Frankenstein , the Frankfurt School, and the Domination of Nature

Sid Simpson

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Symposium: It's Alive!

Sid Simpson

FRANKENSTEIN, THE FRANKFURT SCHOOL, AND THE DOMINATION OF NATURE

Abstract. Mary Shelley's *Frankenstein* has been read and reread for decades as a cautionary myth about science. The interpretation is well known: a gentler, gradualist science is preferable to the aggressive Enlightenment rationality that spawned the Creature. However, I argue in this essay that such a distinction between "safe" and "dangerous" science is largely effaced in the novel itself. By reading *Frankenstein* alongside Adorno and Horkheimer's *Dialectic of Enlightenment*, I aim to demonstrate that Shelley levels a radical critique of how modern science mediates our moral world by dissolving the boundaries between civilization and nature, enlightenment and barbarism.

"You are my creator, but I am your master;—Obey!"[1]

I

In much the same way that the fable of Prometheus is woven through the text of *Frankenstein*, the myth of Mary Shelley's Creature can rightfully be called the ethical touchstone of modern science. From "Frankenfoods" to stem cell research to organ transplants, the novel has

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been and continues to be invoked as a cautionary tale. Just as Promethean fire illuminates and warms but may burn if one gets too close, science itself can be salutary if used judiciously yet deadly if employed blindly.

Broadly, the reading of the novel by the scientific community maps onto critical academic work that has carefully appraised Shelley's treatment of science in the novel. Anne Mellor[2] and Peter Vernon,[3] for instance, identify Shelley's preference for a natural "gradualist" science over the masculine, Baconian "interventionist" science exemplified by Victor Frankenstein himself. Crucially, both Mellor's and Vernon's readings of *Frankenstein,* as well as the popular invocation of the novel in scientific communities, share a single foundational claim: that an ethically responsible science actually is conceptually separable from and preferable to the hubristic science that spawned the famed Creature. In this essay, I aim to demonstrate that even within Shelley's novel such a stark distinction is less than clear, and that *Frankenstein* prefigures a more radical critique of science that is all the more relevant in the twenty-first century. While the prevailing discourse on *Frankenstein* employs the novel to critique the decisions of scientists in the context of "good" and "bad" science, Shelley also invites us to question how science itself mediates the decisions that those scientists are faced with and the new moral worlds into which they are thrust.

Below, I proceed in three parts. First, I contextualize Shelley's portrayal of science in terms of the novel's contemporary import and the critical scholarship on the novel's relationship to eighteenth-century Europe's scientific ethos. This section complicates the neat distinction between the so-called gradualist and interventionist views of science by pointing to an inherently nature-dominating scientific rationality that connects the two paradigms. Second, I argue that Shelley effaces this distinction by framing her radical critique of scientific thinking as a predecessor to the writings of Theodor Adorno and Max Horkheimer.[4] Shelley's transgression of the nature/culture and barbarism/Enlightenment dualities prefigures many of their critiques in *Dialectic of Enlightenment.* In Steven B. Smith's pithy formulation, "Long before Horkheimer and Adorno, Mary Shelley had discovered 'the dialectic of enlightenment.'"[5] Crucially, Shelley's portrayal of how science's domination of nature culminates in the domination of humanity is a clear forerunner to Adorno and Horkheimer's claim that we too are the nature we dominate. Finally, I conclude by bringing Shelley's radical critique of scientific rationality to bear on the novel's recent status as a popular trope in the voluminous scientific and technological literature of late.

Much more than a hand-waving cautionary tale, I argue that *Frankenstein*'s critique of science is both more radical than previously acknowledged and perhaps even more prescient in the wake of its bicentennial than upon its initial publishing.

II

Victor Frankenstein's ventures have long stoked the flame of scientific debate. Shelley's novel was initially associated with the so-called vitalist dispute, which Andrzej Weseliński explains arose chiefly between John Abernathy, then president of the Royal College of Surgeons, and his student William Lawrence over what animates the body: spirit or matter.[6] Fascinatingly, Lawrence was Shelley's physician and neighbor, indicating that *Frankenstein*'s intervention into this debate was almost certainly intentional. Moreover, Shelley's description of the Creature being animated by a "vital spark" cut to the core of anxieties surrounding the experiments of Luigi Galvani, the eighteenth-century Italian scientist who "reanimated" the limbs of deceased frogs with electricity.

The part that the novel played in the vitalist debate, however, gave way over time to a somewhat broader role: what Suparna Banerjee calls a "metaphor for the dangers of scientific adventurism."[7] In this context, "scientific adventurism" entails both the creation of new technologies with uncertain moral implications and the ethically dubious utilization of existing technologies. Within the last four and a half decades, scientific scholarship has repeatedly invoked the novel explicitly to express trepidation regarding various emerging technologies, including the unreflective use of genetic engineering,[8] spare parts surgeries,[9] eugenics,[10] IVF,[11] research on embryos,[12] race science,[13] resuscitation,[14] cloning and bioterrorism,[15] stem cells,[16] genetically modified foods,[17] perfused human organs,[18] synthetic biology,[19] head transplants,[20] organ transplants,[21] and neurology,[22] just to name a few examples. In fact, a 2015 article, cited more than one thousand times, has even retroactively composed an IRB (institutional, or ethical, review board) proposal for Victor Frankenstein's experiment.[23] This substantial body of work invoking *Frankenstein*'s "lesson," as well as a rash of shorter articles in major scientific outlets (such as *Science* and *Nature*) utilizing the novel in similar ways on its bicentennial, constitutes a considerable legacy of reading the text as a measured critique of engaging in ethically undefined scientific projects.

The prevalence of the novel in discussions of scientific innovation has even spawned comments on the legacy of *Frankenstein* in the scientific community by scientists themselves. Lauren Tourette, for example, considers the novel a reaction to scientific breakthroughs, while others, such as Peter Nagy et al., are much more critical. They claim that a "Frankenstein stigma" has emerged in the scientific community "that focalizes the public's as well as the scientific community's negative reactions towards certain sciences and scientific practices." They continue, "This stigma produces ambivalent reactions towards scientific artifacts and it leads to negative connotations because it implies that some sciences are dangerous and harmful."[24] In a similar vein, Jonathan Moreno pleads that respectable scientists (such as the late Stephen Hawking) be the "face of science" rather than Victor Frankenstein with his Promethean visions.[25] For better or worse, the modern invocation of Frankenstein in scientific scholarship clearly revolves around a singular critique: that the immoral or irresponsible use of science runs the risk of causing more harm than good. This claim maps onto Shelley's novel in a relatively straightforward way. The narrative arc of *Frankenstein* is about a scientist whose ethically dubious creation leads to the demise of both him and his loved ones. The message for the STEM community, then, is something like: "Don't let science and your ethically dubious aspirations mix, lest you end up like Victor."

While the scientific community rightly identifies the broad movement of Victor's hubristic transgression against nature and subsequent fall, the novel itself provides the context of the initial tension between Victor's attachment to the ancient alchemy of Agrippa, Paracelsus, and Albertus Magnus and the newer, more "real and practical" science that failed to inspire the excitement in Victor that the ancient natural philosophers did. As he recounts, "In spite of the intense labour and wonderful discoveries of modern philosophers, I always came from my studies discontented and unsatisfied" (p. 39). What excites Victor is the notably masculine project of "penetrat[ing] the secrets" or "entering the citadel of nature," which alchemy seems to promise in a way that natural science fails to (pp. 39–40).

Upon his arrival at Ingolstadt and initial meeting with Professor Krempe, Victor appears to come to terms with his adolescent folly. He reflects that his "contempt for the uses of modern natural philosophy" stemmed from his infatuation with the "futile, yet grand" visions of the "masters of science," immortality and power. Begrudgingly, he recognizes that his grandiose aspirations no longer correspond with modern science:

"The ambition of the enquirer seemed to limit itself to the annihilation of those visions on which my interest in science was chiefly founded. I was required to exchange chimeras of boundless grandeur for realities of little worth" (pp. 46–47). The juxtaposition of alchemy and modern science here implies a simple point: one should not (and, indeed, cannot) entertain the hubris of the old aims of alchemy, but should instead focus on the smaller, more practical aspirations of modern science.

However, this initial distinction between the lofty yet chimerical aspirations of alchemy and the aims of the lower and presumably more modest modern science is almost immediately displaced by Professor Waldman's lecture, which enthralls Victor.

> "The ancient teachers of this [Alchemical] science," said he, "promised impossibilities, and performed nothing. The modern masters promise very little; they know that metals cannot be transmuted, and that the elixir of life is a chimera. But these philosophers, whose hands seem only made to dabble in dirt, and their eyes to pore over the microscope or crucible, have indeed performed miracles. They penetrate into the recesses of nature, and show how she works in her hiding places. They ascend into the heavens: they have discovered how the blood circulates, and the nature of the air we breathe. They have acquired new and almost unlimited powers; they can command the thunders of heaven, mimic the earthquake, and even mock the invisible world with its own shadows." (pp. 47–48)

Waldman obliterates the initial distinction between alchemy and the natural sciences by drawing out their shared vision. Just as Victor looks to Agrippa in order to "penetrate nature" or "enter her citadel," Waldman declares that modern science can similarly "penetrate into the recesses of nature," unlocking "miracles" worthy of rivaling the promises of alchemy. Moreover, and most important, the masculine manipulation of nature and its attendant revelations no longer yield chimeras when pursued by modern science but rather miraculous powers over nature.

Thus, the distinction in the novel is transformed; an initial contradiction between alchemy and modern science dissolves, and in its place arises an apparent tension within modern science itself. Waldman's lecture, and indeed Victor's subsequent animation of the Creature, make clear that the previously foreclosed aspirations of alchemy are actually achievable through the Baconian penetration of nature espoused by Waldman. Thus, with the door to glory and immortality reopened by advances in chemistry, the onus of responsibility falls upon the scientist herself.

This blurring of scientific and ethical boundaries corresponds to the historical context within which Shelley was writing. As Mellor expertly demonstrates, Waldman's lecture is based heavily on an introductory lecture given by the Cornish chemist Humphry Davy, whose conception of science was gaining popularity at the time when Shelley was writing ("FCS," p. 288). Just as Waldman does in the novel, Davy invokes the masculinist language of mastering a feminized nature; Mellor juxtaposes Waldman's claims about the prowess of modern scientists with Davy's claim that a scientist trained in chemistry

> has bestowed upon him powers which may be almost called creative; which have enabled him to modify and change the beings surrounding him, and by his experiments to interrogate nature with power, not simply as a scholar, passive and seeking only to understand her operations, but rather as a master, active with his own instruments. ("FCS," p. 290)

Mellor rightly argues that Shelley is deeply critical of the "interventionist" sort of scientific rationality exemplified by Davy, or in her words, Davy's "'bad' science, the hubristic manipulation of the forces of nature to serve man's private ends" ("FCS," p. 287). Scholars such as Vernon, Gayatri Spivak,[26] and Banerjee similarly draw attention to Shelley's condemnation of a masculine, interventionist conception of science.

Mellor sets up a distinction, later taken up by Vernon, between Davy's "interventionist" conception of science and a comparatively more benign "gradualist" conception of science, which she argues Shelley associated with the English physician Erasmus Darwin. As Mellor explains, Darwin "provided Mary Shelley with a powerful image of what she considered 'good' science, a careful observation and celebration of the operations of nature with no attempt radically to alter either the way nature works or the institutions of society" ("FCS," p. 292). Through his observations, Darwin claimed the evolutionary superiority of sexual reproduction over paternal propagation in his *Zoonomia*, and moreover brought botany and agriculture into the properly scientific realm with his *Phytologia*.

On Mellor's analysis, Shelley was partial to the modesty of Darwin's passive observation over the brutality of Davy's "mastering" of nature. Such a contrast roughly meets up with the popular modern scientific understanding of the novel mentioned above: namely, ethically dubious scientific intervention should be avoided in favor of a more ethically conservative scientific gradualism. In the context of the novel, Mellor reads Shelley's caution against science as akin to Prometheus's warning

to the satyr, that fire "burns when one touches it, but it gives light and warmth, and is an implement serving all crafts providing one knows how to use it well."[27] Though Mellor, Vernon, and Banerjee all skillfully illuminate Shelley's critique of the ills of Baconian scientism, I claim that their critique of scientific thinking (and, more important, Shelley's) may also apply to the gentler, gradualist conception of science they describe. In other words, what does it mean to have science that understands nature without objectifying it, and could we draw a meaningful distinction between these two aims?

This worry is at the core of Victor's dying plea to Robert Walton. He exclaims, "Farewell, Walton! Seek happiness in tranquility, and avoid ambition, even if it be only the apparently innocent one of distinguishing yourself in science and discoveries. Yet why do I say this? I have myself been blasted in these hopes, yet another may succeed" (pp. 217–18). Victor initially tells Walton to take up an "apparently innocent" science, yet laments his own unforeseen fate. This scene casts doubt on an easy distinction between an "innocent" practice of science and doing something clearly "wrong." Of course, Victor never imagined that his work would ultimately result in his demise, much as he never thought that his beautiful creation would be rendered hideous by animation. That is to say, a distinction between describing and manipulating nature is suspect, and Victor's plight demonstrates that attempting to draw a bright line between the two scientific aims is a shaky, post hoc affair.

Perhaps an even more pressing question is whether, provided we grant a distinction between a science that seeks only to "understand" nature versus one that actively seeks to change it, modern advances in science have brought these two visions together in a way that was not possible in the late eighteenth and early nineteenth centuries. Whereas the vitalist debate subsided and Galvani's experiments failed to induce life, recent advances in biotechnology have indeed demonstrated that attempts to "understand" nature in a Darwinian sense can singlehandedly produce the conditions under which that knowledge is utilized to manipulate nature in the Davian sense. Perhaps the most straightforward example of these recent technologies surrounds research on CRISPR DNA sequences and the associated enzyme Cas9. What began as an attempt to understand the possibilities of gene editing using the CRISPR/Cas9 system quickly opened the door to possibilities for germline gene editing (that is, gene editing in which changes are heritable) in humans, with debates over the ethical implications of such research unfolding contemporaneously. Thus, *understanding* nature and *manipulating* nature

are much more deeply intertwined than previously was apparent in the distinction between Darwin's botany and something like Victor's chemistry. If it is the case that we are in the twilight of such a distinction, what does Shelley's critique of science look like now?

While the existing literature indicates that *Frankenstein* should be read as a critique of interventionist science and a supporter of gradualist science, my claim is that Shelley's novel demonstrates that the distinction between these two positions is less than clear. While the rate at which science is done and the aims to which it is carried out are variable, what conjoins these two conceptions of science is a particular objectifying rationality: indeed, the cataloging of nature serves only to reify it as a collection of objects fit for manipulation, and eventually domination. If the distinction is blurred in the text, we may take it as an invitation to explore a more radical reading of Shelley's critique of science. The prominent discourse that *Frankenstein* is a "cautionary" tale must be revisited and expanded to a more capacious critique of science, especially in the face of new technologies that are broaching on transcendence of humanity in nearly the same ways that Victor himself dreamt of.

III

I read Shelley's novel not simply as a critique of using "bad" science (as opposed to "good" science) but also of the scientific thinking that obscures this distinction in the first place. A distinction between "bad" science and "good" science misses out on the way that the one lapses into the other. This does not mean that science is bad in toto (or that I read Shelley as straightforwardly "antiscience"), but rather that "bad" science and "good" science are shades of grey, and that distinctions in the critical literature between the two, or in the scientific community between responsible and irresponsible science, miss this ambiguity. Indeed, Shelley's linking of scientific thinking and the domination of nature proves to be well before its time. Moreover, her keen portrayal of the connections between scientific categorization and a dehumanizing disregard of the body prefigures a number of more explicitly radical critiques of science, one of which I turn to here.

Dialectic of Enlightenment, written in the wake of World War II by Frankfurt School social theorists Adorno and Horkheimer, was an attempt by the two neo-Marxists to discern why "humanity, instead of entering a truly human state, is sinking into a new kind of barbarism" (*DE*, p. xiv). Disillusioned with scientific socialism and increasingly

pessimistic about the proletariat's revolutionary potential, Adorno and Horkheimer expanded the scope of their critique of culture beyond the mere means of production. Instead, they traced the horrors of Auschwitz and the increasingly alienating economic conditions in America back to the notion of rationality itself.

Adorno and Horkheimer's account hinges on an analysis of the inextricable relationship between understanding nature and dominating it. In their view, the barbarism of the twentieth century was not a consequence of "good and responsible" or "bad and irresponsible" choices, but rather a symptom inherent to scientific rationality itself. Adorno and Horkheimer thus draw a conceptual line from the emergence of scientific rationality, through Baconian scientism and Kantian Enlightenment systematicity, to the horrors of Auschwitz. In doing so, the authors of *Dialectic* point to the fundamentally coercive relationship between science and nature, a theme that saturates Shelley's novel.

Adorno and Horkheimer begin their critique of Western rationality with a reading of the *Odyssey*, which they view as the "basic text of European civilization" (*DE*, p. 37). In a famous passage, Odysseus finds himself and his crew trapped in a cave by Polyphemus, the one-eyed giant. His escape entails blinding the giant in its sleep and later binding himself to the bottom of a sheep in order to escape the cave undetected. Adorno and Horkheimer view Odysseus in this episode as symbolically banishing myth (in blinding the cyclops) as well as manipulating nature for his own self-preservation (both through blinding Polyphemus and utilizing the sheep as a getaway vehicle). Thus, in Odysseus they find the birth of Western rationality: self-preservation through the banishing of myth by way of objectifying nature.

This emergent rationality reaches its apex in the Enlightenment: the understanding and cataloging of nature turns it into ever-so-many objects fit for use or manipulation. In my discussion of Davy and Darwin above, the sentiment is already intelligible: barring the sexist metaphors invoked by the likes of Waldman, Francis Bacon, and Davy, the distinction between their brand of science and the one that Mellor associates with Darwin rests not on their shared agreement to classify and understand nature but rather on the voluntary step of deciding to tinker with nature. However, on Adorno and Horkheimer's analysis, the "gentle" science of Darwin is merely a nascent Baconian or Davian science. In stronger terms, Baconian or Davian "interventionist" science is the fully realized form of the ostensibly "gentler" Darwinian science. As Adorno and Horkheimer put it, "Human beings purchase the increase

in their power with estrangement from that over which it is exerted. Enlightenment stands in the same relationship to things as the dictator to human beings. *He knows them to the extent that he can manipulate them*" (*DE*, p. 6; emphasis added).

Writing approximately contemporaneously with Darwin, Davy, Bacon, and importantly, Shelley is the German philosopher Immanuel Kant, who took the categorizing elements of rationality and reduced them to a system capable of generating moral laws. Kant's philosophical system, for the authors of *Dialectic*, is the radicalization of the nature-manipulating rationality that Odysseus employed to escape the mythic cyclops. However, before long, the likes of Friedrich Nietzsche, with his genealogy of morals, and the Marquis de Sade, with his satirical employment of Enlightenment reason in his fictional orgiastic pyramids, demonstrated the moral vacuity of Kant's systematizing rationality. On *Dialectic*'s account, the lie of the Enlightenment is that rationality fetishizes systems, and subsequently tries to pass those off as a fount of morality. As Adorno and Horkheimer remind us, "Science itself has no awareness of itself; it is merely a tool" (*DE*, p. 60).

Victor's ventures confront the radical ambiguity inherent to science; just because something is scientifically or rationally possible does not imply that it is inherently "moral" or "responsible." The tension that Shelley portrays in *Frankenstein* prefigures the morally vacuous and inherently manipulative roots of scientific reason that de Sade and Nietzsche expose, and that Adorno and Horkheimer articulate a century and a half later. Attempts to conceptually distinguish between gentle and manipulative science are a nonstarter; their mutual dependence on the ostensibly passive categorization of nature already sets the stage for its domination. What Adorno and Horkheimer leave us with is a preliminary critique of a thoroughly disenchanted instrumental rationality, which conceives of humans in much the same way that Victor conceives of the body parts he uses to assemble the Creature.

Thus, the pieces fall into place: to understand requires a certain conceptual objectification, and this same objectification makes manipulation possible. The nature that is objectified, unfortunately, also includes humans. In this respect, Adorno and Horkheimer draw our attention to mass exterminations, noting the "Satanic synthesis of reason and nature" in Hitler's Germany.[28] That is, not only did a systematic, scientific rationality enable the extreme technological efficiency of the Third Reich's efforts to murder the Jews (such as the technical precision required to keep the trains running on time) but it also hinged on reducing human

beings to objects fit for manipulation. Rather than human beings, those who died under the Third Reich were instead conceived of technically, or rather, scientifically: as one unit whose mass filled a finite amount of limited space within a train car, camp barracks, or gas chamber.

With decades of hindsight, readers can see the kernel of Adorno and Horkheimer's critique manifest in other shameful atrocities, among them America's fascination with scientifically manipulating and sacrificing humans in the name of "eugenics" and the systematic exploitation and manipulation of Black Americans in the Tuskegee syphilis experiment under the rubric of "science." Shelley, presciently foreseeing and exploring this connection more than a century earlier, makes it all the more explicit: Victor literally manipulates body parts as if they were mere objects, raiding dissecting rooms and slaughterhouses to collect his "materials." Though, significantly, Victor's "human nature" turned "with loathing" (p. 55) from his project, he had clearly already succumbed to the scientific view that humans are simply assemblages of interchangeable parts, like an armchair or bookshelf.

In this way, *Dialectic of Enlightenment* seeks to dissolve the nature/culture and Enlightenment/barbarism dualities prominent in both Romantic and Enlightenment thinking. Adorno and Horkheimer find the appraisal of nature an object worthy of domination by human "subjects" to overlook the simple insight that humanity itself is part of nature, and therefore itself a potential outlet of domination. In the same way, the authors of *Dialectic* argue that the Enlightenment is not a distinct period after barbarism, along the lines of Kant's famous claim that Enlightenment is none other than "human being's emancipation from its self-incurred immaturity."[29] Rather, barbarism lapses into Enlightenment (recall Odysseus's escape from Polyphemus and the emergence of nature-dominating rationality), yet Enlightenment also lapses back into barbarism (recall the way that Kantian systematicity laid the groundwork for the efficient destruction of humans in World War II).

In other words, Enlightenment and barbarism, much like culture and nature, are mutually constitutive and inextricable terms rather than the two poles of a dichotomy. Crucially, *Frankenstein*, too, dissolves these dualities: by producing a human out of dead limbs and other body parts, Victor Frankenstein demonstrates that subjectivity is constituted through the manipulation of nature itself. That is, the experiments undertaken in Victor's lab expose how a manufactured conceptual division between nature and culture obscures the straightforward fact that humans *are* nature. In much the same way, the critique of scientism alluded to by

the novel's subtitle (*the Modern Prometheus*) attests to the claim that only through Enlightenment rationality can humanity create barbarism (both in the sense that the Creature is uncultured [barbarous], and in that Victor and the Creature end up destroying each other).

Adorno and Horkheimer take great pains to explain that we are the nature we dominate, and that the classifying faculties of thought that allow us to understand nature simultaneously open the door to dominating the things that we classify. They, of course, give the critique in the most hyperbolic way: connecting the emergence of scientific rationality with the technical efficiency of human destruction in the Holocaust. While Shelley does not go this far for obvious historical reasons, the imagery is already visible. Victor sacrilegiously disturbs graves and defiles bodies to assemble his "materials." Human flesh becomes nothing more than cogs that fit together, interchangeable and variable according to his needs. The classificatory rationality that Victor employs in his observations is the same that allows him the knowledge to reassemble body parts in this way. Thus, *Dialectic* and *Frankenstein* use opposite imagery to make the same point: for Adorno and Horkheimer, scientific rationality allows one to see nature, and other humans, as objects, which in turn allows them to be efficiently destroyed. For Shelley, the same rationality that sees human body parts as objects allows for the creation of life. Both scenarios are barbarous: observing nature and transgressing nature are more deeply intertwined than they appear. In the final analysis, an easy distinction between "good" and "bad" science obscures the way that science itself mediates which decisions we are presented with and the subsequent moral world surrounding those decisions.

For precisely this reason, what Mellor terms the "gradualist" view of science that respects nature is elusive in the novel. Although Victor's qualms are with animating the Creature he made, he does not question the scientific rationality that allowed him to see humans as spare parts for his science experiments in the first place. Nevertheless, Shelley's novel directs its readers to the implied tension: that the cutting-edge science taught at Ingolstadt mediates the way Victor sees human beings, and in doing so completely changes the moral landscape of the eighteenth-century scientific world. The "gradualist" and "interventionist" distinction, then, is constantly effaced.

Indeed, Shelley repeatedly contrasts Victor's gruesome manipulations of nature with decidedly unscientific scenes of nature's calming beauty. For example, seeing his friend Henry Clerval again after animating the Creature snaps Victor out of his horror-induced trance: he claims that

Clerval "again taught me to love the aspect of nature" (p. 70). Not long after, Victor seeks the "sublime ecstasy" of nature in order to soothe the pain of William and Justine's deaths. And later, while Victor sought to stave off his task of creating the Creature a mate, he "passed whole days on the lake alone in a little boat, watching the clouds, and listening to the rippling of the waves" in an attempt to find peace in nature (p. 150). Finally, even as he and Clerval are making their way to the remote spot in Scotland where the second Creature is to be assembled, they repeatedly remark on the "majestic" mountains of Switzerland and the "charm" in the banks of the Rhine, that "divine" river (p. 156).

Interestingly, the Creature too finds comfort in nature. Remarking on his first experience of the passing of the seasons, the Creature explains that his "chief delights were the sight of the flowers, the birds, and all the gay apparel of the summer" (p. 131). Even after his horrific episode at De Lacey's home, the Creature retreats into the woods and only once there "dares to be happy" (p. 140). The moments in which we see nature at its most beautiful and calming are not ones in which it is being catalogued and described à la Darwin; rather, they are when it is unperturbed by the probing scientific mind. Fascinatingly, Victor himself points out that his scientific experiments preclude him from seeing nature in all its calming beauty. In the midst of the creation of his first Creature, Victor laments that "it was a most beautiful season; never did the fields bestow a more plentiful harvest, or the vines yield a more luxuriant vintage: but my eyes were insensible to the charms of nature" (p. 55).

Notably, ills befall those who begin to trespass on nature. Though Victor's fate is the most obvious, Walton's crew sustains a number of deaths as a result of his scientific voyage to the north. While Shelley is certainly critical of interventions into nature, the alternative is not simply engaging with science in a "gentler" way. Rather, the imagery in the novel importantly implicates any and all transgressions against nature, including ostensibly gentle ones, and portrays nature at its most beautiful in explicitly nonscientific settings. Indeed, Victor's exchanges with Walton at the beginning of the text are some of the most fruitful for illuminating how Shelley destabilizes the distinction between a gentler and more manipulative science. In his fourth letter to his sister, Margaret Saville, he recounts a conversation with Victor in which he (Walton) declares, "One man's life or death were but a small price to pay for the acquirement of the knowledge which I sought; for the dominion I should acquire and transmit over the elemental foes of our race"

(p. 28). That is, Walton's budding interest in exploration already implicitly objectifies and devalues humans in its utilitarian thirst for knowledge. Victor, whose fate we have not yet heard, exclaims, "Unhappy man! Do you share my madness? Have you drank also of the intoxicating draught? Hear me,—let me reveal my tale, and you will dash the cup from your lips!" Even more to the point, Victor proclaims six days later that Walton searches "for knowledge and wisdom, as I once did; and I ardently hope that the gratification of your wishes may not be a serpent to sting you, as mine has been" (pp. 29–30).

In this crucial exchange, Victor broadly indicts the thirst for knowledge and the scientific endeavor, rather than his own folly. He recognizes the conceptual slippage detailed above; namely, that scientific rationality itself mediates the sorts of decisions one confronts. Victor even tells Walton that seeking "knowledge and wisdom" was what stung him, rather than implicating some sort of interventionism, hubris, or moral lapse. Victor's claims here, alongside his repeated reference to his ultimate destruction as his "irrevocably determined destiny," cast light on Shelley's implication that something about the broader scientific urge, rather than the morally dubious decisions made later in the lab, leads to human pain and suffering.

In light of Shelley's juxtaposition of natural stillness against scientific terror and the tragic fate of the titular scientist, we are perhaps tempted to interpret Shelley as rejecting science in its totality. Once again, however, she avoids falling into easy dualisms; she cannot be said to advocate for the absence of science simply because the "good/bad" science distinction is illusory. Rather than adopt an easy Romanticism, the subtlety of her critique rests in the observation that the fundamental ambiguity of science intersects with our own evolving sense of subjectivity. In this respect, the novel likewise foreshadows *Dialectic*'s related critique of the damage to human subjectivity that such scientific rationality inevitably entails. Adorno and Horkheimer argue that the emergence of scientific rationality is coextensive with, and inextricable from, the inception of bourgeois subjectivity. The episode in which Odysseus succeeds at dominating nature is also the moment at which subjectivity is born; for Adorno and Horkheimer, human subjectivity is secured through the classification and manipulation of nature. Over two millennia later, this fractured subjectivity manifests itself in the exploitation of the capitalist marketplace as well as in the camps under Hitler's Germany.

In *Frankenstein*, this double movement animates the relationship between Victor and the Creature. Victor is the full manifestation of

Enlightenment systematicity and its inherent domination of nature, while the Creature is cognizant that his own subjectivity is a product of that very domination.[30] Of course, the novel culminates in their (presumed) destruction together, whereby Victor realizes that his manipulation of nature is insurmountable, while the Creature cannot reconcile his subjectivity, knowing the details of his origin. Victor is inextricably linked with the Creature, a slave to his own fractured subjectivity, in a suicide quest to the symbolic locus of both exploration and in-hospitality, the North Pole. Fittingly, then, the Creature dies in a burst of Promethean fire; his fate is the unspoken and unavoidable complement to one of his first perceptions of the world: "I found a fire which had been left by some wandering beggars, and was overcome with delight at the warmth I experienced from it. In my joy I thrust my hand into the live embers, but quickly drew it out again with a cry of pain. How strange, I thought, that the same cause should produce such opposite effects!" (p. 104). Though safety initially seemed to be secured through good judgment, the Creature nonetheless found himself compelled, through the struggle for his subjectivity against the backdrop of the scientific experimentation that produced him, to succumb to the ostensibly gentle rationality that bore him.

In the final analysis, juxtaposing *Frankenstein* with *Dialectic of Enlightenment* illuminates Shelley's more radical critique of science. The existing critical literature as well as the broader scientific reception of the novel correctly intuit what might be called Shelley's "second order" critique of science: namely, not to be irresponsible or driven by ambition in one's scientific endeavors. What I have attempted to show above is that there is a "first order" critique of science at work as well: that beneath a distinction between responsibility and irresponsibility, scientific rationality itself changes the rules of the game, making possible previously unimaginable scientific experiments and forcing modern scientists into new moral landscapes that would not otherwise have existed. In the end, perhaps the true chimera is the distinction between "gradualist" and "interventionist" science, since, as Shelley demonstrates, they are not separate categories but rather related and mutually constitutive.

IV

Frankenstein is indeed a cautionary tale, but not in the way that it is thought to be today. Shelley reminds us that we need not simply to be careful but that the scientific domination of nature transforms humans

into mere material to be dominated. Her contention is especially relevant at a time when contemporary advances in science are increasingly more anthropocentric: either by literally involving the manipulation of human life (using technologies such as CRISPR/Cas9 for gene editing[31]) or mimetically aping and displacing the distinctively human (in attempts to create artificial intelligence, for example).

Shelley's obliteration of the "good/bad" science distinction in favor of a radical critique of scientific rationality is an important rebuke to the novel's popular reception today. By reading *Frankenstein* as a herald to radical critiques of rationality in the twentieth century such as *Dialectic of Enlightenment*, we see that she consciously deconstructs the dichotomies between barbarism and Enlightenment and between nature and culture—dichotomies that the novel's contemporary reception rests upon. Moreover, her connection of scientific rationality with the physical manipulation of human bodies and eventual annihilation of human subjectivity (both Victor's, and, of course, the Creature's) is entirely radical yet unfortunately missed in the critical literature.

The Human Genome Project, undertaken between 1990 and 2003, provides a case in point; its stated goal was to map the sequence of nucleotide base pairs that comprise human DNA. This "mapping," ostensibly the passive science of Darwin translated for the twenty-first century, produced a wide topography of moral quandaries that inevitably threatened both human life and subjectivity. For example, knowledge of the human genome yielded the insight that achondroplasia (the most common form of human dwarfism) is caused by mutations of the FGFR3 gene. With the advent of CRISPR/Cas9 technologies and current research on the possibilities of modifying disrupted FGFR3 genes in utero,[32] parents whose children exhibit this mutation are now faced with difficult questions about whether or not to consciously intervene. Understandably in light of these technologies, such questions have caused anxiety for little persons considering parenthood, with some weighing the pain of social ostracism their children may experience against the erasure of their own distinctive subjectivity.[33]

Similarly, in late 2018 a Chinese biophysics researcher named He Jiankui came under fire for creating the world's first germline genetically modified human babies.[34] The girls, whose pseudonyms are Nana and Lulu, had modified CCR5 genes with the stated objective of making them genetically resistant to HIV. The experiment was reportedly sloppily executed, leading to a potentially dangerous genetic condition termed "mosaicism" in which a mixture of cells is exhibited. This risk, alongside

the reported instance of "off-target" (accidental or unintentional) gene edits, only underscores the painfully intertwined relationship between scientific understanding and manipulation. As *Frankenstein* invites us to ask, would such a moral quandary exist without the prerequisite "mapping" of the genome done ten years prior? Moreover, Shelley reminds us that we cannot turn back the clock, so to speak: now that we have knowledge of the human genome, a Pandora's box of genetic experimentation has been blown wide open, at the risk of human suffering.

What role, then, does *Frankenstein* play in the twenty-first century? Shelley's novel offers much-needed intervention into popular scientific discourse; it lays outs the difficulties of "good" and "bad" distinctions, foresees that description and domination are inextricably linked, and spells out how humans become caught in the scope of the nature we are ostensibly "gently" exploring. In doing so, the novel forces us to reckon with the damage we ultimately do to ourselves. Ironically, the novel's popularity is the biggest hurdle facing a radical rereading. In the final analysis, the damage of the "*Frankenstein* effect" is less that the public deems some forms of science as "bad" but rather that the public allows an illusory distinction between "good" and "bad" forms of science to distract them from how science constantly dissolves our moral world.

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