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On Sir Charles Bell's *The Hand*, 1833

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Francis Henry Egerton, the eighth Earl of Bridgewater, died on 11 February 1829. His will bequeathed £8,000 to the President of the Royal Society to publish a work of natural theology on the "Power, Wisdom, and Goodness of God as manifested in the Creation" (Bell vi). In conjunction with the Archbishop of Canterbury and the Bishop of London, the Royal Society decided to divide the task among eight authors whose individual publications between 1833 and 1836 became known as the *Bridgewater Treatises*. Sir Charles Bell's *Treatise* on the "mechanism and vital endowments" of the human hand was published by William Pickering in June 1833, following those of William Whewell's March 1833 work on "astronomy and general physics" (Bell vi), John Kidd's April 1833 work on the "adaptation of external nature to the physical condition of man" (Bell vi), and Thomas Chalmers's May 1833 work on the "adaptation of external nature to the moral and intellectual constitution of man" (Bell vi). Each *Treatise* discussed popular issues in science from nontechnical but authoritative positions that were intended to promote God's existence by detailing the purposeful design of the universe. This combination of accessibility and authority helped the series to become one of the most widely circulated works on science published in the first half of the nineteenth century. Its popularity was reinforced by more than 120 reviews that appeared in forty different periodicals during the 1830s (Topham, "Beyond the 'Common Context'" 249).

Critics often see the *Treatises* as performing the relatively unremarkable task of updating an English tradition of deistic "natural theology" of which William Paley's *Natural Theology* (1802) is the classic example of what was known as the 'Argument from Design.'[1] The simple fact that an "argument" needed to be made for divine creation frames Paley's work as a determined response to the extreme materialistic physiology coming from France in the eighteenth century. Paley's *Natural Theology* is often described as the apotheosis of the design argument partly because its full title so succinctly reflects its teleological content: *Natural Theology: Or, Evidence of the Existence and Attributes of the Deity, Collected from the Appearances of Nature*.

According to Stephen Jay Gould, Paley's *Natural Theology* "presents 500 pages of diverse arguments for God's existence, personality, natural attributes, unity, and goodness (in this explicit order in Paley's chapters), all centered upon one primary theme, endlessly hammered" (9). Since Bell edited and illustrated later editions of *Natural Theology*, it is not surprising that he follows a similar format in his own work.

Bell's *Bridgewater Treatise* on *The Hand* (1833) generally adheres to the Paleyan model where the notion of "purposeful" adaptation to the natural development of appendages may be seen throughout the animal world. Bell takes up the subject comparatively, exhibiting a detailed anatomical view of appendages descending from the human hand to the "hand-like" extremities of monkeys, the paws of bears and lions, the wings of birds, and the fins of fish. These physical morphologies are unproblematic for Bell because of his belief that "man [was] created last of all"—as "the highest and most perfect" of all creation by a God who had intended it to be ordered in this way (*The Hand* 21, 34). The deeply religious Bell was the son of an Episcopal Church of Scotland clergyman and believed unequivocally that the hand was "the last and best proof of that principle of adaptation which evince[d] design in the creation" (*The Hand* 38). Thus Bell's *Bridgewater Treatise* explicitly anticipated the "missing link" debates regarding the status of human superiority in the animal kingdom. For this reason, *The Hand* is often mentioned solely as a theological precursor to the evolutionary controversy that polarized Victorians in the second half of the century.

If, however, we consider the context of the 'Machinery Question' as it intensified in the 1820s, in conjunction with Bell's experiences as a surgeon treating victims of industrial accidents at Middlesex Hospital and Leeds Infirmary, Bell's *Treatise* may be seen not only in a strictly evolutionary context but also as an important cultural response to the era's struggle with the grim physical reality of the supersession of hand labor by automatic manufacture.[2] This is highlighted in the choice of body parts that Paley and Bell choose to frame their arguments for design. For Paley, the mechanical perfection of the human eye is "a cure for atheism": "The chamber of the eye is a camera obscura, which, when the light is too small, can enlarge its opening; when too strong, can again contract it; and without any other assistance than that of its own exquisite machinery" (63, 55). For Bell, writing thirty years later in his *Bridgewater Treatise*, "machinery" itself poses a challenge to the hand as a divine model of perfection.

This is not to suggest that the process of industrialization was instantaneous after 1802, or even that automatic

manufacture was a leading form of production. As Elaine Freedgood has pointed out, the power loom, the steam engine, and the spinning frame "had not achieved the dominance in mid-Victorian imaginations that we might expect in part because they had not [yet] achieved that dominance in production" (2). John Wyatt patented "a spinning engine without hands" in the 1730s and James Watt patented his steam engine in 1775, yet half of all British textile workers were employed in factories by 1850 (Ure 161). Nonetheless, with the development and implementation of all-metal mechanisms, the machine had become simultaneously both a tangible influence and a philosophical symbol. "On every hand," Thomas Carlyle wrote in 1829 in "Signs of the Times," "the living artisan is driven from his workshop, to make room for a speedier, inanimate one" in which "the shuttle drops from the fingers of the weaver, and falls into iron fingers that ply it faster" (59). Though the "inward sense" of mechanization was clearly Carlyle's greatest concern for a culture living in what he termed "the Age of Machinery," the tangible effects of automatic manufacturing were beginning to register in new ways. Economic historians estimate that the number of powerlooms increased by a factor of almost ten between 1820 and 1833 (Crouzet 199).

The proliferation of such an unprecedented productive power had wide-ranging effects. Even if handloom weavers still outnumbered powerlooms in Britain, there was something acutely disconcerting about the growing specter of mechanized manufacturing at the time of Bell's *Treatise*. For the first time in history, machines were successfully beginning to employ automatic appendages that functioned more productively than the human hand. Mechanical contrivances had moved far beyond the flute-playing automatons of Vaucanson to accomplish significant industrial tasks in British textile mills during the first decades of the century. In the Yorkshire woolen industry, for example, mechanized gig-mills and shearing frames accomplished a week's worth of manual work in a single day (Bailey 3). The operations performed by both of these devices had formerly been done by the hands of skilled workman for centuries. Unlike human hands, machines operated with unparalleled rapidity, regularity, and tirelessness.[3] Thus, the human body part that had been celebrated as the "instrument of instruments" from Aristotle to Galen, Shakespeare to Bulwer was beginning to appear physically inadequate in a way that was previously inconceivable. As one commentator poignantly noted in 1835, the prevalence of automatic manufacture was "rendering *hands* artificially *superfluous*" (Place 171, original emphasis). Moreover, the increased productivity brought on by industrial machines was hardly the only unsettling feature of England's progression to mechanized production. The frequent injury—and often death—endured by factory workers as a result of their interactions with machinery was a far more immediate concern.

By the 1820s the problem of accidents in factories was attracting attention all over England. The scenes of grisly dismemberment in *A Memoir of Robert Blincoe* (25 January – 22 February 1828 in *The Lion*) helped to establish and then to popularize the "man-eating machine genre" in the press. *The Times* published a representative example of this genre in its reporting of the death of Daniel Buckley, a mill worker who died in 1830 as a result of injuries to his hand by a machine used for carding horsehair. *The Times* article recounts in graphic detail how Buckley's "left hand was caught and lacerated, and his fingers crushed" by the studded teeth of a cylinder before the machine could be stopped ("Coroner's Inquest"). The article also reports that Buckley died after spending two full weeks in Middlesex Hospital where Charles Bell, the future author of the *Bridgewater Treatise* on *The Hand*, was employed as a surgeon.

Tending to such cases in the 1820s had compelled Bell to visit surgeons at other hospitals in England's manufacturing towns. One of the colleagues Bell visited was Samuel Smith, his former student and a surgeon at the Leeds General Infirmary, where severe injuries to the arms and hands occurred in disproportionately large numbers. Smith testified to Michael Sadler's Parliamentary Committee on Factories in July 1832 that he had "frequently seen accidents of the most dreadful kind that it is possible to conceive. . . cases in which the arm had been torn off near the shoulder joint. . . the upper extremity chopped into small fragments, from the tip of the finger to above the elbow. . . the most shocking cases of lacerations that it is possible to conceive" (503). After touring the region's hospitals and hearing similar reports, Bell testified before the same Parliamentary Committee less than a month later that he "was very much struck with the nature and number of the accidents received [from machinery]" both in his own hospital and in those he visited (Bell, "Testimony" 605). The experiences of many other medical practitioners reveal similar responses. William Lutener, a Montgomeryshire surgeon, testified that he "had frequently to amputate the hands and fingers of children" (Lutener 179). The Sadler Committee's report was controversial, though, partly because its grim findings were thought to lack firm data. The Factory Act of 1833, though, required official inspectorates to keep lists of injuries with specific headings such as "Time, place

and Mode of Maiming." Its more formally-collected data confirmed that the most common injury requiring hospitalization was the severing or pulverization of the hand by mechanized fly-wheels. In 1840, for instance, severe injuries to the hand, thumb, or fingers accounted for 243 of the 261 patients treated at the Leeds Infirmary in cases related to mill accidents (Lee 89). Bell even testified that his concern for the loss of life and limb from unfenced machinery prompted him to appeal to Francis Horner, one of the founders of the *Edinburgh Review* and an MP from Bell's native Scotland ("Testimony" 605).

Bell's experience treating victims of factory accidents at Middlesex Hospital, combined with his deep religious faith, undoubtedly influenced his decision to write about the hand several years later when he was invited to contribute to the *Bridgewater Treatises*. For him, and for many Britons in the nineteenth century, "the perfection" of the human hand directly implied "the presence of the hand of the Creator" (*The Hand* 223). This belief arose in part from the unique anthropomorphic relationship between the Judeo-Christian God and his human creation in the Hebrew Bible, wherein the hand acts as the most important scriptural representation of the divinity's literal and metaphorical power in the Old Testament. God tells Moses that by "a mighty hand" he will free the Israelites from Egyptian captivity (*New Oxford Annotated Bible*, Exod. 6,1). The transmission of divine power also takes its principal corporeal form in the hands of the prophets: Moses leads the Israelites out of Egypt by stretching his hands over the Red Sea (Exod. 14,21), and later leads the Israelite army to victory over Amalek by raising and lowering Joshua's hands on a hill above the battle site (Exod. 17, 10-13). Iconography from the medieval and early modern periods drew explicitly on this belief in the special relationship between God and humans vis-à-vis hands (the iconic image of Adam touching the hand of God in Michelangelo's Sistine Chapel immediately comes to mind). From a contemporary medical and anatomical perspective, the Grant of Arms of the Royal College of Physicians (1546, fig. 1) is especially relevant.

Figure 1: Grant of Arms of the Royal College of Physicians (1546).

Here, God's hand emerges from the gilded clouds to grasp (and perhaps to measure the pulse of) the human patient below. As Katherine Rowe has shown, medical illustrations from this period drew on conventions that directly asserted God's hand as *the* model for anatomical exposition. In fact, early English anatomists dissecting the hand learned "to trace the action of Creation" by making visible "the trace of God's molding hand in a kind of *imitatio Dei*" (Rowe 49). The anatomist John Bannister put it this way in his *Historie of Man* (1578): "Thus if we wel perpend the construction, and composition of the partes, and bones of the hand, our senses shall soone conceive the maner of the action, with no lesse admiration, in beholding the handy worke of the incomprehensible

Creator" (qtd. in Rowe 33).

This same rhetoric of divine perfection pervades Bell's *Treatise* on *The Hand*. In two lengthy chapters, Bell analyzes how "the Author of nature" constructed the superior sense of touch in the hand and states his chief purpose for doing so: "to show that the most perfect proof of power and of design" resides in the hand's sensory apparatus (172, 175). Its status as a "perfect" physical adaptation reflects his faith in a world literally wrought "pure from the Maker's hands" (220). In this sense, Bell's belief that the anatomy of the hand itself "implies the presence of the hand of the Creator" (223) not only updates but also literalizes the metaphorical demonstrations of God's purposeful intent that had become such a dominant feature of Paley's *Natural Theology*. Paley, we might recall from one of his best known examples, marvels at how a female bird—"an animal delighting in motion, made for motion"—"is fixed to her nest [eggs], as close as if her limbs were tied down by pins and wire" (33). Paley explicitly states that it is God's "invisible hand," working indirectly through the bird's instinct (not by palpable grasp), that "detains the contented prisoner from her fields and groves for a purpose" (33). Paley undoubtedly arrived at this isomorphic articulation of "an invisible hand" from the Scottish economist Adam Smith, whom had published *The Wealth of Nations* in 1776. Even for Smith, though, the invisible hand is always metaphorical and appears a total of only three times in all of his works.[4] Where Paley makes an argument for God's invisible hand, Bell makes a case for God's visible hand. That is, in his *Bridgewater Treatise*, Charles Bell had the opportunity to literalize (humanize) the field of natural theology by connecting in a single text his deep religious faith, his Edinburgh anatomical training, and his growing concern for the machinery-mangled hands of England's industrial workers.

Considering the confluence of these personal and professional interests, Bell likely regarded the perfection of the divinely-constructed hand as an overlooked subject in a culture where automatic machinery was becoming more and more prevalent. What would have exacerbated Bell's concern in such a scenario was the fact that proponents of the factory system routinely invoked a rhetoric of mechanical and anthropomorphic "perfection" of their own when describing the rapid improvement of self-acting machines during the 1820s and 1830s. In *Philosophy of Manufactures* (1835), for instance, Andrew Ure counted "the grand principle of manufacturing improvement" based on "perfect" machine work among the most significant "*blessings* which physico-mechanical science [had] bestowed on society" (162, 156, emphasis added). Ure was unabashed in his opinion that improvement in the factory system was meant "to substitute mechanical science for hand skill"—a process "speedily brought to perfection" by "the work of mechanical fingers and arms, regularly impelled with great velocity by some indefatigable power" (163, 160). Indeed, the mysterious and "indefatigable power" behind the machine appeared unmistakably God-like in Ure's accounts: "the benignant power of steam summons around him his myriads of willing menials, and assigns to each the regulated task, substituting painful muscular effort on their part, the energies of his own gigantic arm" (162). As Joseph Bizup has shown, prominent defenders of the factory system (Andrew Ure, Edward Baines, William Cooke-Taylor) tried to represent the factory itself as a great "co-operative body," romanticizing its origins by portraying it as an outgrowth of native English "genius" (14). Critics of factory expansion sensed blasphemy in these pro-machinery descriptions and often met such rhetoric with deistic and anthropomorphic invocations of their own. A letter from an 1835 delegate meeting of Preston cotton spinners, for example, appealed to the kind of interventionist power of God's hand in the Old Testament by calling on "the arm of Omnipotence, humbly imploring his power and approbation" on their behalf (Place 170).

This is not to suggest that Charles Bell was sympathetic to Luddite complaints, or even that he was hostile to factory expansion per se; nowhere in his *Treatise* does he criticize the productive power of automatic manufacture. Rather, he endeavors to show how *all* mechanical contrivances are themselves based on the model of anatomical perfection embodied in the divinely–designed hand. Accordingly, Bell asks in the introduction, "is it not the very perfection of the instrument [the hand] which makes us insensible to its use?" (13). This is one reason why his *Treatise* opens with an anecdote about the perfection of the hand in relation to the mechanical as opposed to the animal, as one might have expected in a work of natural theology. In the first chapter of *The Hand*, he laments how:

> a man will make journeys to see an engine stamp a coin or turn a block; yet the organs [hands] through which he has a thousand sources of enjoyment, and which are in themselves more exquisite in design and more curious both in contrivance and in mechanism, do not enter his thoughts. (12)

Bell's repeated emphasis on the God-given hand as the model for all "mechanical contrivances" becomes a theme that dominates the treatise (114). In one notable demonstration of this principle, Bell illustrates the skeletal mechanisms running from the hand to the shoulder that are required to make use of a traditional hammer (fig. 2).

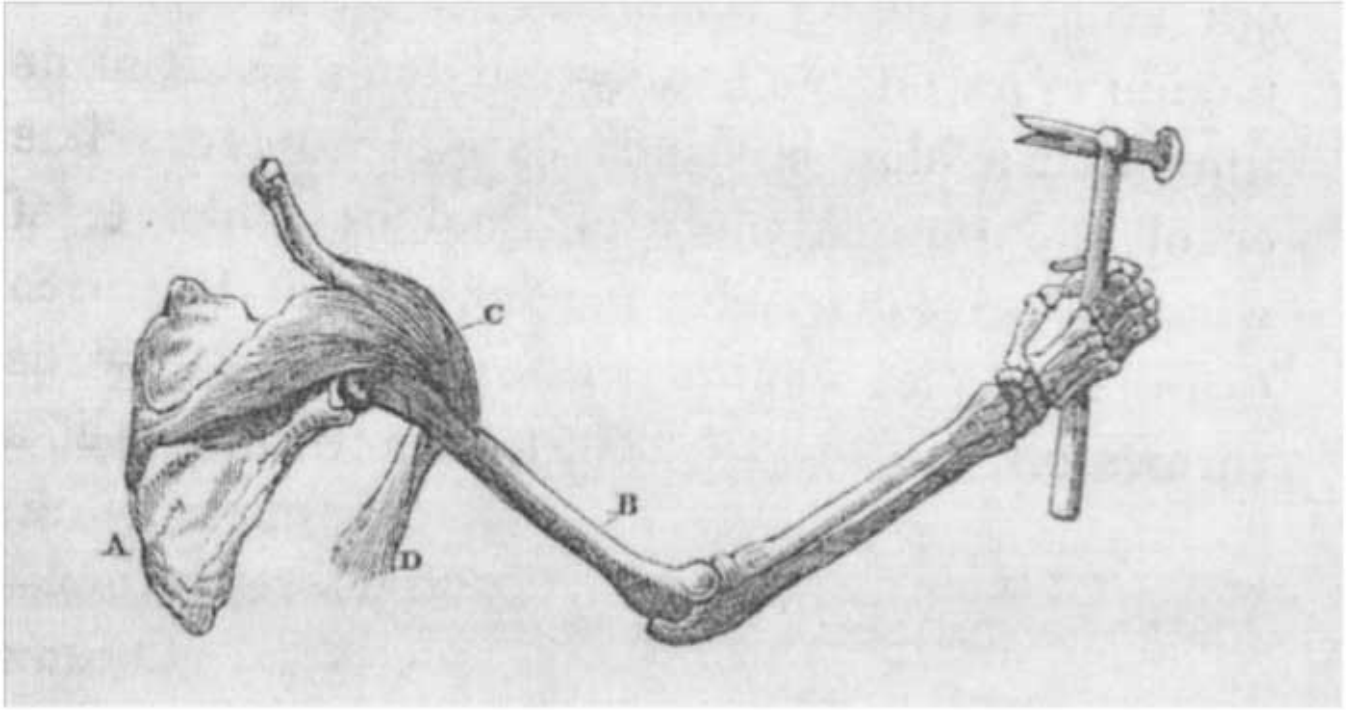

Figure 2: Charles Bell, _The Hand_ 115

According to Bell, the hand's use of a hammer "is, in truth, similar to the operation of the fly wheel, by which the gradual motion of an engine is accumulated in a point of time, and a blow is struck capable of crushing or of stamping a piece of gold or silver" (116). Such reasoning prompts him to ask, "in what respect does the mechanism of the arm differ from the engine with which the printer throws off his sheet?" (116).

Here and elsewhere throughout the *Treatise*, his focus is not so much on judging the usefulness of the new productive power offered by automatic machinery. Instead, his emphasis is on demonstrating the ways in which machinery achieves its productive power by utilizing a series of mechanical components originally designed by the Creator. His era's tendency to overlook what he considers the original perfection—and by extension God's role in mechanical development—often appears as Bell's chief concern regarding the unprecedented surge of machine power during this period. A meteorological analogy drawn from the latter part of the *Treatise* further emphasizes this point. If "one sees the fire of heaven brought down into a phial," Bell writes, "and materials compounded, to produce an explosion louder than the [original] thunder, and ten times more destructive, the storm will no longer speak an impressive language to him" (230).

As we might expect given the terms of the Earl of Bridgewater's bequest, large sections of Bell's *Treatise* do in fact perform a sustained comparison of human hands in relation to "lower" animals. But even this strategy is framed by a critique of his culture's tendency to be drawn to "what is uncommon and monstrous" than to "what is natural and perfectly adjusted to its office" (12). Bell maintains that "a vulgar admiration is excited by seeing the spider-monkey pick up a straw, or a piece of wood, with its tail; or the elephant searching the keeper's pocket with his trunk" (13). This chiding, however, is relatively innocuous in Bell's work precisely because the imperative to distinguish humans from animals by way of the hand was not yet as urgent in the 1820s and 1830s as the one to distinguish them from the machines that were injuring them in the process of mechanical supersession. The extraordinary sales figures for his *Treatise* before *The Origin of Species* (1859)—and, therefore, before the full-blown debate about evolutionary adaptation—suggest that Bell's view of "manual perfection" was reassuring to a culture whose "hands" were being outperformed, displaced, and mangled by machines. When *The Hand* was published in June 1833, the first edition was already oversubscribed by 300

copies (Topham, "Beyond the 'Common Context'" 244). This is impressive, considering that a successful print run would have been 500 copies. Pickering published 2,000 additional copies in September 1833, 3,000 in April 1834, and 2,500 in October 1834 (Topham, "'Infinite Variety of Arguments'" 284). In a way, then, Bell's 1833 *Treatise* marks the unique historical moment in the nineteenth century when representations of the hand could be said to sit precariously between perfection and superiority in relation to animals on the one side and between imperfection and productive inadequacy in relation to machines on the other. The anxiety stemming from the precariousness of the body part so essential to notions of what it meant to be human helped inaugurate an intense cultural fascination with all things manual for the remainder of the nineteenth century.[5]

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ENDNOTES

[1] D. W. Gundry maintains that the *Bridgewater Treatises* were "little more than variations—interesting variations—on Paley's theme" (141-44). Martin Rudwick claims that the *Treatises* were "intended to refurbish the Paleyan tradition of natural theology from the latest discoveries of contemporary science" (202). David Livingstone sees the *Treatises* "firmly cast in a Paleyan mould" (8). For an exception treating the more fine-grade developments and divergences within natural theology at the time, see Jonathan Topham, *'An Infinite Variety of Arguments'* (3-7).

[2] For labor historians such as Raphael Samuel, "the machinery question attracts attention chiefly in the 1820s and 1830s, when Cartwright's loom was throwing thousands out of work, and when the rival merits of an agrarian and an industrial society ('past and present') were being canvassed on all sides" (9).

[3] The speed and efficiency of automatic manufacture did not, of course, go uncontested. In *The Stones of Venice* (1851-53), John Ruskin celebrated the imprecision of manual labor as a sign of elevated humanity: “Men were not intended to work with the accuracy of tools, to be precise and perfect in all their actions. If you will have that precision out of them, and make their fingers measure degrees like cogwheels, and their arms strike curves like compasses, you must unhumanize them” (Ruskin 1436).

[4] For a more detailed analysis of Smith’s famous metaphor, see Courtemanche.

[5] A partial list of additional texts showing a heightened interest in the hand include *The Psychonomy of the Hand* (1843), *The Hand Phrenologically Considered* (1848), “Handy Phrenology” (1848), *Hard Times* (1854). Jacques Derrida’s coinage of the term *humainisme*

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