolutionary epistemology of human beings. Bacon himself nods to their impact when he refers to a trinity of modern inventions – the magnet, the printing press, and gunpowder – and proclaims: ‘no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these mechanical discoveries’ (4, 114).

More than any other text from the period *The New Atlantis* showcases the correlation between the technological take-off of the West and the theory of a universal science. Significantly, as the head of Salomon’s House lists all of their engineering marvels, the text shifts abruptly from first person singular to the first person plural. Thirty of the final thirty-seven paragraphs begin with ‘We’, as do a similar percentage of sentences within each paragraph. The grammar reinforces Bacon’s notion of science as a collective enterprise and fits with his belief that such inventions will serve to improve the lot of all mankind. The switch reflects the fact that Baconian objectivity is predicated upon access to and mastery of technology. Conspicuously absent from the account is any mention of the arduous labor involved in the construction, operation, and maintenance of these devices. As in the creation story from Genesis, the inventions of the College of the Six Days’ Works – such as observatories, wind machines, air filters, furnaces, telephones, clockwork automata – appear to have been forged by mystical fiat rather than any physical exertion. The bland verbs that somewhat monotonously dot the catalogue of technology – ‘have’, ‘use’, ‘represent’ – serve an important rhetorical function by reducing the scientists to mere ciphers. Bacon’s prose thus invests the gadgets with a remarkable agency while the researchers themselves appear astonishingly inert, heightening the impression of human impartiality.

While scholars have justly traced the germination of objectivity back to Bacon's work some important caveats must be kept in mind to check anachronistic assertions. Rather than speak of 'facts', a buzzword singled out by Daston, Bacon by far prefers the term 'axioms' to signify a rudimentary and indubitable truth-claim about nature. And at no point does Bacon deploy the word 'objectivity' in the modern sense, being more likely to refer to the 'certainty' of the 'human understanding.' There is a simple explanation for this: 'certainty' conveyed both the idea of mental constancy and a fixedness in nature while the first usage of 'objectivity' to refer to the capacity to pronounce a disinterested judgment only dates from 1803. Nor could he reach for the shortened form 'objective.' This adjective did not yet even allude to the thing's existence independent of its beholder – a definition introduced into the language by Coleridge via Kant. In fact in the seventeenth century 'objective' carried nearly the opposite meaning: the registering of objects within the consciousness of the subject, their mental in contrast to their real existence.

This earlier sense – which effectively endowed material things with a greater ability to penetrate the mind – gave rise to yet another definition of 'objective' in the early modern era that spotlights the role of technology in the advent of scientific disinterestedness. In 1671 a paper appeared in the transactions of the Royal Society distinguishing between two reflective surfaces on a microscope by declaring that 'the eye is always more distant from the convex *objective* glass than its point of concourse.' According to the OED, 'objective' here designates 'the lens or combination of lenses in a refracting telescope or microscope that is nearest the object to be viewed.' Note that the use of the term to refer to a piece of an optical instrument precedes by over a century its connotations with the absolute neutrality of the observer. Though microscope design was still fairly primitive in England prior to the publication of Hooke's treatise on the subject in 1665, Bacon knew that reflective mirrors could be used for the purposes of magnification. The sages of Salomon's House possess certain 'glasses', far more powerful than spectacles, that allow them 'to see small and minute bodies perfectly and distinctly' (3, 162). Just as the microscope contributed to the new meaning of objective, Bacon seizes on the technology of optics in the *Novum Organum* to craft a theory of impartiality by comparing the human understanding to a mirror (4, 54). When imperfectly fashioned it distorts and colors the impressions it receives. By following Bacon's prescription for the 'expiations and purgings of the mind', however, the

natural philosopher's understanding can be 'cleansed' so as to reflect reality like an unblemished glass. The metaphor reveals how Bacon internalizes the contrivances of 'art', in this case medicine and microscopes, to transform the conventional understanding of 'nature.'

One of the most important planks in Bacon's platform is to collapse the art/nature binary to sanction the use of scientific instruments to wrest raw data from the biophysical world. In a memorable phrase from *The Advancement of Learning* he proclaims 'Vulcan is a second nature' (3, 351), implying that a scientific experiment merely serves to accelerate an organic process without fundamentally altering the results. Bacon goes on to posit that technology is not only a useful supplement but also an essential corrective for the vagaries of human perception. As he declares at the beginning of the *Novum Organum*: 'Neither the naked hand nor the understanding left to itself can effect much. *It is by instruments and helps that the work is done*, which are as much wanted for the understanding as the hand' (4, 47). By championing the use of instruments to aid the intellect, Bacon's writings consecrate technology as a means to duck the four key obstacles to objective thought he identifies in the *Novum Organum*. By extending the relatively feeble reach of our sensory apparatus, it mitigates the effects of the Idol of the Tribe. In its seemingly unbiased reporting of events it overcomes the personal and cultural idiosyncrasies he labels the Idols of the Cave. Through its ability to transmit information without language it evades the Idols of the Marketplace. And finally, in its capacity to generate axioms unknown to the ancients it liberates natural philosophers from blind faith in outdated systems – the Idols of the Theatre.

In his aforementioned book on the 'philosophy' of scientific instruments David Baird argues that technologies are themselves epistemologically loaded – that is, they are capable not only of processing but actually bearing knowledge. He points to the numerous occasions in which scientists and mechanics sent out the devices themselves, instead of written descriptions, as witnesses of their own innovation.<sup>6</sup> Bacon makes a similar observation in *The Advancement of Learning*. He recalls that Aristotle once mocked his opponents by comparing them to cobblers who instead of teaching how to make a shoe would 'only exhibit in a readiness a number of shoes of all fashions and sizes.' Bacon tellingly sides with the Sophists: 'But yet a man might reply, that

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<sup>6</sup> Baird D., *Thing Knowledge* 3–8.

if a shoemaker should have no shoes in his shop, but only work as he is bespoken, he should be weakly customed' (3, 390). The analogy of the cobbler's shop serves to explain how scientific instruments not only generate, but encode and preserve information. Bacon is even more explicit in *The Great Instauration*, noting that in a lecture on mathematics 'it is easy to follow the demonstration when you have a machine beside you, whereas without that help all appears involved and more subtle than it really is' (4, 31). This same logic inspires Bacon to dream up the first gallery in *The New Atlantis* which the members of Salomon's House stock with 'all manner of the more rare and excellent inventions' (3, 165). The gallery – part religious shrine, part Museum of Science and Industry – is intended to commemorate past innovations and more importantly spur new ones. When placed before the proper audience these tools and machines essentially do what authors do: they tell stories. This leads, I would suggest, to a slight modification of Foucault's theory of the vanishing of the author-function in modern scientific writing: it does not disappear completely but rather is transferred to the instruments. Scientists no longer appeal to the authority of all-knowing Aristotle or Galen to support their hypothesis but to the infallible and impartial microscope. The upshot is the displacement of objectivity onto technology. This displacement is perhaps most apparent in the next generations of scientists such as Boyle, although in the following passage the influence of Bacon is abundantly evident:

The pressure of the water in our recited experiment [on the diver's bell] having manifest effects upon inanimate bodies, which are not capable of prepossessions, or giving us partial informations, will have much more weight with unprejudiced persons, than the suspicious, and sometimes disagreeing accounts of ignorant divers, whom prejudicate opinions may much sway, and whose very sensations, as those of other vulgar men, may be influenced by predispositions, and so many other circumstances that they may easily give occasion to mistake.

In a similar fashion Boyle once coolly responded to a critic who had challenged his findings: '[I] question not [his] Ratiocination, but only the staunchness of his pump.'<sup>7</sup> Boyle's concern with the 'prejudicate opinions' of others, and his faith in the ability of technology to neutralize them, both derive from Francis Bacon. But not everyone was

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<sup>7</sup> Robert Boyle, "Hydrostatical Discourse", 614–15; Boyle to Moray, July 1662, in Christian Huygens, *Oeuvres* (Hague: 1888–1950) 4, 220; rptd. in Shapin S. – Schaffer S., *Leviathan and the Air Pump* (Princeton: 1985) 218, 77.



instantly persuaded of the epistemological validity of using instruments as tools for manufacturing truth-claims. Among the next generation of natural philosophers Bacon's faith in technology sparked not only adulation, but also debate and even parody.

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Francis Bacon's quest to inaugurate a universal science has never lacked detractors. In that early modern anthology of celebrity gossip, Aubrey's *Brief Lives*, William Harvey snidely remarks that his contemporary and sometime patient 'writes philosophy like a Lord Chancellor.'<sup>8</sup> Almost four centuries later a chorus of critics have echoed Harvey's snub, exposing the social and historical contingencies that mold Baconian epistemology. The gadflies of post-structuralist theory have swarmed on the claim to scientific objectivity, denouncing it as a hubristic flight of fancy that inevitably constructs and enshrines an aristocratic male outlook on the natural world. Julie Robin Solomon has shown that Bacon conflates the scientist's perspective on nature with the monarch's allegedly disinterested authority over his domains; Steven Shapin posits that the 'Idols of the Cave' was meant to disqualify merchants obliged to consider their material self-interests; while Carolyn Merchant has accused Bacon of appropriating the interrogative tactics of the early modern legal system to underwrite the impartial (and sadistic) inquisition of the natural world.<sup>9</sup> The fact that a theory of universal science receives a key articulation in a utopian narrative now seems exceptionally apt, as criticism has sought to unmask objectivity as a voyage to an epistemological Shangri-la. Yet long before the current wave of skepticism broke, the bias in Bacon's mechanistic science was spelled out in another seventeenth-century English utopia, *The Blazing World* by Margaret Cavendish, the Duchess of Newcastle. Remarkably, her critique does not target any of the aspects mentioned above, but exposes the dubious use of technology as a means to generate and verify truth-claims.

<sup>8</sup> John Aubrey, *Brief Lives* (London: 1950) 130.

<sup>9</sup> Solomon J.R., *Objectivity in the Making: Francis Bacon and the Politics of Inquiry*; Shapin S., *A Social History of Truth: Civility and Science in Seventeenth Century England* (Chicago: 1994) 224–5; Merchant C., *Death of Nature: Women, Ecology and the Scientific Revolution* (New York: 1980).

*The Blazing World* recounts the journey of a well-born English woman who, as the lone survivor of an ill-fated voyage, drifts ashore in another world poised on top of the North Pole. Here she encounters a technologically advanced race of mutant creatures. Overwhelmed by her natural beauty, they promptly arrange a marriage with their ruler and crown her Empress. From her throne she surveys the state of their learning. In the following extract she consults her astronomers, men with the heads of bears, eager to hear of the marvelous discoveries they have glimpsed through their powerful telescopes. The results prove disappointing.

But these telescopes caused more differences and divisions amongst than ever they had before; for some said, they perceived that the sun stood still, and the earth did move about it, others were of opinion, that they both did move; and others said again that the earth stood still, and the sun did move; some counted more stars than others; some discovered new stars never seen before; some fell into a great dispute with others concerning the bigness of the stars; some said the moon was another world like their terrestrial globe, and the spots therein were hills and valleys, but others would have the spots to be the terrestrial parts and the smooth and glossy parts, the sea.<sup>10</sup>

As in Montaigne's *Apology for Raymond Sebond* the sheer proliferation of widely divergent yet plausible theories renders the search for a single definitive truth absurd. Rather than contributing to the consensual validation of scientific 'axioms,' technology breeds controversy and dissension. Frustrated by their disagreements, the Empress orders the astronomers to smash their telescopes.

The bear-men replied, that it was not the fault of their glasses, which caused such differences in their opinions, but the sensitive motions in their optic organs did not move alike, nor were their rational judgments always regular: to which the Empress answered, that if their glasses were true informers, they would rectify their irregular sense and reason; but, said she, nature has made your sense and reason more regular than art has your glasses, for they are mere deluders and will never lead you to the knowledge of truth. (141–2)

Repeatedly the text uncovers that the much-vaunted scientific instruments cannot overcome either human error or self-interest. The satire

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<sup>10</sup> Margaret Cavendish, *The Description of a New World Called The Blazing World And Other Writings* (New York: 1992) 140–1. Subsequent citations from this edition will be noted in the text.

reaches a climax when the Worm-men arrive and the Empress demands they make a patently absurd attempt to examine a whale under a microscope. The scene serves as a humbling reminder of the limitations of technology as a springboard to a domineering, omniscient perspective over the natural world.

Cavendish, the first woman ever permitted to attend a meeting of the Royal Society, here inveighs against a scientific enterprise directed exclusively by men. Oddly enough, Pepys noted her visit in his diary and reported 'Margaret was full of admiration, all admiration.'<sup>11</sup> Even after observing several experiments 'she cried out still she was "full of admiration."' Yet *The Blazing World* tells a rather different tale. A woman enters the halls of science and immediately debunks the technologies invented and operated by the men as unreliable, if not outright fraudulent. And in a clever parody, the scientists – whose reason and research seems bent on catapulting mankind above the rest of brute creation – have been spliced with the heads of various animals: bears, worms, dogs, and birds. Utopian fiction offers Cavendish the chance to found her own private textual empire from which to wage campaigns against men like Bacon, Boyle, and Pepys and grant herself the intellectual authority her culture denied her.

The past few decades have witnessed a long overdue surge of interest in Cavendish's scientific writings: Carolyn Merchant, Sylvia Bowerbank, and Sarah Hutton have all celebrated her works as an eco-friendly alternative to the ruthless mechanism outlined by Bacon.<sup>12</sup> As opposed to the *Novum Organum's* vision of an inanimate environment freely manipulated by mankind, her *Observations Upon Experimental Philosophy* sets forth a system of organic materialism that sees Nature as a living, self-moving, self-aware entity. Whereas Bacon asserts that 'Vulcan is a second nature', Cavendish declares that artificial experiments are only 'partly natural', reproducing an isolated phenomenon 'like an emulating ape' without understanding it. Finally, as if in a deliberate bid to rival him, she appends *The Blazing World* to her scientific treatise just as he had attached *The New Atlantis* to the *Sylva Sylvarum*. In light of

<sup>11</sup> Samuel Pepys, *Diary* (Berkeley: 1970–83) vol. 8, 242–3 (30 May/9 June 1667).

<sup>12</sup> Merchant C., *Death of Nature*; Bowerbank S., "The Spider's Delight: Margaret Cavendish and the 'Female' Imagination", in Farrell K. – Hageman E. – Kinney A. (eds.), *Women in the Renaissance* (Amherst: 1990) 187–203; Hutton S., "Science and Satire: The Lucianic Voice of Margaret Cavendish's *Description of a New World Called the Blazing World*", in Cottagnies L. – Weitz N. (eds.), *Authorial Conquests* (London: 2003) 161–78.

the parallels between the utopias it seems a plausible conjecture that Bacon's legacy is the main quarry her satire pursues. But Cavendish's relationship to Bacon is in fact far more complex than either this essay or prior studies on the topic have yet implied. If Cavendish saw herself as the belated nemesis of Bacon, why does she refrain from mentioning him directly in either *The Blazing World* or the *Observations*? After all she does single out the theories of Gassendi, Descartes, Hobbes, and Henry More for rebuttal on several occasions. Can her silence simply be chalked up to *de mortuis nil nisi bonum*? One possible explanation for the clemency shown to Bacon is that the two thinkers have more in common than a cursory glance at their works or current critical reputations would indicate.

Cavendish has long suffered under the aspersions that her natural philosophy was erratic and inconsistent;<sup>13</sup> in her dogged pursuit of truth she espouses a number of seemingly conflicting opinions, including theories that rely on technology or embrace mechanistic principles, as in her chapters 'Of Natural Matter and Motion' (199) and 'Of Natural Sense and Reason', where she accepts Glanvill's proposition that the body and the mind are 'moved by the inward springs and wheels of the corporeal machine' (215). But if Cavendish can be taxed for contradictions, neither is Bacon's philosophy exempt from the same charge. For instance some of his early works (not published until 1653) express enthusiasm for Democritus' materialist doctrines on the vacuum and the immutable atom. Though he eventually rejected these teachings in the *Novum Organum*, Cavendish found them congenial and may have borrowed from Bacon's early commentaries to formulate her materialist ontology.<sup>14</sup> Rather than condemn their writings as a hopeless muddle, the discrepancies are a sign of their intellectual honesty. Given that both Bacon and Cavendish were continually refining, rescinding, and/or updating their theories over several decades, it is not surprising their opinions would periodically intersect. Most recent studies on the Duchess, while acknowledging her inconsistencies, have focused almost exclusively on her skepticism toward the male scientific establishment and read *The Blazing World* as a compensatory fantasy, a retreat into

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<sup>13</sup> See for instance Perry H.T.E., *The First Duchess of Newcastle and Her Husband as Figures in Literary History* (Boston: 1918) 197; Woolf V., *A Room of One's Own* (New York: 1929) 65.

<sup>14</sup> See E. O'Neil's introduction to the *Observations Upon Experimental Philosophy* (Cambridge: 2001) xiv.

radical subjectivity.<sup>15</sup> But there is another strain in Cavendish's philosophy that embraces the Baconian vision of a universal, impartial science engaged in the discovery of 'natural truths.' A more nuanced comparison of their writings reveals that Cavendish at times entertains the possibility of objective knowledge, while Bacon's later works display a marked ambivalence toward technology that anticipates aspects of Cavendish's critique.

Cavendish's quarrel with Baconian science rests more with its means than with its ends. In other words, while she rejects the use of technology that effectively grants men a monopoly on the production of scientific knowledge, she does not dismiss objectivity outright as a philosopher's pipedream. On the contrary, the preface to her utopia avers 'there is but one truth in nature' (123), and much of the book that follows consists of an attempt to ascertain it. In addition to attacking Descartes, Boyle, and Hobbes, Cavendish also hurls some of her most venomous invective at the teachings of skepticism, in both its classical and modern dispensations. To the extent they deny the possibility of genuine knowledge, Cavendish deems 'their doctrine is not only unprofitable, but dangerous' (214). Cavendish proceeds to call on skeptics and overly confident dogmatists to set aside their differences and adopt a less biased approach that strives for consensus rather controversy, and 'make *an harmonious consort and union in the truth of nature*' (214).

As we have seen, the notion of objectivity, to the extent it existed in the early modern period, was closely knitted to certainty and impartiality. In her utopia Cavendish assumes this discursive pose through the persona of the inquisitive Empress. As a stranger to the realm she ostensibly has no pre-existing political agenda; nor do personal or fiscal interests warp her judgment. Wielding a comprehensive knowledge of current scientific theories and the supreme authority to accept, question, denounce, or modify them, the Empress can be seen as an incarnation of the objective mind. Of course this is not to say that Cavendish herself succeeds in attaining absolute neutrality: in selecting an Empress as her mouthpiece she even more blatantly than Bacon conflates objectivity with a royalist point of view. Coming from the pen of a Duchess, the theory of a universal order in nature may be justly suspected of shielding

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<sup>15</sup> Bowerbank S., "The Spider's Delight"; Sarasohn L., "A Science Turned Upside Down", *Huntington Library Quarterly* 47 (1984) 289–307; Whitaker K., *Mad Madge: The Extraordinary Life of the Duchess of Newcastle* (New York: 2002) 307.

a desire to preserve the fragile peace of the Restoration – hence her denunciation of skepticism as ‘dangerous’. But Cavendish also seems to sense that a truly unbiased methodology could present a loophole allowing women under the tent of the scientific community. When the Empress decides to hire a scribe to record her decrees, she rejects Plato, Pythagoras, Gassendi, Descartes, and Hobbes on the grounds that they are ‘wedded to their own opinions’ and too ‘self-conceited’ to respect a woman. Instead she selects the Duchess of Newcastle since ‘although she is not one of the most learned, eloquent, witty and ingenious, yet she is a plain and rational writer’ (181). In a brilliant rhetorical parry, Cavendish turns her lack of a university education into an asset. Her alleged simplicity endows her with superior epistemological credentials: a mind guided by reason rather than presupposition, which therefore pays no homage to the Idols of the Theatre. Shortly afterwards the disembodied spirits of the two women depart the Blazing World to float above the earth and ‘in a moment viewed all the parts of it, and all the actions of the creatures therein’ (190). The text here imagines an omniscient and disinterested perspective on the phenomenal world, one attained by the powers of reason and imagination rather than the promise of technology.

In a curious passage from the *Observations* Cavendish refers to technology as a ‘hermaphroditical’ art. As a woman who literally barged into the male-dominated scientific community, her word-choice would practically scream of authorial self-consciousness. By calling the new devices ‘hermaphroditical’ she projects onto them her own daring program to infuse natural philosophy (and its patriarchal authority over nature) with her feminist perspective. But rather than substitute the outpourings of her ‘female imagination’ for the rational methodology of her male contemporaries,<sup>16</sup> Cavendish more often than not promotes her work as offering a vital supplement. Just as she attaches *The Blazing World* to the *Observations*, Cavendish’s lengthy prefaces and epilogues fashion a self-image that is both highly creative and eminently rational. Although she deflects criticism for her bold scheme onto technology, she in effect formulates a hermaphroditic epistemology with the aim of inaugurating a science that is truly universal and objective.

Cavendish’s hostility toward the mechanical arts also relaxes on several occasions. Despite the Empress ordering the Worm-men to

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<sup>16</sup> Bowerbank S., “The Spider’s Delight”.

smash their telescopes, Cavendish was no Luddite. In fact some of her early writings exhibit an avid interest in scientific instruments and the potential discoveries they could unlock. In 1657 she composed a detailed letter to Constantijn Huygens that evinces both fascination with the microscope and some expertise in operating one.<sup>17</sup> Even the sailors of the *Blazing World* have equipped their ships with motors which the narrator deems an ‘extraordinary art, much to be taken notice of by experimental philosophers’ (129). And it is worth recalling that the Empress’s order to destroy the ‘deluding glasses’ is not actually obeyed. To be sure, by the time she penned her later works her enthusiasm for such devices had soured. Though criticism has recognized her disillusion with technology, it has not fully unraveled the motives behind it. Hilda Smith speculates that Cavendish turned against the new instruments because of their failure to produce practical results.<sup>18</sup> While Smith’s point is well-taken, I would argue that the Duchess’s aversion primarily springs from a sense that these tools problematize the search for objective knowledge. While Bacon boasts of the glasses by which the members of Salomon’s House manipulate light at their whim, Cavendish’s chapter on micrography complains that these devices produce ‘so many alterations made by several lights, their shadows, refractions, reflexions, as also several lines, points, mediums, interposing and intermixing parts, forms and positions, as *the truth of an object* will hardly be known’ (50; italics mine). This would seem to point to a fundamental difference between the two thinkers: whereas Bacon attempts to naturalize technology, Cavendish relies on technology to define the natural, drawing a distinction between ‘artificial delusions’ and ‘natural truths’ (142).

But again to portray the two thinkers as bitterly and hopelessly divided on this issue would be reductive. First off, Cavendish is most likely not reacting to Bacon here but to Hooke’s *Micrographia*, which appeared in 1665, the year before she wrote *Observations* and *The Blazing World*. Secondly, close scrutiny of Bacon’s writings reveals that he shares Cavendish’s concern to distinguish between ‘artificial delusions’ and ‘natural truths.’ Though Cavendish’s suspicion is more pronounced, it is as if both thinkers gradually realized that new technologies raise more

<sup>17</sup> British Library, Add. Ms. 28558. f.65.

<sup>18</sup> Smith H., “Margaret Cavendish and the Microscope as Play”, in J. Zinsser (ed.), *Men, Women, and the Birthing of Modern Science* (DeKalb: 2005) 48–70.

interpretive difficulties than they resolve. Bacon too was keenly aware that these devices could be exploited to mislead the senses, thus admitting the possibility that the data they generated in experiments might also be chimerical. In addition to the *camera obscura* he had personally witnessed Drebbel perform a series of optical illusions with specially designed lanterns to make his silhouette assume the shape of a lion, a bear, a pig and even a tree with fluttering leaves.<sup>19</sup> Recognizing that their use in parlor tricks might sabotage his program, he actually equates the frisson of delight people feel at such *trompe l'oeil* with sexual arousal: 'With arts voluptuary I couple practices jocular; for the deceiving of the sense is one of the pleasures of the senses' (3, 379). Thus his litany of technological marvels in the *New Atlantis* concludes with a firm commandment outlawing any practices that smack of magic:

But we do hate all impostures and lies; insomuch as we have severely forbidden it to all our fellows, under pain of ignominy and fines, that they do not show any natural work or thing, adorned or swelling, but only pure as it is, without all affectation of strangeness. (3, 164)

Though recent criticism has peddled a caricature of the Lord Chancellor as the sinister architect of our modern technocracy and its ensuing ecological crisis,<sup>20</sup> his later writings often express reservations about technology and preach a moderate pace for its advance. In a piece added to the final edition of his *Essays*, 'On Innovations', Bacon advises that new inventions 'be held for a suspect' (6, 434); necessity, not novelty, should determine whether they find widespread acceptance in society at large. Bacon voices his misgivings even more loudly in *De Sapientia Veterum*, where he interprets Daedalus as a personification of mechanical philosophy and reflects on some of the dubious devices credited to the Greek inventor: the 'machine' that enabled Pasphinae to copulate with a bull, the Minotaur's labyrinth, Icarus's wings. For Bacon the myth offers a cautionary fable about 'the unlawful contrivances of art' (6, 735). While he concedes that technology has brought numerous benefits for mankind, he concludes with a doleful reminder that 'out of the same fountain come instruments of lust, and also instruments of death [...]. The most exquisite poisons, also guns, and such like engines of destruction, are the fruits of mechanical invention' (6, 735). This sobering observation qualifies the zeal for technology that animates *The*

<sup>19</sup> Boesky A., *Founding Fictions: Utopias in Early Modern England* (Athens: 1996) 57.

<sup>20</sup> Merchant C., *Death of Nature*.



*New Atlantis*. Further evidence that Bacon's passion for technology had cooled can be inferred from the *Valerius Terminus*. The heading for the tenth chapter of the work announces that it will contain 'an enumeration of inventions already discovered and in use' (3, 324). The text exists in a fragmented state, leaving its Victorian editors to conclude that Bacon intended to insert the inventory at a later date. However instead of the promised catalogue he scrawls only a final sentence in the margins of the manuscript rebuking the impostors and charlatans who have deluded the public with tales of fabulous devices 'differing as much from truth in nature as Caesar's Commentaries differeth from the acts of King Arthur' (3, 234). The addendum captures Bacon's creeping distrust of technology as a basis for establishing certainty in the natural sciences. Just as Bacon himself scrambles the categories of history and fiction by appending *New Atlantis* to his scientific writings, his warnings against the abuse of technology undercut his claims that it will facilitate an impartial, universal knowledge of nature.

Compared with the Royal Society's mania for technology, such proclamations would have struck Cavendish as exceedingly sensible and cautious. Rather than conceiving of *The Blazing World* as a searing rebuttal to Bacon, her utopia may represent an attempt to dispute his real legacy. Their mutual interest in uncovering 'natural truths' and their concern with the problems 'hermaphroditical art' posed to this project should remind us to beware of oversimplifying the correlations between gender and epistemology in early modern science.

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