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‘Hermaphroditical Mixtures’: Margaret Cavendish on Nature and Art¹

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A striking feature of Margaret Cavendish’s natural philosophy is her insistence that things created by the practitioners of scientific arts such as chemistry and microscopy cannot rival the things to be found in nature. These arts, she argues, ‘can put several parts together, or divide or disjoin them’; but they ‘cannot make those parts move or work so as to alter their proper figures and interior natures’ (Cavendish 1664, II.12; Cavendish 2001, 84). In advocating this view, Cavendish partly sets out to challenge experimentalists who claim to be able to transform the natural world. Their aspirations, she argues, extend beyond their powers, and their conceptions of what they can achieve are deluded.

At the root of this debate lie two venerable ontological problems about the relation between art and nature. Can the stock of natural kinds be enlarged by human artifice? For example, when chemists first produced pewter or farmers began to breed mules, did they increase the number of kinds in existence by creating new types of things? Equally, are humans able to use artifice to produce new instances of existing natural kinds? For example, can an alchemist create a new piece of gold by combining and heating various natural ingredients? Aristotle had answered these questions cautiously. According to his *Physics*, art can imitate nature, as when a painted bird resembles a natural one, or else perfect nature, as when a farmer helps nature along by planting seeds in the soil; but it cannot equal, let alone surpass her. The painted bird cannot fly, and without nature’s generative powers the farmer’s efforts would be in vain (Aristotle 1984, II.8, 199a15-17). By Cavendish’s time, however, a more optimistic attitude prevailed. According to the experimentalists she criticises, the issue was not so much *whether* art could equal or surpass nature, but how, and how far it could do so. Some chemists claimed to be able to transform one kind of metal into another and even to generate new life. At the same time, experimentalists inspired by the Baconian programme, including the group of investigators associated with the Royal Society, were convinced that not only chemistry, but a whole range of

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experimental arts can replicate existing natural things, and sometimes create new kinds. ‘If any skilful servant of nature shall bring force to bear on matter’, Bacon had asserted, ‘and shall vex it and drive it to extremities as if with the purpose of reducing it to nothing, then will matter (since annihilation or true destruction is not possible except by the omnipotence of God), finding itself in these straits, turn and transform itself into strange shapes’ (Bacon 1890, 726; Weeks 2007, 134). This view of art’s potential is echoed, for example, in Robert Boyle’s boast that ‘If Adam were now alive, and should survey that great variety of man’s productions, that is to be found in the shops of artificers, the laboratories of chemists, and other well-furnished magazines of art, he would admire to see what a new world, as it were, or set of things has been added to the primitive creatures by the industry of his posterity’ (Boyle, 1663).

Cavendish opposes this conception of the power of art throughout her natural philosophy; but her most concentrated engagement with it is contained in her *Observations on Experimental Philosophy* and in its companion text, *The Blazing World* (Cavendish, 2003). This first of these works aims to vindicate a more sceptical attitude to artifice and a greater reverence for nature by showing that some of the leading *virtuosi* of the Royal Society, including Robert Boyle, Henry Power and Robert Hooke, have misunderstood the implications of their own experiments. Rather than surpassing nature by creating new natural kinds, or even replicating existing kinds by artificial means, their arts deform nature by generating ‘hermaphroditical mixtures’ that they mistake for natural things (Cavendish, 2001, 197-8).

In a sophisticated intellectual milieu captivated by novelties, Cavendish’s outlook was liable to appear old-fashioned and under-informed. Although, as Peter Dear has argued, she did not defend the Aristotelian view of the relation between art and nature to the letter, she must nevertheless have seemed bent on reviving its spirit (Dear 2007, 132); and some of the experimental scientists she attacked would no doubt have shared the view recently voiced by William Newman, who characterises Cavendish’s position as ‘a *reductio ad absurdum* of the arguments usually mustered against the chymical art’ (Newman 2005, 284). However, before we can assess her view, we need to know what she was trying to achieve. Cavendish does indeed set out to show that chemists and microscopical experimenters are unable to transform nature; but since her aim is not merely to discredit their claims, her critique of the experimental arts cannot simply be dismissed in Newman’s terms. As well as

standing against prevailing opinion, Cavendish opens out an existing seventeenth-century discussion by turning her critical gaze on to the desires and aspirations of artificers. What drives chemists or microscopists to try to rival nature, she asks, and why do so many of them delude themselves about the extent of their achievements?

Part of the answer lies in ordinary epistemological failings. However, as I argue in this chapter, Cavendish also uncovers an erotic component of the desire to emulate and surpass nature's powers, which she expresses in her description of the fruits of experimental art as 'hermaphroditical mixtures'. In addition to criticising experimental artificers on epistemological grounds, she shifts the terms of debate by offering a diagnosis of the desires that lead them to try to master nature; and in the long narrative that spans the *Observations* and *Blazing World* she considers how their desires can be satisfied. According to her account, there is nothing wrong with the desires themselves, which, like everything else, are part of nature. Rather, the problem lies in the way that artificers strive to realise them. As the *Observations* explains, the experimental sciences cannot equal nature, so that practitioners who try to exercise their creativity through these arts are bound to be frustrated. However, as the *Blazing World* goes on to illustrate, nature has given us the imaginative means to create new things and, by doing so, to satisfy the erotic desires that underlie our efforts to surpass the natural world. The art of imagining, of which *Blazing World* is a manifestation, can compensate us for the limitations of the experimental arts, and satisfy the misdirected desires that generate opposition between art and nature.

In defending this interpretation, I build on a rich set of explorations, both of the gendered character of Cavendish's natural philosophy (Clucas 2014; Cottegnies 2014; Keller 1997, 450-1; Sarasohn 2010, 158-63) and of the relationship between *Observations* and *Blazing World*. However, three strands of recent research are particularly pertinent. First, I follow a group of authors who have observed, as Tien-yi Chao puts it, that the principle of "nature before art" is, for Cavendish, 'a fundamental principle, to be implemented in both philosophical reasoning and literary writing' and is defended throughout the *Observations* and the *Blazing World* (Chao 2012, 73). In the latter text, I argue, Cavendish presents imagination as an integral aspect of nature that can make up for the limitations of the experimental arts, and release the practitioners of these arts from the destructive illusion that these arts can outdo nature.

My argument also resonates with Chao's proposal that, despite Cavendish's resolutely critical attitude to the alchemical tradition, she is in some ways indebted to it (Chao, 2009). This is not immediately obvious. For example, as Stephen Clucas has pointed out, Cavendish's most explicit engagement with chemistry – her discussion of Van Helmont's *Oriatrike* in her *Philosophical Letters* – echoes Boyle's slightly earlier comments on the same author (Clucas 2011, 4). Like Boyle, she objects to Van Helmont's obscure language, and questions the validity of some of his experiments. But whereas Boyle accepts a version of Van Helmont's view that chemistry can transform nature, Cavendish reiterates her central thesis. 'Your Author, being a Chymist, is much for the Art of Fire, although it is impossible for Art to work as Nature doth; for Art makes of natural Creatures artificial Monsters, and doth oftener obscure and disturb Natures ordinary actions, then prove any Truth in Nature' (Cavendish 1664, III.12). Because Cavendish repeatedly emphasizes the deficiencies of the chemical tradition, it is easy to overlook the extent to which it permeates her own outlook. Chao seeks to redress this balance by offering an alchemical reading of the *Blazing World*. The conception of nature defended by the Empress, she contends, is also articulated in alchemical works by Paracelsus and Sendivogius, which Cavendish could in principle have read (Chao, 2009, 66-9). I offer a different kind of support for this strand of interpretation by identifying another of Cavendish's alchemical debts: the conception of the hermaphrodite that figures in her critique of experimental philosophy. Commentators have remarked on the use of this image as a symbol of illusion and deformity (Fox Keller, 1980), and Dear has illuminated its overall place in Cavendish's philosophy. As he points out, she construes nature as feminine, and thus aligns art with the masculine (Dear 2007, 133). However, as far as I am aware, there is no systematic account of the role that the image plays in *Observations* and *Blazing World*. By tracing its fortunes, I suggest, we can extend our understanding of the philosophical argument about the relation between nature and art that is enfolded in these texts.

After summarizing the most relevant features of Cavendish's ontology, I focus on her claim that chemists produce hermaphroditical mixtures rather than natural things. I trace the source of this image and indicate how Cavendish uses it to assess both the achievements and the motives of practising chemists. I then show how she uses a parallel range of arguments to criticize microscopy before turning to her central

aim: that of explaining how experimental artificers can satisfy the desires that underlie their aspiration to create new things by turning to the art of fiction. In the final section of the paper I show how Cavendish spells out this strategy in the *Blazing World*.

Cavendish develops her critique of the experimental arts against a background conception of the natural world as orderly and infinitely productive. Nature, she argues, is an organised whole made up of living and self-moving bodies that all belong to a single ontological kind and are composed of three types of matter, inanimate, sensitive and rational. Furthermore, nature is infinitely productive and delights in her own variety. Her orderliness is reflected in the fact that the number of species is fixed. (All species last as long as nature does, and the human species, for example, ‘is as lasting as the sun, moon and stars’ (Cavendish 1668, 11, 234; Cavendish 2001, 132).) But because natural motions are not entirely regular and allow for infinite variation, no two individuals of a given species are exactly alike, and things of a given kind can differ from one another in an infinite number of ways (Cavendish, 1668, 31). This diversity makes it easy to misclassify things. For example, we may mistakenly infer that blue and white diamonds are separate minerals, or wonder whether black moors, ‘who seem a kind of race of men different from the white’, were produced by Adam (Cavendish, 2001, 115). Equally, we may wrongly conclude that individuals who seem to us to be monsters are unnatural, when in fact they are simply the result of irregular though natural motions that cause them to deviate from what we regard as the norm.

A further source of confusion derives from what some of Cavendish’s contemporaries describe as ‘middling things’, which combine the features of two different species. According to John Weemes, for example, the bat is between creeping things and fowls and the hermaphrodite between man and woman (Weemes, 1632), while Benjamin Spencer adds that mandrakes are of a middle nature between a plant and living creature, while amphibians are between flesh and fish (Spencer, 1659). Cavendish extends this list: flying fish, she claims, are part beasts and part fish, bats combine the properties of mice and birds, and owls those of birds and cats (Cavendish 1668, 164,171). But these creatures are not exceptions to nature’s rule. They have their own figurative motions or appearances, their own interior natures or capacities, and are thus natural species in their own right. It is only because ‘man is

apt to judge according to what he, by his senses, perceives of the exterior parts of corporeal actions of objects, and not by their interior difference' that we are sometimes misinterpret the ontological structure of the natural world (Cavendish, 2001, 115).

Alongside their diversity, natural things have certain common features, of which one of the most crucial is the power to reproduce 'from the producers' own parts' (Cavendish, 1668, 233). Natural bodies, as Cavendish conceives them, possess the power to alter themselves by 'patterning out' the figures of other bodies, as when the snow 'patterns out' the figure of the sole of a boot, or the eye patterns out the figure of a face. But they also reproduce themselves through 'a mutual transformation of all figures and parts of nature' (Cavendish 1664, III.10). Where two individuals of the same species unite to generate their offspring, parents and children resemble one another 'in their interior and exterior figures'. But reproduction does not always conform to this pattern; 'not everything doth always produce its like', and in some cases an individual of one species generates an individual of another, with its own exterior form and intellectual nature (Cavendish 1668, 39). The production of maggots by cheese, minerals by the earth, or worms by fruit and flowers, not only illustrate nature's infinite generative capacity but also remind us of how little we know about its interior operations.

Cavendish's assessment of the relation between art and nature is shaped by this philosophical outlook, and by an accompanying reverence for the complexity and variety of natural motions (Cavendish 1662, 162-3; Cavendish 1668, 29, 117; Detlefsen 2009, 430-4; Walters 2009, 256.). She agrees with her opponents that art can mimic nature by making things that superficially resemble natural things, can assist nature by facilitating or speeding up natural processes of production, and can produce useful combinations of materials such as ships or necklaces that do not pretend to be natural kinds (Cavendish 2001, 84; Cavendish 1668, 39). But when it comes to the question of whether art can transform a thing of one kind into a thing of another, or add to the existing stock of natural kinds, she parts company with them. While they claim that artificial processes can join distinct types of bodies 'under a new form', thus creating new kinds of things that are not merely mixtures of their components, but rather, as Bacon puts it, 'properly an union', Cavendish insists, as we have seen, that art can never do more than mix components (Bacon 1872,93-4).

This unwavering conviction is partly grounded on Cavendish's belief that, because we cannot perceive the great variety of actions that are constantly occurring in every part of every natural creature, we cannot fully understand the inner natures of things. We can therefore never be sure whether things that we create really match their natural counterparts, and thus whether we have succeeded in replicating nature, whose 'waies and originals are utterly unknown' (Cavendish 1653, 176; Cavendish 1664, IV.24; Cavendish 2003, 42-3). By itself, this appeal to ignorance is weak, but it makes more sense when allied to Cavendish's observations about nature's generative power. As we have seen, one of the defining features of natural things is their capacity to reproduce. Here, Cavendish implies, we find a crucial difference between the products of nature and those of the experimental arts. While natural things reproduce, artefacts do not (Cavendish 1664, I.45). For example, while a farmer may cross a donkey with a horse to produce a mule, the mule is sterile; and while a chemist may make pewter by heating tin and lead, pewter is not naturally produced or reproduced, as Cavendish believes that minerals are. Such cases provide support for the generalisation that the inner natures of artefacts are not the same as those of natural things, so that, in this respect, art fails to imitate nature. Furthermore, the inability of artefacts to reproduce shows that they lack the internal unity of natural things and are merely artificial mixtures. Pewter, for example, is just a mixture 'between tin and lead' (Cavendish, 2001, 14), and mules mix up the properties of horses and donkeys without constituting a distinct species (Cavendish 2001, 232). So, whereas a housewife who uses milk to make cheese taps into nature's ability to transform one kind of thing into another and benefits from her fecundity, a chemist who strives to make new metals vainly attempts to 'enforce nature and make her go out of her natural pace' by redirecting her power (Cavendish 1653, 176). Rather than assisting in the creation of a natural thing, capable of playing its part in the reproductive cycle of nature, he produces something sterile.

Cavendish could in principle have made the image of sexual sterility explicit. In fact, however, she incorporates it in the more arresting metaphor of hermaphroditical mixture on which we have already touched. 'I call artificial effects hermaphroditical, that is partly natural and partly artificial: Natural because art cannot produce anything without natural matter....; but artificial because it works not after the way of natural productions' (Cavendish 2001, 198). Why, though, does Cavendish's argument take this turn? Her train of thought draws, I suspect, on the

works of Paracelsan chemists, who hold that their arts of transforming base metal into gold and creating living things involve the conjoining of a male and female principle, and attribute the power to unite the two to Mercury or Hermes. Sometimes, Mercury is represented as a hermaphrodite who personifies this union; in other accounts he is simply the possessor of the masculine power on which it depends. In either case, he lends his power to chemists, endowing them with the capacity to transform one thing into another, whether by summoning a hermaphroditic being or Rebus, creating a homunculus or living man, restoring the dead to life, or transforming base metals into gold (Long 2006, 117).

The various forms of transformation that chemists claim to achieve are therefore associated with the idea of sexual unification. But so, too, is their own power, and in conceiving of themselves as conjoining male and female principles chemists express an underlying aspiration to unite the two that they find in a range of ancient myths. For example, alongside his invocations of Mercury, Paracelsus draws on a rabbinical interpretation of *Genesis* v. 2, in which Adam is represented as a hermaphrodite. ‘Rabbi Jeremiah b. Leazar said: When the Holy One, blessed be He, created Adam, he created him an hermaphrodite, for it is said, *Male and female created he them and called their name Adam*’ (Freedman and Simon 1934, 54; Almond 1999, 4-8). The philosopher’s stone, Paracelsus now infers, is both a ‘fiery and perfect Mercury extracted by nature and art’ and at the same time ‘the artificially prepared and truly hermaphrodite Adam, a reproductively self-sufficient being that ‘copulates by itself ... marries itself and conceives in itself’ (Paracelsus 1659, 51; Paracelsus, 1976, 67). The stone, and by implication the chemist, are thus endowed with the power to unite opposing sexual principles by two hermaphroditical figures, Mercury and also Adam, ‘the inventor of all the arts’ (Paracelsus, 1976, 48).

Chemistry is one of the main targets of Cavendish’s attack on the view that art can surpass nature, and her objections to it are sensitive to these sexual connotations. By criticising its experimental credentials she opens the way to a deeper exploration of its practitioners motivations. Echoing a widespread scepticism, Cavendish doubts that it is possible to create gold by artificial means and dismisses their claims on behalf of the philosopher’s stone as expressions of hope rather than assurance (Cavendish, 1664, III.13). Their experiments fail to establish that heating metals in a furnace can do more than rarefy them, and do not show that their techniques can convert one substance or form into another (Cavendish, 1664, III.5). Equally, there is

no good reason to suppose that they can restore the dead or create living things; what Paracelsus describes as a homunculus is more likely to be ‘some dregs gathered together into a form’, which he then ‘persuaded himself was like the shape of a man’ (Cavendish 1653, 176). In short, chemical art has not shown that its products are more than mixtures, which superficially resemble natural things but lack their inner forms.

In describing these mixtures as hermaphroditical, Cavendish implicitly subverts the chemists’ sense of their own power. While they conceive of themselves as endowed with the extraordinary ability to generate hermaphroditical beings in which male and female are seamlessly united, Cavendish represents their products as sexually-fragmented assortments of male and female traits. This criticism is not unprecedented. According to Charles Estienne, for example, cross-breeding fruit trees couples two natures in one and creates a fruit that is mongrel or hermaphrodite (Estienne 1616). Furthermore, as Estienne makes clear, the criticism carries connotations of deformity and impurity that are associated with hermaphrodites throughout seventeenth-century culture. Ancient opinions, such as Aristotle’s contention that hermaphrodites have a male breast and nipple on the left and a female on one the right, are endlessly repeated, and the ‘mixed’ genitalia of those identified as hermaphrodites are routinely classified into four types (Paré 1634, 973; Laqueur 1992, 135). In the *English Parnassus*, Joshua Poole defines ‘hermaphrodite’ as ‘ambiguous, promiscuous, sex-confused, mongrel, neuter, effeminate’ (Poole 1657, 111), so that the shadow of monstrosity is never far away. The terms is disparagingly applied to men who have long hair, love music, or have gentle dispositions, and to women who are ‘Virago-roaring girls’, fail to cover their hair, cross-dress, or occupy positions of authority. Unsurprisingly, the deep anxiety that these disciplinary strategies reveal is also reflected in the law, where hermaphrodites pose difficulties in relation to marriage and inheritance. In response, legal authorities argue that anyone classified as a hermaphrodite must make a binding decision to ‘become’ male or female, ‘according to the predominance of their sex’ (Edgar 1632, 5).

When Cavendish describes the products of chemistry as hermaphroditical mixtures she draws on this disturbing penumbra of meaning, in which hermaphrodites are portrayed as not fully male or fully female, not one thing or another, and also as individuals whose sexuality is concealed and thus misleading. Picking up the first aspect of this image, she plays on the view that the hermaphrodite stands between man and woman in her claim that chemical mixtures form ‘a third figure between

nature and art' (Cavendish, 2001, 53). Exploiting the second aspect, she transposes the supposedly deceptive appearance of the hermaphrodite on to the products of chemistry. Chemists confuse mixtures with natural things, she contends, 'as if they were to mistake a doll made of paste, wax and gummed silk for a living child' (Cavendish, 2001, 114).

To some extent, the chemists' error results from ordinary mistakes such as inaccurate perceptions or invalid inferences. But in Cavendish's view it also flows from a deeper failure to acknowledge that chemistry itself is a hermaphroditical mixture, a *mélange* of nature and artifice. While practitioners regard it as a unified practice, whose power and efficacy is proved by its extraordinary ability to transform nature, she condemns it as a jumble of artificial or experimental techniques that are unsuccessfully brought to bear on natural things. Rather than tapping into nature's motions and enhancing the changes they produce, the chemists distort the natural things on which they work and produce artificial monsters. Cavendish's appeal to hermaphroditic mixtures therefore belongs to a subversive strategy designed to undermine the pretensions of chemistry by pitting one set of symbolic associations against another. To discredit the Paracelsan image of the hermaphrodite who unifies and transcends sexual difference, she draws on a popular conception of hermaphroditism as a condition of unresolved incompleteness. Far from uniting or transforming natural things, chemistry disorders nature.

It is rare for a seventeenth-century writer to reject chemistry as wholeheartedly as Cavendish does, but many of her contemporaries shared at least some of her reservations. They also doubted chemistry's more extravagant claims, and questioned the explanatory power of the arcane forces to which practitioners appealed (Cavendish 1664, III.2, III.5.). Cavendish's attack was therefore part of a broader debate. To a lesser extent, the same is true of her parallel critique of a second experimental art, namely microscopy (Wilkins, 2014, 7). A number of authors had raised doubts about the validity of microscopical observations, but again, Cavendish carries them to unusual heights. When she contends that such 'toyish' investigations are also a hermaphroditical travesty of art, she is on relatively unfamiliar ground (Cavendish 1668, 294).

Like the argument that we have traced so far, this critique has two connected aspects, one to do with microscopic images, the other with the art of microscopy itself. Addressing the first, Cavendish starts from the widely-accepted claim that,

when we view an object under a microscope, we only perceive what Sydenham calls ‘the outer husks of the things we would know’ and do not penetrate to their inner natures (Sydenham 1850, ii.171). Developing her position, Cavendish next introduces the more troubling suggestion that microscopy may not accurately reveal the surfaces of things. ‘The question’, she asserts, is ‘whether it can represent the exterior shapes and motions so exactly, as naturally they are’ (Cavendish 2001, 50). After all, objects under a microscope look different when viewed from diverse angles and in various lights, so that, as Hooke had explained in the Preface to his book of engravings, *Micrographia*, he had had to combine a number of microscopic images to capture the ‘true forms’ of things, (Hooke 1667, f2; Keller 2009, 454). Furthermore, appearances vary from one lens to another. ‘A glass that is flawed, cracked or broke, or cut into the figure of lozenges, triangles, squares of the like, will present numerous pictures of one object’ (Cavendish 2001, 50). Cavendish knew from experience that these microscopists have to try to surmount these familiar obstacles, but she also goes on to voice a deeper reservation. When we look at a natural object through a microscope, she points out, we do not observe it directly: ‘it is not the body of the object which the glass presents’. Instead, we see an image of the object reflected through a lens: ‘the glass only figures or patterns out the picture presented by and in the glass’ (Cavendish 2001, 51). The resulting image or figure is therefore the fruit of mixing a natural process - ordinary vision - with an artificial one - the interposition of a lens. And in Cavendish’s view, this is enough to discredit the image itself. It is ‘a hermaphroditical, that is mixt figure, partly artificial and partly natural’ (Cavendish 2001, 50).

By describing microscopic images in these terms, Cavendish indicates that she regards them, not as natural things, but rather as ontological distortions of nature’s operations, brought about by meddling artificers. However, her principal objection to the use of lenses in philosophical investigation is epistemological (Keller 1997, 450). As we have seen, she is convinced that chemists have a delusory conception of their art. They believe they are creating new kinds of things on a par with those created by nature, when in fact they are only producing hermaphroditical mixtures. Analogously, microscopists believe that they have created an artificial form of vision, superior to the one with which nature has endowed us. But this, too, is a mistake, because microscopic images are also only hermaphroditical mixtures. While Cavendish does not go so far as to claim that all such images lack veracity - ‘I do not

say that no glass presents the true picture of an object' - she nevertheless takes distortion to be the rule rather than the exception (Cavendish 2001, 50). Since optic glasses 'oftentimes present falsely the picture of an exterior object', representing its figure in so 'monstrous a shape, as it may appear misshapen rather than natural', the safest course is to avoid them (Cavendish 2001, 50-1). 'Wherefore the best optic is a perfect natural eye and a regular sensitive perception' (Cavendish 2001, 53).

Microscopists such as Power or Hooke, who ignore this advice, overreach themselves when they claim to know what the eye of a fly really looks like, just as chemists are deluded when they claim to be able to transform base metal into gold. Both sets of practitioners fail to recognise that their knowledge claims are the outcome of distorting arts that 'blind the understanding and make the judgment stagger', and are duped by their faith in artifice (Cavendish 1662, III.13). Led on by desire for the kind of power that nature exercises when she creates unified natural kinds, experimenters comfort themselves with the fantasy that they, too, are capable of achieving this feat. In doing so, they generate the illusion that art can dominate nature.

In the light of this conclusion, Cavendish calls for a reconsideration of the ontological relation between nature and art. Within natural philosophy, that 'rational search and enquiry into the causes of natural effects', fantasies such as the ones that chemists and microscopists indulge in are a serious failing, to be avoided at all costs (Cavendish 2003, 5). If these experimenters are to contribute to philosophical enquiry, they will have to scale back their ambitions and concentrate on what they can soberly establish to be the case. However, the capacity to form desires that go beyond our existing achievements and imagine that they are already realised is part of our nature; and, as we can infer from the currency and persistence of the experimental delusions that Cavendish has identified, it can be intensely pleasurable. Since this feature of human life is a natural one and is not going to disappear, Cavendish contends, we need to consider how people can experience the satisfactions of imagining without running the risk of philosophical error. Happily, nature has provided one. By cultivating the art of fancy or fiction, a man may frame ideas 'in his own mind, ... without regard whether the things he fancies be really existent without his own mind or not'. While 'reason searches the depth of nature and enquires after the true cause of natural effects, fancy creates of its own accord whatever it pleases and delights in its own work' (Cavendish 2003, 5).

With this reassurance, Cavendish shifts her readers' attention away from the experimental arts to a materialist analysis of art in general. All arts are part of nature and, when properly practised, contribute to her power to produce an infinite sequence of individual bodies. Furthermore, these bodies are of a single ontological type. Whether they are grains of sand, dandelions or human beings, they are composed of self-moving matter and possess to a greater or lesser degree the capacity to move in the various ways that constitute sensing, imagining and reasoning. The power to imagine, then, is not confined to a few natural species. On the contrary, it is ubiquitous, and each individual body exercises its fancy in its own fashion. Although we are often unable to imagine how other species imagine or what they fantasise about, the imaginings of minerals and plants, for example, are among the manifestations of nature's infinite productivity (Cavendish 1668, 29). Equally, when we imagine, we do not go against nature or disrupt her orderly motions. Rather, in accordance with the Aristotelian definition of art, we imitate nature by imagining objects that resemble her own creations, and perfect her by increasing her variety.

If, as Cavendish argues, many of the claims made by chemists and microscopists lack a rational foundation, they have no place in natural philosophy; but, as products of imagination, they fit comfortably into the art of fiction. In a domain where we do not have to worry whether the objects of our fancy exist, a chemist can safely imagine that a mixture is, as Bacon puts it, 'properly an union'. Equally, though more strangely, microscopists can imagine that they are seeing nature as she truly is, regardless of the presence of an optic glass. To make this point explicit, Cavendish conjoins her *Observations on Experimental Philosophy* with the fictional *Blazing World*. Where the *Observations* repudiates the claims made by experimenters, the *Blazing World* shows how they can be realised, and thus how the desires of their creators can be satisfied. It offers them a refuge from their inability to use the experimental arts to make bodies such as gold, or powers such as vision, and invites them to create new tokens and types in the only way that nature allows, through fiction.

The young woman who becomes the Empress of the Blazing World rules over a country in which many of the artefacts that Cavendish's contemporaries strive to produce occur naturally, so that their arts are rendered unnecessary. It contains, for example, 'more gold than all the chymists ever did, and as I verily believe, ever will be able to make', so that there is no need to create more by artifice (Cavendish 2003,

6); and it is a world where the natural vision of the creatures who inhabit the earth and sky surpasses anything that can be seen through a microscope or telescope.

Cavendish also uses her fiction to bridge the gap between the mixtures that she accuses experimental scientists of producing and the unified individuals that they claim to create, by filling the Blazing World with creatures who are simultaneously mixtures and natural kinds. The Empress encounters men with azure, purple, grass-green, scarlet and orange complexions (Cavendish 2003, 17), bear-men, worm-men, ant-men, bird-men, fish-men and satyrs (Cavendish, 2003, 10, 18), and creatures who are described as intermediate, for example between flesh and fish. Viewed in one way, this is a playful realisation of the experimental scientists' desires, an arena in which their mixtures have become the natural things they aspire to produce. At the same time, it is a fictional exploration of Cavendish's philosophical view that nature manifests her variety by combining qualities from two distinct species to make a third. In our world, for example, an individual of one species such as a bat may combine features of other species such as mice and birds; but in the Blazing World this strategy runs riot and produces a plethora of paradoxically united mixtures. The distinction between mixtures and natural kinds, and between the products of art and those of nature, is obliterated in a fictional world that overspills the limits of our own.

In case we should miss this point, the philosopher scientists of the Blazing World are themselves naturalised mixtures, who follow the professions 'most proper for the nature of their species' (Cavendish, 2003, 18). Founding a series of scientific societies, the Empress installs the fly-men, bear men and worm-men as her experimental philosophers, the fox-men as her politicians, the parrot-men as her orators, and so on, and interrogates each group in turn. Her conversation with the bear-men turns on the value of their optic glasses. Demonstrating the power of their microscopes, the bear men show the Empress magnified images of some of Hooke's prize exhibits (a louse, the eye of a fly, a piece of charcoal, a nettle leaf), much as the members of the Royal Society had performed experiments for Cavendish herself. Throughout these experiments, however, the Empress raises a string of objections: that microscopes may not be true informers; that some of the inferences the bear-men draw from their observations are contradictory; that their art serves no practical purpose; and that 'notwithstanding their great skill, industry and ingenuity in experimental philosophy, they could yet by no means contrive such glasses, by the help of which they could spy out a vacuum' (Cavendish 2003, 31). The Empress's

assessment of telescopes is initially still more critical. Claiming that they cause ‘more differences and divisions among [the bear-men] than ever they had before’, she condemns them as false informers and commands the bear-men to break them (Cavendish 2003, 26). ‘Nature’, she pronounces, ‘has made your sense and reason more regular than art has made your glasses, for they are mere deluders, and will never lead you to the knowledge of truth’ (Cavendish 2003, 27-8).

The bear-men do not try to defend the success of their optical art and merely express the hope that, ‘in time, by long study and practice’, they will be able to answer her objections (Cavendish 2003, 31). But they successfully plead to be allowed to keep their instruments and continue their investigations. ‘We take more delight’, they explain, ‘in artificial delusions than in natural truths. Besides, we shall want employments for our senses and subjects for arguments; for were there nothing but truth, and no falsehood, there would be no occasion for dispute, and by this means we should want the aim and pleasure of our endeavours in confuting and contradicting each other’ (Cavendish 2003, 28). In the *Blazing World*, the optical arts do not reveal nature or enhance philosophical understanding. Nevertheless, they are a source of pleasure and a subject of harmless disagreement. To look through a telescope or microscope and argue about what one has observed is like going to the theatre and then discussing the world of the play; one enters a practice where the unswerving pursuit of truth is set aside in favour of the imaginative exploration of possibilities. This, Cavendish implies, is what experimental philosophers are already doing, and through her own fiction she gives them permission to indulge themselves.

The compensation that Cavendish holds out to chemists, the ape-men of the *Blazing World*, is less direct. After listening to their rambling and inconclusive opinions, the Empress briskly rejects their central claims; but various aspects of the *Blazing World* nevertheless validate the traditional aspirations of chemistry. By imagining a realm where the qualities of gold are acknowledged to be exceptional (the capital city, an epitome of beauty, is built of it and the Empress’s gold ships are vital to the success of her military campaigns), Cavendish respects rather than disparages the chemists’ longing to create gold out of base metal. At the same time, she invents a substitute for the philosopher’s stone; its almost-magical powers are bestowed on a naturally-occurring, fiery sun stone that the Empress uses to impress her subjects and terrify her enemies (Radley 2014, 161-3). Finally, the *Blazing World* contains a gum (concealed in a hollow stone) with which (in a parody of the techniques described by

Paracelsans) the ape-men are able to rejuvenate members of the Imperial race. Listening to their account of this process, the Empress is initially incredulous but eventually convinced. ‘She would not have believed it’, she comments, ‘had it been a medicine prepared by art; for she knew that art, being nature’s changeling, was not able to produce such a powerful effect, but being the gum did grow naturally she did not so much scruple at it; for she knew that nature’s works are so various and wonderful that no particular creature is able to trace her ways’ (Cavendish, 2003, 157). As in Cavendish’s own world, the art of the Blazing World is only effective when it successfully taps into what are, in that domain, the workings of nature.

While the Empress gives students of optics *carte blanche* to pursue their arts and reap the pleasures of doing so, the chemists are offered a realm in which nature already realises many of their aspirations. The resolution of their desires lies in the existence of what they have longed for, a world of unlimited gold and eternal life, rather than in continuing experiment. However, as Cavendish also acknowledges, the satisfaction that the experimental sciences deliver also derives from the delight its practitioners take in their technological prowess. The chemists’ desire to transform nature is partly a yearning to control the natural world and direct it to human ends. To satisfy this ambition, Cavendish fills the Blazing World with artificial marvels that go beyond the scientific achievements of her day. For example, by contrast with a real-life but failed attempt to construct a submarine and sail it up the Thames, the Empress builds a whole fleet of gold ships that can ‘swim under water’ (Cavendish 2003, 192).

The sexual aspect of the desires that Cavendish’s critiques of chemistry and microscopy lay bare also has its counterpart in the Blazing World. As well as realising the chemists’ aspirations to transform mixtures into unified things, its fictional inhabitants also play out the Paracelsan desire to unite male and female principles into one. Cavendish distances herself from Paracelsus’s hermaphrodite exemplars, Mercury and Adam; but she nevertheless offers a means to satisfy the desires that these figures symbolise. Within her narrative, a fictional Duchess of Newcastle becomes the Empress’s counsellor, and with the help of some resourceful spirits the two women’s souls travel to England, where they visit the Duchess’s husband, the Duke of Newcastle. Their souls enter into him, so that three souls are contained within his body; ‘and had there been but some such souls more, the Duke would have been like the Grand Signior in his seraglio, only it would have been a platonic seraglio’ (Cavendish 2003, 81). Before long the souls of the Duke and

Empress grow enamoured of each another, and the Duchess becomes uneasy. Only by considering ‘that no adultery can be committed amongst Platonic lovers’ does she manage to ‘cast forth of her mind the idea of jealousy’ (Cavendish 2003, 81). One function of the fictional *Blazing World* is therefore to render safe a range of erotic desires. Adultery loses its sting, a single body can house male and female souls, sex may be doubled or tripled in male and female combinations, and lovers may become, as Cavendish’s correspondent Walter Charleton expresses it, hermaphrodites but no monsters (Charleton 1668, 70). In fiction, the fragmented conception of the hermaphrodite that dominates Cavendish’s critique of experimental philosophy is set aside in favour of a contrasting but also current image – the hermaphrodite as the symbol of sexual unification. The delights of this union are made present in the conversation between the souls of the Duchess, Duke and Empress, which were, as we learn from the *Blazing World*, ‘so pleasant that it cannot be expressed’ (Cavendish 2003, 81).

The implication that the aspirations of the experimental arts can only be realised by the art of fiction is still more explicit in a further exchange between the Duchess and the spirits of the *Blazing World*. Having acted as the Empress’s adviser, the Duchess forms a desire to rule a world of her own and asks the spirits to help her conquer one. They, however, are surprised by her request. ‘We wonder’, they tell her, ‘that you desire to be Empress of a terrestrial world ... when every creature can create an immaterial world fully inhabited by immaterial creatures, ... and all this within the compass of the skull’ (Cavendish 2003, 72). Moreover, they continue, the rulers of material worlds can only derive as much pleasure from them ‘as a particular creature is able to enjoy’; but ‘by creating a world within yourself, you may enjoy all both in whole and in parts ... and enjoy as much pleasure and delight as a world can afford you’ (Cavendish 2003, 72). Accepting this advice, the Duchess first tries to create imaginary worlds along the lines proposed by a string of philosophers from Thales to Hobbes; but she soon comes to the conclusion ‘that no patterns would do her any good in the framing of her world’ (Cavendish 2003, 75). She therefore resolves to make a world of her own invention that, as it happens, conforms to the principles worked out in Cavendish’s natural philosophy. The message is clear. In the world of material bodies that philosophy struggles to understand, we cannot change the kinds of things that exist. Nature has not endowed us with forms of power that she alone possesses – the power to create new natural kinds or replicate kinds that already exist.

To this extent, we are subject to what the spirits describe as the ‘power and control’ of nature (Cavendish 2003, 72). However, our desire for novelty is itself a natural one, and nature has given us a means to satisfy it. The imaginative arts offer us a way to transcend the limits of physical experiment and enjoy the pleasures that the experimental arts deny us (Chao 2009, 70).

Cavendish’s attack on the arts of chemistry and microscopy appears conservative insofar as it holds that these arts cannot transform nature; and if this were all she had to say, her position would indeed be out of joint with the spirit of her times. In fact, however, her negative assessment of the experimental arts is only the beginning of her argument. Adopting the stance of a critical theorist *avant la lettre*, she enquires into the motives underlying these arts, representing them not just as practices that aim to create new kinds of things, but also as manifestations of a desire to outdo nature, sexually and otherwise. As things stand, she contends, chemists and microscopists are failing to face the fact that their aspirations cannot be realised, because the products of their experimental arts cannot equal those of nature. But they do not need to suppress this insight. Nature has provided us with arts that allow us to outstrip her, by endowing us with the ability to imagine things that she has not created. Experimental scientists should therefore turn to the art of fiction to satisfy their desires.

In offering this form of compensation, Cavendish is challenging an underlying assumption that the experimental arts are more powerful, consequential and efficacious than their imaginative counterparts. The real creators, she claims, are not chemists or microscopists, who wrongly believe that they are capable of making new things, but the authors of poems and fancies (Sadler 1997, 69-76). At the same time, Cavendish offers a resolution of the supposed conflict between art and nature. As far as the experimental arts are concerned, there is no conflict: nature determines what art can do, and only nature can create new things. Nor is there a conflict between the imaginative arts and nature. These arts produce new things; but their creative power is part of nature. All in all, then, there is no opposition between art and nature. Nature reigns supreme over all the arts and licenses the only artistic creations of which human beings are capable.

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