
Sugar Machines: Picturing Industrialized Slavery

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As negroes, cattle, mules, and horses are the *nerves* of a sugar plantation, it is expedient to treat the subject with some accuracy; for, the success of the whole consists chiefly in this, as in a well constructed machine, upon the energy, and right disposition of the main springs, or primary parts.

Samuel Martin¹

WE HISTORIANS ARE INTERESTED in sugar because slaves made it, and we hate slavery. Sugar fascinated many early modern Europeans because machines made it, and they loved machines. Historians link sugar and slavery inextricably: there are more than three dozen modern historical works with both “Sugar” and “Slave/Slaves/Slavery” in their titles. Conversely, none of the three dozen or so books about the technology of sugar published before 1888—when legal slavery ended in the Americas—referred to slavery in their titles. Early modern visual representations of sugar plantations privileged machinery over people. This privileging largely took the work of slaves for granted and, intentionally or not, deflected attention from slavery. When the threat of abolition loomed, anti-abolitionist patrons supported artists who naturalized the plantation regime by representing sugar’s technology and its enslaved peoples in picturesque style.²

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¹ Samuel Martin, *An Essay upon Plantership, Humbly Inscrib’d to All the Planters of the British Sugar-Colonies in America*, 2nd ed. (London, 1750), quote from 9; see also 30: “a plantation ought to be considered as a well constructed machine, compounded of various wheels, turning different ways, and yet all contributing to the great end proposed.” With its springs and counter-turning wheels, the metaphor of the machine referenced both clocks, with their regularity, and the three-roller mill, which processed the sugar cane.

² For images of the sugar-slavery nexus, see Jerome S. Handler and Michael L. Tuite Jr., comps., *The Atlantic Slave Trade and Slave Life in the Americas: A Visual Record*, <http://slaveryimages.org/> (search “sugar”). Regarding historians’ hatred and repudiation of slavery, consider such titles as James Pope-Hennessy, *Sins of the Fathers: The Atlantic Slave Traders, 1441–1807* (London, 1967); Orlando Patterson, *Slavery and Social Death: A Comparative Study* (Cambridge, Mass., 1982); Robert Edgar Conrad, comp., *Children of God’s Fire: A Documentary History of Black Slavery in Brazil* (Princeton, N.J., 1983); Joseph C. Miller, *Way of Death: Merchant Capitalism and the Angolan Slave Trade, 1730–1830* (Madison, Wis., 1988); Robert L. Paquette, *Sugar Is Made with Blood: The Conspiracy of La Escalera and the Conflict between Empires over Slavery in Cuba* (Middletown, Conn., 1988); David Brion Davis, *Inhuman Bondage: The Rise and Fall of Slavery in the New World* (Oxford, 2006). Regarding early modern Europeans’ love of technology, consider that the word “machine(s)” appears in more than 26,000 of the 136,000 publications catalogued in *Eighteenth Century Collections Online* (Gale). “God” appears in fewer than half as many, about 11,000.

Yet a major historiographic debate—whether the dependence on slave labor made the production of sugar economically regressive—has simply ignored the abundant visual evidence on the issue. In Anglo-American historiography, the question of whether the sugar-slavery nexus was susceptible to economic modernization is oriented to commercial cost-benefit analyses of Britain's abolition of the transatlantic African slave trade in 1807.³ Broader comparisons of sugar regions throughout the Americas and later into the nineteenth century tend to polarize between neoclassical and Marxist interpretations of the industrial potential of sugar plantations as a means of production.⁴ Whatever the econometric resolution of this issue, throughout the early modern period and into the period of industrialization, European artists presented the production of sugar as technologically progressive, regardless of its investment in slavery. Commodified sugar derived from an agricultural raw material, sugarcane, but European viewing and reading publics were primarily interested in the machinery that made sugar, not the agricultural processes of enslaved labor.⁵ Sugar production was an industrial enterprise: "In view of the labour, discipline, and organisation of work, the interchangeability of labour units, time-consciousness owing to the crop's rapid perishability, the separation of production from consumption and [of] the slaves from their tools [not to mention the maximum expropriation of the surplus of labor], sugar manufacture was the most industrialised form of human enterprise" during the early modern period.⁶

On Europeans' admiration for machines, see Andrea Barghini, Pier Luigi Bassignana, Ferruccio Gambaruto, and Vittorio Marchis, *La cultura delle macchine dal Medioevo alla rivoluzione industriale nei documenti dell'Archivio storico Amma* (Turin, 1989); Vittorio Marchis, *Storia della macchine: Tre millenni di cultura tecnologica* (Rome, 2005); Alan Q. Morton, "Concepts of Power: Natural Philosophy and the Uses of Machines in Mid-Eighteenth-Century London," *British Journal for the History of Science* 28, no. 1 (1995): 63–78; Larry Stewart, "A Meaning for Machines: Modernity, Utility, and the Eighteenth-Century British Public," *Journal of Modern History* 70, no. 2 (1998): 259–294; Thomas Brandstetter, "'The Most Wonderful Piece of Machinery the World Can Boast of: The Water-works at Marly, 1680–1830,'" *History and Technology* 21, no. 2 (2005): 205–220.

³ Eric Eustace Williams, *Capitalism and Slavery* (Chapel Hill, N.C., 1944); David Eltis, *Economic Growth and the Ending of the Transatlantic Slave Trade* (New York, 1987); Seymour Drescher, "Capitalism and Slavery after Fifty Years," *Slavery and Abolition: A Journal of Slave and Post-Slave Studies* 18, no. 3 (1997): 212–227; Heather Cateau and S. H. H. Carrington, eds., "Capitalism and Slavery" *Fifty Years Later: Eric Eustace Williams—A Reassessment of the Man and His Work* (New York, 2000); David Beck Ryden, *West Indian Slavery and British Abolition, 1783–1807* (Cambridge, 2009); Seymour Drescher, *Econocide: British Slavery in the Era of Abolition*, 2nd ed. (Chapel Hill, N.C., 2010), especially the new foreword by David Brion Davis and Drescher's new preface, xiii–xxx.

⁴ Manuel Moreno Fraginals, *The Sugarmill: The Socioeconomic Complex of Sugar in Cuba, 1760–1860*, trans. Cedric Belfrage (New York, 1976; orig. Spanish ed. 1964); R. Keith Aufhauser, "Slavery and Technological Change," *Journal of Economic History* 34, no. 1 (1974): 36–50; H. A. Gemery and J. S. Hogendorn, "Technological Change, Slavery, and the Slave Trade," in Clive Dewey and A. G. Hopkins, eds., *The Imperial Impact: Studies in the Economic History of Africa and India* (London, 1978), 243–258; J. R. Ward, "The Amelioration of British West Indian Slavery, 1750–1834: Technical Change and the Plow," *New West Indian Guide / Nieuwe West-Indische Gids* 63, no. 1/2 (1989): 41–58; Alex van Stipriaan, "The Suriname Rat Race: Labour and Technology on Sugar Plantations, 1750–1900," *ibid.*, 94–117; Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York, 1986), 46–61. These themes are enjoying a revival in United States historiography; e.g., Edward E. Baptist, *The Half Has Never Been Told: Slavery and the Making of American Capitalism* (New York, 2014); Walter Johnson, *River of Dark Dreams: Slavery and Empire in the Cotton Kingdom* (London, 2013).

⁵ Stuart Schwartz, "A 'Babilónia' colonial: A economia açucareira," in Francisco Bethencourt and Kirti N. Chaudhuri, eds., *História da expansão portuguesa*, 5 vols. (Lisbon, 1997–1999), 2: 213–231, analyzes the agricultural as well as the industrial aspects of Brazilian sugar production.

⁶ James S. Pritchard, *In Search of Empire: The French in the Americas, 1670–1730* (Cambridge, 2004), quote from 171; Richard B. Sheridan, "The Plantation Revolution and the Industrial Revolution, 1625–1775," *Caribbean Studies* 9, no. 3 (1969): 5–25.

Pride in the technological progress embodied in the sugar plantation, however, carried dire humanistic implications because it implicitly rationalized slavery and the Atlantic African slave trade as necessary factors of modernization.

From its origins in manorial sharecropping on Española, through the consolidation of the sugar-slavery nexus in Brazil, to its refinement in the form of the integrated slave plantation in Barbados, through the spread of that plantation type in the Caribbean, to the industrial climax of colonial sugar manufacturing in Cuba, the machinery of sugar production predominated among representations of colonial economies in European visual culture.⁷ The mainstay of the plantation workforce—fieldworkers preparing the ground, planting, weeding, and harvesting the cane—received only token artistic attention. Accordingly, the Brazilian term for the sugar plantation was *engenho*; the Cuban term was its cognate, *ingenio*.⁸ In both dialects, the colonial synecdoche of sugar mill for sugar plantation derived from the respective metropolitan words for both machines and ingenuity. The iconic sugar mill was overwhelmingly the most frequent illustration of sugar plantations—as it remains on book cover illustrations to this day. But these images of sugar technology have a history; it is ahistorical to take them for granted as convenient illustrations.

Besides its large fixed capital requirements and the intensity and elaboration of its work processes, illustrations of sugar's complex production technology made it stand out from other colonial staples—silver, tobacco, cotton, indigo, coffee, cacao, furs, rice, salt fish, and whale oil.⁹ After sugar, silver mining was the most frequently illustrated primary industry in the American colonies; images of silver production emphasized instances of looting and the brutality of working conditions in the mines, not technology.¹⁰ Tobacco was a metonym of America: it figured in dozens of images as an emblem of trade and empire, as an ethnographic prop, and as a native plant, but there were only a few images of its production as a staple, and those mostly

⁷ Sugar had been produced in Europe for half a millennium before the expansion of sugar plantations into the Atlantic, but its technology had not been of much visual interest, perhaps because it was unspecialized and adapted mills used to produce wine and olive oil, and because the labor involved took familiar forms. William D. Phillips Jr., "Sugar in Iberia," in Stuart B. Schwartz, ed., *Tropical Babels: Sugar and the Making of the Atlantic World, 1450–1680* (Chapel Hill, N.C., 2004), 27–41, here 30.

⁸ Some historians refer to watermills as *engenhos* and to animal-powered mills as *trapiches*, but only *engenho/ingenio* applied to sugar plantations generically. Stuart B. Schwartz, "Introduction," *ibid.*, 1–26, here 2–3. On sugar plantations as machines, see Justin Roberts, *Slavery and the Enlightenment in the British Atlantic, 1750–1807* (New York, 2013), 33–35, 68–78. Roberts argues that the most important innovations in eighteenth-century sugar production were managerial, not technological.

⁹ For illustrations of tobacco use, production, and emblems, see the John Carter Brown Library Archive of Early American Images, <http://www.brown.edu/academics/libraries/john-carter-brown/jcb-online/image-collections/archive-early-american-images> [hereafter JCBL Archive], 04039, 03374-1, 08927, 01897-3, 09905-1, 06193-4, 29947-1, 29947-2. Coffee production figured in a half-dozen plans of coffee plantations and a couple of illustrations of its technology, e.g., JCBL Archive, 06944-74, 35315, 72-196-39, 72-196-40, 72-196-41, 72-196-42, 72-196-43; Simon David Smith, "Sugar's Poor Relation: Coffee Planting in the British West Indies, 1720–1833," *Slavery and Abolition* 19, no. 3 (1998): 68–89. Cotton was of visual interest mostly for its botany. The technology of rice production figured in only one image in the JCBL Archive: 06193-3. Fur trapping went nearly unpublished visually. The apparatus of the whale fishery drew illustrators' attention, but the far more important cod fishery stimulated only a few views, albeit classic ones; e.g., JCBL Archive, 02260, 09906-4, 09534-28.

¹⁰ One-third of the illustrations of the silver industry showed looting. The most frequently depicted technologies were picks and ladders. For illustrations of colonial silver mining, see JCBL Archive, 09187-3, 35313-1, 34724-4, 04684-43. Indigenous artists created the only series of illustrations of the colonial silver industry; e.g., Bernardino da Sahagún, *Historia universal de las cosas de Nueva España: Codice Laurenziano Mediceo Palatino* 218, 219, 220, 3 vols. ([1575–1577]; facsimile, Florence, 1996), book 19, chap. 16.



FIGURE 1: Indigo production required complicated processing facilities, but not the high-tech machinery identified with sugar. “Indigoterie,” engraving, from Jean-Baptiste Du Tertre, *Histoire générale des Antilles habitées par les Français*, 2 vols. (Paris, 1667–1671), 2: following 106. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 01897-5.

showed buildings. Among the other staples, images of indigo production most closely resembled those for sugar in their emphasis on fixed capital and intricate stages of manufacture, and they were the next most numerous colonial technological illustrations.¹¹ (See Figure 1.) The 7,000 or so images in the John Carter Brown Library’s Archive of Early American Images provide a rough index of the two staples’ relative importance for illustration: the collection includes about a dozen images of indigo production and more than one hundred images of sugar.

NOTHING SHOWED EARLY MODERN Europeans’ love of mechanical devices better than the development of a new genre of printed technical illustration, the theater of machines—books devoted to illustrating machinery, organized into categories by their functions.¹² Jacques Besson, a mathematician and, though a former Huguenot pastor,

¹¹ More than half of the JCBL Archive’s images of indigo technology derive from José Mariano da Conceição Velloso, “Tinturaria Indigo,” in Velloso, *O fazendeiro do Brasil: Melhorado na economia rural dos generos já cultivados, e dos outros que se podem introduzir; e nas fabricas, que lhe são proprias, segundo o melhor, que se tem escrito a este assumpto*, 5 vols. (Lisbon, 1798–1806), 2: pt. 1; e.g., JCBL Archive, 01897-5, 09534-1, 09320-5, 15101-2, 32114, 06193-3, 72-196-23, 72-196-24, 72-196-25, 72-196-26, 72-196-29, 72-196-30, 72-196-33, 72-196-34.

¹² Histories of medieval technical illustration rely heavily on the mid-thirteenth-century sketchbook of Villard de Honnecourt, but only six of its sixty-five pages of drawings depict machines (a mechanical saw, a crossbow, a screw press, several automatons, a catapult, and a perpetual motion machine); of the others, twenty-one are architectural, and the rest figural. Theodore Bowie, ed., *The Sketchbook of Villard de Honnecourt* (Bloomington, Ind., 1959), figs. 2, 59–62. Predecessors to the theaters of machines—

Charles IX's "master of the King's Engines," initiated the genre in 1571 with *Theatrum instrumentorum et machinarum*. Its sixty plates, engraved by Jacques du Cerceau, France's premier architectural illustrator (and another Huguenot), emphasized machines that used rotary motion to make things and to perform operations: devices for reciprocal sawing; windlasses for dredging and for moving large architectural stonework; screw-powered pile drivers; rotary-powered mortars; gearing for grain milling; pulleys to lift cannon; screw-gearred derricks to lift heavy cargoes from barges; screw-driven belts for buckets to lift sand, gravel, or mortar for the construction of walls; screw-gearred windlasses for baskets to lift ore from mine shafts. Many of Besson's machines relied on human energy but gave it mechanical advantages over direct human power in lifting, cutting, and hammering. The two hundred illustrations in Agostino Ramelli's 1588 *Le diverse et artificiose machine* went beyond Besson's images in their attention to water power and in their exploration of technical possibilities, not just best practice. (See Figure 2.) Similarly, Vittorio Zonca's 1607 *Novo teatro di machine et edificii per varie e sicure operationi, con le loro figure* consolidated the genre by putting the focus on productive machinery: over- and under-shot waterwheels; animal-powered mills; water- and hand-powered grinders; a water-powered cam-fitted fulling machine; a human-powered screw press for wine; a water-driven spinning jenny with dozens of bobs; a rolling press for printing; several machines for lifting water; and, most relevant to sugar production, water-driven edge rollers for oil extraction and for making gunpowder.¹³ Giovanni Branca's *Le machine: Volume nuovo et di molto artificio da farre effetti marauigliosi tanto* (1629) showed a horizontal two-roller mill for drawing metal—a parallel application to those possibly used in sixteenth-century Spanish sugar domains, but which had not theretofore been deemed worthy of illustration.¹⁴

Most of the mechanical elements found in the theater of machines were derived from ancient, medieval, and Renaissance technology: levers, windlasses, pulleys, cams, crankshafts, cylinders and pistons, gears, bearings, chains, drive belts, and conical valves. Similarly, devices employing this technology were well known to engineers—pumps,

amounting to exceptions to the rule about the lack of visual interest in medieval and Renaissance technology—would include the dozens of fifteenth- and sixteenth-century engineers' handbooks that have survived in manuscript; on the technological contexts of these handbooks, see Bertrand Gille, *Engineers of the Renaissance* (Cambridge, Mass., 1966; orig. French ed. 1964). Cf. Roberto Valturio, *De re militari* (Verona, 1472)—"the first printed book of mechanical technology" (Eugene S. Ferguson, *Engineering and the Mind's Eye* [Cambridge, Mass., 1992], 65); Marcus Vitruvius Pollio, *De architectura* (first illustrated edition, Venice, 1511); Georgius Agricola, *De re metallica* (Basel, 1556).

On the history of mechanical illustration, see M. Ceccarelli and M. Cigola, "Trends in the Drawing of Mechanisms since the Early Middle Ages," *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science* 215, no. 3 (2001): 269–289; Celina Fox, *The Arts of Industry in the Age of Enlightenment* (New Haven, Conn., 2009); Charles Kostelnick, "Visualizing Technology and Practical Knowledge in the *Encyclopédie's* Plates: Rhetoric, Drawing Conventions, and Enlightenment Values," *History and Technology* 28, no. 4 (2012): 443–454. After fortifications, mining and metallurgy were the most heavily illustrated technologies in Europe; Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore, 2001), 183–188, 201–208.

¹³ Martha Teach Gnudi, trans., *The Various and Ingenious Machines of Agostino Ramelli*, annotations and pictorial glossary by Eugene S. Ferguson (Baltimore, 1976), original available online. Vittorio Zonca, *Novo teatro di machine et edificii per varie e sicure operationi, con le loro figure*, ed. Carlo Poni (1607; repr., Milan, 1985). For a compendium of Besson's, Ramelli's, and Zorca's illustrations, see A. G. Keller, *A Theatre of Machines* (London, 1964). The genre would be continued by Giovanni Branca, *Le machine: Volume nuovo et di molto artificio da fare effetti marauigliosi*, ed. Luigi Firpo (1629; repr., Turin, 1977); Georg Andreas Böckler, *Theatrum machinarum novum* (Nuremberg, 1661 [German], 1662 [Latin]).

¹⁴ Branca, *Le machine*, 10, fig. 2.

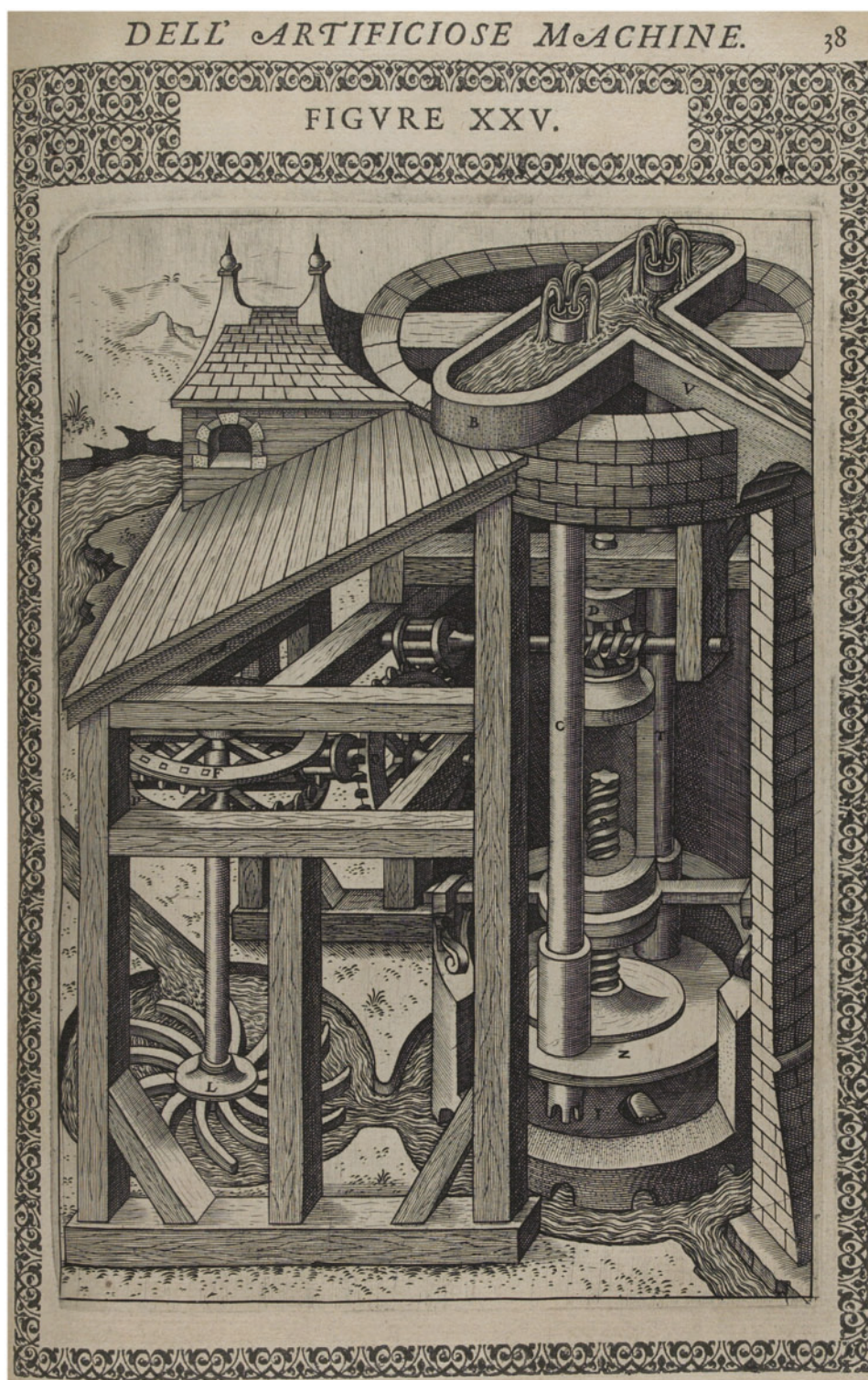


FIGURE 2: Illustrations in theaters of machines explained mechanical technology while making it intriguing. Water-wheel to raise water, engraving, from Agostino Ramelli, *Le diverse et artificiose machine del Capitano Agostino Ramelli* (Paris, 1588), fig. 25, 38 recto. Courtesy of the Library of Congress, Rosenwald Collection, TJ144.R3.

fountains, hoists and cranes, missile throwers, and clocks.¹⁵ The crucial developments from the genre were in media for visual communication, not mechanical technology: linear perspective, which promised a duplicable visual experience of things represented; projective geometry, which provided accurate measurements of three-dimensional objects on flat paper; cutaway and exploded views, which highlighted intricate designs; copperplate engraving, which sharply defined technical elements; and printing, which provided numerous precise copies of the results. Together they “greatly enhanced the precision with which a vision in one person’s mind might be conveyed by material means—drawings [and prints]—across space and time to another person’s mind.”¹⁶

FOR NEARLY ITS FIRST TWO centuries, Atlantic sugar production took place in Iberian domains, but Spanish and Portuguese artists never represented sugar plantations. Iberian artists, especially in the colonies, concentrated on religious subjects, notably for church decoration. Spanish and Portuguese artistic traditions lacked secular genres for landscape and natural history; instead, Iberian patrons relied on Netherlandish artists to produce such works.¹⁷ Hence, Flemish artists introduced Europeans visually to the *engenho/ingenio*, just as Flemish and then Dutch merchants carried sugar products to northern European markets and then used the proceeds to bring more enslaved Africans to the colonies to produce more sugar. These early illustrations of sugar farms and plantations compressed their landscapes into schemata linking the different stages of production: harvesting, transporting to a mill, milling, boiling for clarification, claying for crystallization, and packing for export.

As an offshoot of the nascent genre of the theater of machines, illustrations of sugar manufacturing figured among the twenty or so discoveries—*Nova Reperta*—that Johannes Stradanus (also known as Jan van de Straet) identified around 1590 as markers that Europeans were living in a new age—the modern—that separated them from antiquity and the Middle Ages.¹⁸ (See Figure 3.) In the background of the print

¹⁵ Thomas Combe, *Theater of Fine Devices*, ed. Mary V. Silcox (ca. 1593; repr., Aldershot, Hants, 1990), emblem 85.

¹⁶ Ferguson, *Engineering and the Mind’s Eye*, quote from 75; see also 82–83.

¹⁷ Richard L. Kagan and Fernando Mariás, *Urban Images of the Hispanic World, 1493–1793* (New Haven, Conn., 2000); Egbert Haverkamp-Begemann, “The Spanish Views of Anton van den Wyngaerde,” in Richard L. Kagan, ed., *Spanish Cities of the Golden Age: The Views of Anton van den Wyngaerde* (Berkeley, Calif., 1989), 54–67. In the seventeenth and eighteenth centuries, Spanish creole artists developed genres particular to the colonies, notably city portraits and casta paintings; on city portraits, see Kagan and Mariás, *Urban Images of the Hispanic World*, 129–205; Ilona Katzew, *Casta Painting: Images of Race in Eighteenth-Century Mexico* (New Haven, Conn., 2004).

¹⁸ Jan van der Straet, *Nova Reperta* (Amsterdam, ca. 1580), *ECHO: Cultural Heritage Online*, http://echo.mpiwg-berlin.mpg.de/ECHOdocuView?url=/permanent/einstein_exhibition/sources/PZ39PA1P/index.meta. The other discoveries illustrated in *Nova Reperta* are America, the lodestone/compass, gunpowder, printing with movable type, the mechanical clock, a medicine against venereal diseases (Guaicum), distillation, silk manufacturing, the stirrup, the watermill, the windmill, the olive oil press, oil painting, eyeglasses, the longitude and the declination of the poles, polished armor, Amerigo Vespucci’s discovery of the Southern Cross with an astrolabe, and copperplate engraving. On Stradanus, see Alessandra Baroni Vannucci, *Jan Van Der Straet detto Giovanni Stradano: Flandrus pictor et inventor* (Milan, 1997), especially 397–400; for a catalogue of his work, see Marjolein Leesberg and Huigen Leeftang, eds., *The New Hollstein: Dutch and Flemish Etchings, Engravings and Woodcuts, 1450–1700—Johannes Stradanus*, 3 vols. (Ouderkerk aan den IJssel, 2008), especially 3: 5–25 on the *Nova Reperta*; Susan Dackerman, ed., *Prints and the Pursuit of Knowledge in Early Modern Europe* (New Haven, Conn., 2011), 38–41. On sugar as a Baconian cliché of the modern era, see



FIGURE 3: Sugar production with Mediterranean technology at an unspecified locale. Madeira was the main sugar-producing place at this time. Philippe Galle after Jan van der Straet, “Saccharum,” engraving, from van der Straet, *Nova Reperta* (Antwerp, ca. 1590), fig. 13. Courtesy of the Library of Congress, FP-XVI-C698.

titled “Saccharum,” barely visible fieldworkers cut canes and load them onto mules for transport to the factory. In the cramped foreground, burly workers in European dress perform the processing tasks: cutting canes into manageable pieces for the water-powered millstone and the human-powered screw press to extract sugar sap; carrying the pressed juice in buckets to heated reducing vats; ladling the concentrated syrup into pots for cooling and crystallization; and packaging the finished product. The print emphasizes segmented manual labor, sequential stages of production, and the variety of processes involved—fieldwork, manual preparation of the raw material, mechanical power (both human and inorganic), heat, and chemical reaction. As a worksite, this sugar factory most closely resembled *Nova Reperta*’s illustration of a shop producing olive oil; it too used a screw-press mill (but also an edge roller, which was actually better suited to extracting sugar juice than the adapted gristmill in “Saccharum”) to transform an agricultural raw material—olives instead of sugarcane—into a food product with a distinctive structure—oil instead of crystals. Late-sixteenth-century European sugar producers used generic Mediterranean milling and extraction technologies: chiefly edge rollers, screw presses, and waterwheel-driven horizontal two-roller mills derived from

Eric Otremba, “Inventing Ingenios: Experimental Philosophy and the Secret Sugar-Makers of the Seventeenth-Century Atlantic,” *History and Technology* 28, no. 2 (2012): 119–147.



FIGURE 4: Sugar production on Española, still with Mediterranean technology, but now by African workers (“Nigritæ”) in non-European dress. Girolamo Benzoni, “Nigritæ exhaustis venis metallicis consciendo saccharo operam dare debent,” engraving, from Theodor de Bry, ed., *Americæ pars quinta nobilis & admiration plena Hieronymi Bezoni* (Frankfurt am Main, 1595), pt. 5, fig. 2. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 34724-3.

cotton gins (though “Saccharum” only alludes to this last possibility, since it shows sugarcane being loaded into a grain hopper, to which it was unsuited).

This unspecialized Mediterranean technology characterized the first illustration of sugar production in the Americas. (See Figure 4.) It depicts semi-nude workers, presumably enslaved Africans (identified as *nigritæ* in the caption and as *mori* in the text), harvesting the cane and carrying it to the trough of a human-powered edge roller, from which juice is scooped and emptied into cauldrons, out of which syrup is ladled into large jars, which are carried to a curing rack. The emphasis is as much on heavy physical labor and the linkages between divisions of labor as on mechanical technology. Indeed, the actual function of the waterwheel in the background is unclear, and the wedge press making a second pressing is obscured behind the edge runner. This image was used as an illustration in Theodor de Bry’s 1595 publication of Girolamo Benzoni’s *Historia del mondo nuovo* (originally published in Venice in 1565).¹⁹ Benzoni, a

¹⁹ Theodor de Bry, ed., *Americæ pars quinta nobilis & admiration plena Hieronymi Bezoni* (Frankfurt a.M., 1595). On Benzoni, see Benjamin Schmidt, “‘O Fortunate Land!’: Karel van Mander, a *West Indies Landscape*, and the Dutch Discovery of America,” *New West Indian Guide / Nieuwe West-Indische Gids* 69, no. 1/2 (1995): 5–44.



FIGURE 5: Images of sugar plantations focused on their mechanical and processing technology, while Flemish and Italian scenes of rural labor featured people working with hand tools. Pieter van der Heyden after Pieter Bruegel the Elder, *Summer*, engraving (Antwerp, 1570). Courtesy of the Metropolitan Museum of Art, Harris Brisbane Dick Fund, 1926.

Hispano-phobic Milanese who spent the 1540s and 1550s roaming Spanish America, expressed no interest in the technology of sugar production. For him, sugar marked the failure of gold and silver mining on Española and the Spaniards' subsequent reallocation of enslaved Africans to produce sugar as an alternative source of wealth.

Both Stradanus's and de Bry's illustrations of the *engenho/ingenio* resemble contemporaneous European genres schematizing rural labor, as epitomized in Pieter Bruegel the Elder's *Summer*. (See Figure 5.) But the comparison highlights the peculiarity of representations of sugar production, which present it as fundamentally industrial, not agricultural. Conversely, in a collection of more than thirteen hundred medieval and early modern images of rural labor, the overwhelming majority feature hand tools: axes, billhooks, flails, scythes, shears, and sickles. Some show animal-drawn equipment—harrows, plows, and wagons—but the screw winepress is the only mechanical technology illustrated. Besides ovens, the only processing equipment shown is grape vats and wine barrels. None of the images portray how mills worked, though they were ubiquitous.²⁰

²⁰ For the database of images of rural labor, see *Cicli dei mesi—Labours of the Months*, <http://www.flicker.com/groups/949209@N23/pool>. Liana Vardi, "Imagining the Harvest in Early Modern Europe," *American Historical Review* 101, no. 5 (December 1996): 1357–1397; Professor Vardi suggested the link. See also Terry S. Reynolds, *Stronger Than a Hundred Men: A History of the Vertical Water Wheel* (Baltimore, 1983).

FIRSTHAND REPRESENTATION OF sugar plantations began when artists accompanied Dutch West India Company forces on their short-lived invasion of Bahia in 1624 and on their successful occupation of Pernambuco and the northeastern Brazilian captaincies in the 1630s and 1640s.²¹ The first invasion was too fleeting to allow artists much opportunity to record Brazil firsthand, and it resulted in only one image of Brazilian sugar works, which apparently borrowed heavily from the one in de Bry's 1595 edition of Benzoni's *Mondo nuovo*, though by the 1620s edge-runner mills were archaic in Brazil.²² The three-roller mill, probably introduced to Brazil from Peru in the early 1600s, was coming to predominate at Brazilian *engenhos*. Animal, wind, or water power turned the vertical axle of the mill's central cylinder and its two counter-turning rollers. Such mills required fewer workers than edge rollers to feed and to tend them: cane could be fed from opposite sides in a continuous process. The rollers' superstructure supported the application of more force than was possible with the high friction and inertia of edge rollers. And they extracted more of the cane's juice because their tolerances could be adjusted. Sugar output per worker increased by 150–200 percent.²³

The most notable of the artists during the second phase of Dutch Brazil, Frans Post, drew careful studies of both ox- and waterwheel-driven three-roller mills of the distinctive Brazilian type, using a numbered key to explain the stages of production—the first on-the-spot recordings of sugar technology. These were work scenes rather than mechanical drawings: they showed enslaved African Brazilians unloading sugarcane from oxcarts, carrying the cane to the mill, feeding the cane through the rollers, and discarding the crushed cane. (See Figure 6.) But they also functioned as technical drawings, with wide-angle views of well-illuminated and carefully articulated interiors that gave a clear idea of the mills' construction and gearing.

Post was among the more than three dozen scientists, engineers, and artists who had accompanied Johan Maurits, the count of Nassau-Siegen and governor general of Nieuwe Hollande, as a member of the future imperial prince's 1637–1644 cultural expedition. On his return to the Netherlands, Post contributed illustrations for Caspar van Baerle's *Rerum per octennium in Brasilia*, which celebrated Maurits's wishfully benign and tolerant rule of Dutch Brazil.²⁴ The book's map of Pernambuco featured a frequently reproduced sugar-works scene as a visual metonym of Dutch Brazil. To enliven the technical aspects of his earlier drawing of a sugar mill, Post added a party of Europeans and their attendants arriving at the house of a *senhor do engenho*, while a boisterous group of enslaved people gathered in the yard.

Back in Amsterdam, Post spent the rest of his life painting landscapes of Brazil,

²¹ C. R. Boxer, *The Dutch in Brazil, 1624–1654* (Oxford, 1957); Wim Klooster, *The Dutch in the Americas, 1600–1800* (Providence, R.I., 1997), 20–39.

²² [Nicolas van Geelkercken], *Reys-boeck van het rijcke Brasiliën, Rio de la Plata ende Magallanes* ([Dordrecht?], 1624), JCBL Archive, 07667-1.

²³ John Daniels and Christian Daniels, "The Origin of the Sugarcane Roller Mill," *Technology and Culture* 29, no. 3 (1988): 493–535; J. H. Galloway, *The Sugar Cane Industry: An Historical Geography from Its Origins to 1914* (Cambridge, 1989), 73–77; Schwartz, "A 'Babilônia' colonial," table 3; Lizette Cabrera Salcedo, *De los bueyes al vapor: Caminos de la tecnología del azúcar en Puerto Rico y el Caribe* (San Juan, P.R., 2010), 33–54.

²⁴ Caspar van Baerle, *Rerum per octennium in Brasilia et alibi nuper gestarum, sub praefectura illustrissimi Comitiss I. Mauriti Nassaviæ &c. comitis, historia nunc Vesaliæ gubernatoris & equitatus fœderatorum Belgii ordd. sub Auriaco ductoris, historia* (Amsterdam, 1647); van Baerle, *The History of Brazil under the Governorship of Count Johan Maurits of Nassau, 1636–1644*, ed. and trans. Blanche T. van Berckel-Ebeling Koning (Gainesville, Fla., 2011).

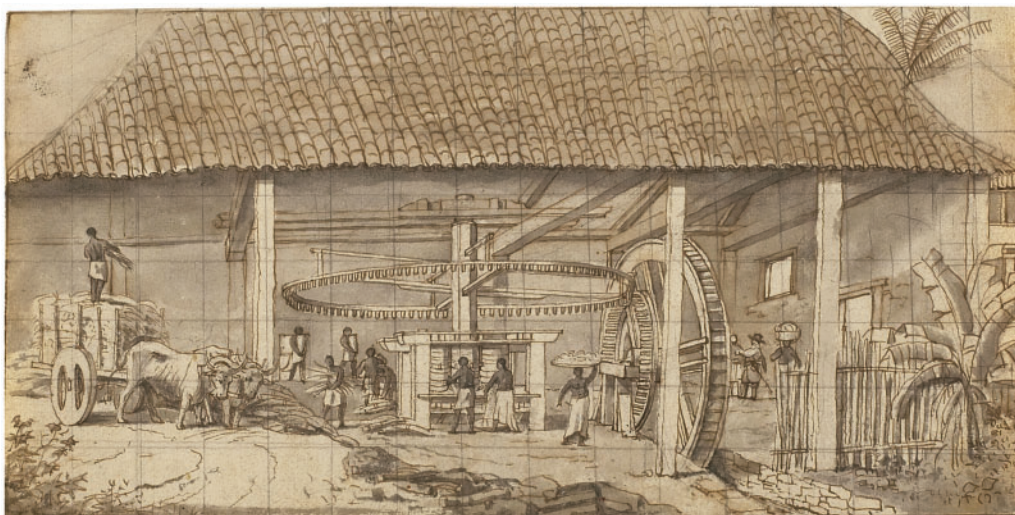


FIGURE 6: The earliest known on-the-spot drawing of the recently invented vertical three-roller sugar mill, worked, presumably, by enslaved Africans. Frans Post, *Pressoir à sucre au Brésil* (ca. 1640). © Royal Museums of Fine Arts of Belgium, Brussels, Inv. 4060 / 2888. Photo: Grafisch Buro Lefevre, Heule.

usually with the mills and settlements of sugar plantations as the setting for a wide range of rural and manufacturing activities.²⁵ Since the 1560s, Dutch artists had been creating landscapes that were topographically specific to their country and populated with peasants going about their everyday lives. Post drew on these traditions for his paintings of Dutch Brazil, and accordingly he made their scenes and settings distinctively Brazilian.²⁶ (See Figure 7.) The social spectrum went from African Brazilians in plantation and European dress to Europeans on horses and palanquins. The built environment corresponded to the social and economic peculiarities of the Brazilian countryside, with sugar mills belonging to monasteries as well as to *senhores de engenhos*, along with the houses of landholding and sharecropping *lavradores*, who owned slaves but lacked the capital to build mills and therefore had to deliver their cane to nearby manorial mills.²⁷

Post's paintings and engravings had a strong genre quality and took sugar technology for granted, rather than isolating it. They naturalized the sugar plantation.

²⁵ On Dutch visual interest in Brazil, see R. Joppien, "The Dutch Vision of Brazil: Johan Maurits and His Artists," in E. van den Boogaart, H. R. Hoetink, and P. J. P. Whitehead, eds., *Johan Maurits van Nassau-Siegen, 1604–1679: A Humanist Prince in Europe and Brazil—Essays on the Occasion of the Tercentenary of His Death* (The Hague, 1979), 297–376; P. J. P. Whitehead and M. Boeseman, *A Portrait of Dutch 17th Century Brazil: Animals, Plants, and People by the Artists of Johan Maurits of Nassau* (Amsterdam, 1989); Jean Michel Massing, "Albert Eckhout, Frans Post and the Imagery of Afro-Americans in Seventeenth-Century Brazil," in Massing, *Studies in Imagery*, vol. 2: *The World Discovered* (London, 2007), 141–171; Elizabeth Sutton, "Possessing Brazil in Print, 1630–54," *Journal of Historians of Netherlandish Art* 5, no. 1 (2013), <http://www.jhna.org/index.php/past-issues/volume-5-issue-1/181-possessing-brazil-in-print>.

²⁶ On peasants as genre subjects, see Walter S. Gibson, "Festive Peasants before Bruegel: Three Case Studies and Their Implications," *Simiolus: Netherlands Quarterly for the History of Art* 31, no. 4 (2004/2005): 292–309; Karolien De Clippel and Michael Hoyle, "Two Sides of the Same Coin? Genre Painting in the North and South during the Sixteenth and Seventeenth Centuries," *Simiolus* 32, no. 1 (2006): 17–34; Stephanie Porras, "Producing the Vernacular: Antwerp, Cultural Archaeology and the Bruegelian Peasant," *Journal of Historians of Netherlandish Art* 3, no. 1 (2011), <http://www.jhna.org/index.php/past-issues/vol-3-1/134-producing-the-vernacular>.

²⁷ On *lavradores*, see Schwartz, "A 'Babilônia' colonial," 226–228.



FIGURE 7: *Real* (royal) referred to the mill's waterwheel, the most technologically advanced form of power, but *engenho* embraced the entire plantation landscape. Frans Post, *Vue d'engenho real au Brésil* (n.d.), painting. Musée du Louvre, Inv. 1724. Photo René-Gabriel Ojéda. © RMN-Grand Palais / Art Resource, NY.

Dutch landscapes from Brazil in the 1630s and 1640s show that European visual culture had the resources to represent the people and spaces of sugar plantations comprehensively, but through the middle of the eighteenth century, artists largely ignored them in favor of technical illustrations. There were exceptions—Zacharias Wagener's watercolor (ca. 1640) of the fields and mills of a plantation in Dutch Brazil, Dirk van Valkenburg's painting (ca. 1707) of festive slaves on a Suriname plantation, and a painting (ca. 1742) of the governor of Barbados riding past workers in cane fields—but they were too episodic to constitute a genre.²⁸

DUTCH BRAZIL WAS SHORT-LIVED, but its decline and fall provided opportunities and a catalyst for intensified sugar production in the Caribbean—in the transfer of technology, capital, commercial connections, and access to labor—first in Barbados, then in

²⁸ Zacharias Wagener, *Ingenho Masciappe*, watercolor, reproduced in Dante Martins Teixeira, ed., *The "Thierbuch" and "Autobiography" of Zacharias Wagener* (Rio de Janeiro, 1997), 186–187, fig. 102; Dirk van Valkenburg, ["Black People Making Merry in Surinam"], reproduced in Hugh Honour, *The European Vision of America: A Special Exhibition to Honour the Bicentennial of the United States* (Cleveland, 1975), fig. 84; Anonymous, *Governor Robinson Going to Church*, reproduced in John E. Crowley, *Imperial Landscapes: Britain's Global Visual Culture, 1745–1820* (New Haven, Conn., 2011), 112, fig. 154.

Suriname and the Lesser Antilles, and eventually in Jamaica and Saint-Domingue.²⁹ This expansion involved the development of the classic sugar plantation, with cane-growing and sugar production integrated in a single enterprise, in contrast to the preceding differentiation of the two processes in Brazil, where *senhores de engenhos* typically relied on *lavradores* for half or more of the cane they processed.

Most of the classic illustrations of sugar works appeared in books that discussed the integrated slave plantation. These books typically discussed the labor and living conditions of enslaved Africans at length, but the only aspect of the plantation that required illustration was the sugar works—mill, boiling house, curing house, and distillery. For example, take depictions of early sugar production on Barbados, the most important Caribbean sugar colony from the middle of the seventeenth century through the early eighteenth century. Richard Ligon, a Royalist refugee, arrived in Barbados in 1647 as the integrated sugar enterprise was coming to the fore. He stayed three years, becoming a plantation manager, and on his return to England he wrote a history of the island. In the text he discussed the living conditions and labor of both indentured European servants and enslaved Africans, but his illustrations featured “the Ingenio that makes the Sugar.” Ligon illustrated “the Ingenio it selfe, which is the *Primum Mobile* of the whole work, the Boyling-house, with the Coppers and Furnaces, the Filling room, the Still-house, and Curing-house,” with large copperplate engravings based on highly accomplished mechanical drawings of sections and plans.³⁰ (See Figure 8.) Besides the three-roller mill, they showed the arrangement of the evaporating process in a continuous battery of pans, which had replaced the individually heated cauldrons used previously to concentrate the syrup for crystallization. Ligon’s illustrations set a new standard for technical illustrations of sugar production.

For the remainder of the seventeenth century, however, and for much of the eighteenth as well, French artists predominated in illustrating colonial American sugar production.³¹ During the reign of Louis XIV, encyclopedic works on the history, geography, and natural history of the Caribbean became a specialty among French publishers.³² French technical graphics came to the fore with Jean-Baptiste du Tertre’s *Histoire générale des Antilles habitées par les Français* (1667–1671), which

²⁹ For revisionist cautions against exaggerating the direct role of the Dutch in the expansion of sugar into the Caribbean, see John J. McCusker and Russell R. Menard, “The Sugar Industry in the Seventeenth Century: A New Perspective on the Barbadian ‘Sugar Revolution,’” in Schwartz, *Tropical Babels*, 288–330, here 297–301; Wim Klooster, “The Geopolitical Impact of Dutch Brazil on the Western Hemisphere,” in Michiel van Groesen, ed., *The Legacy of Dutch Brazil* (Cambridge, 2014), 25–40; Stuart B. Schwartz, “Looking for a New Brazil: Crisis and Rebirth in the Atlantic World after the Fall of Pernambuco,” *ibid.*, 41–58.

³⁰ Richard Ligon, *A True & Exact History of the Island of Barbados* (London, 1657), quote from 55–56; see also Susan Scott Parrish, “Richard Ligon and the Atlantic Science of Commonwealths,” *William and Mary Quarterly*, 3rd series, 67, no. 2 (2010): 209–248. On the development of the integrated sugar plantation, see Philip D. Curtin, *The Rise and Fall of the Plantation Complex: Essays in Atlantic History* (Cambridge, 1990); Richard S. Dunn, *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624–1713* (New York, 1972), chaps. 2–3; B. W. Higman, “The Sugar Revolution,” *Economic History Review*, new series, 53, no. 2 (2000): 213–236; Russell R. Menard, *Sweet Negotiations: Sugar, Slavery, and Plantation Agriculture in Early Barbados* (Charlottesville, Va., 2006).

³¹ Ligon’s plans were reproduced in a 1674 Parisian collection of accounts of Atlantic voyages: Henri Justel, ed., *Recueil de divers voyages faits en Afrique et en l’Amerique, qui n’ont point esté encore publiez; contenant l’origine, les moeurs, les coutumes & le commerce des habitans de ces deux parties du monde* (Paris, 1674), JCBL Archive, 01903-8, 01903-9, 01903-10.

³² Philip P. Boucher, *Les Nouvelles Frances: France in America, 1500–1815—An Imperial Perspective* (Providence, R.I., 1989), 45–54, 63–64.

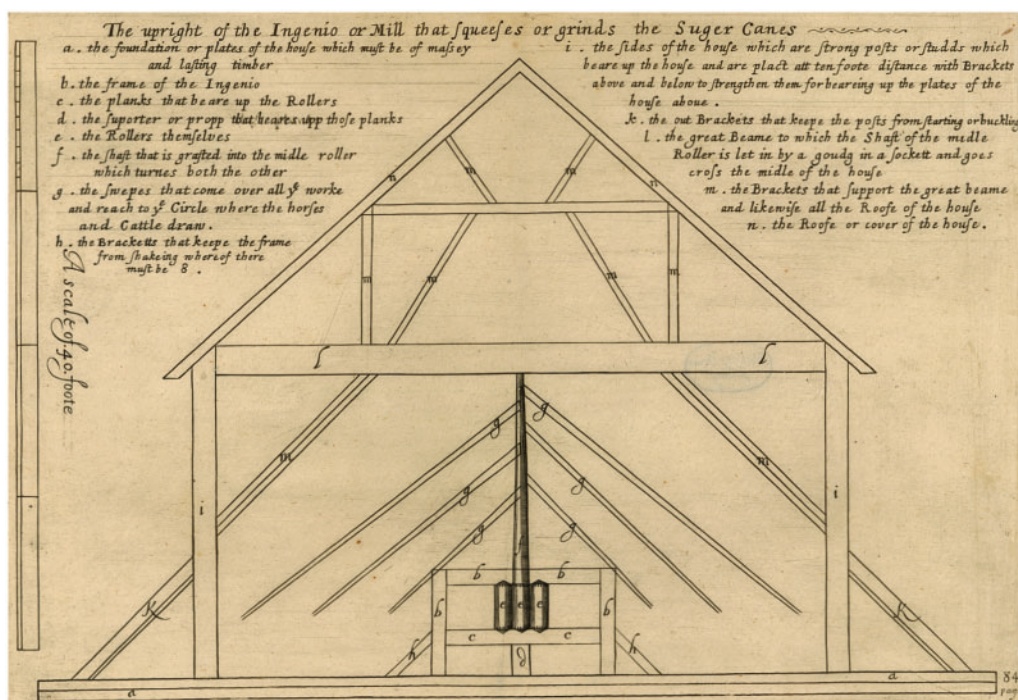


FIGURE 8: The key and scale made this print a construction blueprint for a vertical three-roller sugar mill, which is labeled with the Latin/Iberian term. Richard Ligon, "[Vertical section of] The Upright of the Ingenio or Mill That Squeezes or Grinds the Sugar Canes," engraving, from Ligon, *A True & Exact History of the Island of Barbados* (London, 1657), following 84. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 03547-008.

illustrated sugar works with an engraving by Sébastien Le Clerc. Le Clerc did not observe his subject firsthand, which made it all the easier for him to design an informative schematization of a sugar works. (See Figure 9.) He framed the works itself with a sugarcane field, a mansion house, slave housing ("cases de Negres"), and a half-dozen illustrations of indigenous plants that nearly take over the picture. In effect, he synthesized Post's landscape naturalism with Ligon's graphic analysis. Each of the stages of production received its separate space, and realistic detail was minimized in order to maintain focus on the technical processes. Just three people are depicted carrying cane from the field to the mill. The three-roller mill is shown in silhouette to clarify its construction. Single figures feed cane from opposing sides of the counter-turning rollers, with a minimal amount of debris at their feet. A solitary driver manages a single pair of oxen turning the mill's sweeps. A pipe carries the pressed juice from a trough beneath the mill to a settling tank, which then feeds a series of heated evaporating coppers that progressively concentrate the syrup, which is ladled into clay forms to cool for crystallization. At the bottom of the hill, a still makes rum from the molasses byproduct. A light-skinned figure in a loose shirt, culottes, and a hat directs eight half-clothed dark-skinned workers.

Le Clerc was a protégé of Charles Le Brun, Louis XIV's favorite artist, who held an appointment at the Gobelins tapestry works thanks to Jean-Baptiste Colbert.



FIGURE 9: The print's key gave priority to the mill, rather than to the raw material of the sugarcane (number 5), and identified the slaves' housing (number 10) as an afterthought to the plants. Sébastien Le Clerc, "Sucrerie," engraving, from Jean-Baptiste du Tertre, *Histoire générale des Antilles habitées par les Français*, 2 vols. (Paris, 1667–1671), 2: facing 112. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 01897-2.

Eventually he became professor of geometry and perspective at the Académie royale de peinture et de sculpture.³³ It made perfect sense that he, one of France's foremost graphic artists, should contribute illustrations to a publication promoting French colonial staples. In 1663 Colbert arranged a royal charter for the Académie, granting it a monopoly of artistic instruction and institutionalizing its capacity to synergize French art and commerce through "a state-sponsored system with salaries, honors, and an official status for its artists."³⁴ In 1664 he also sponsored a series of edicts encouraging the French sugar industry: protective tariffs against foreign refined sugar, preferential duties for raw sugar imported from French colonies, and drawbacks on those duties when French-refined sugar was exported. He intended these measures to establish a French sugar-refining industry and thereby undercut the Dutch near-monopoly in shipping and refining sugar produced in the French Antilles. He also encouraged, and in some cases subsidized, the development of French refineries, which numbered more than two dozen by 1683. Meanwhile, sugar production in Martinique, Guadeloupe, and Saint Christopher doubled, and France developed its own African slave trade to maintain it. A March 1685 "Edit du roi touchant la police

³³ W. McAllister Johnson, *French Royal Academy of Painting and Sculpture Engraved Reception Pieces, 1672–1789: An Historical Publication Based on the Collections of the Département des estampes et de la photographie de la Bibliothèque Nationale, Paris* (Kingston, Ont., 1982), 57.

³⁴ Paul Duro, *The Academy and the Limits of Painting in Seventeenth-Century France* (Cambridge, 1997), 59–60.

des îles de l'Amérique Française"—soon known as the Code Noir—defined the legal, social, economic, and religious implications of racially based slavery.³⁵

The most profusely illustrated account of France's Caribbean colonies was Jean-Baptiste Labat's *Nouveau voyage aux îles de l'Amérique* (1722). Labat arrived in Martinique in 1694 as a Dominican missionary, but his mathematical training led to his employment by the colonial government as a civil and military engineer. This work involved travel throughout the Caribbean, including visits to English and Dutch colonies. He also managed a sugar plantation on Martinique as a sort of model farm to test technical and managerial improvements in sugar production. When he returned to Europe in 1706 and wrote up his experiences, he devoted more than three hundred pages to the labor, technology, and economics of sugar production. He broke down the work regimes of the plantation by hours and by division of tasks, devoting nearly fifty pages to an elaborate description of the work of planting and harvesting. He appreciated that the deadliest work on the plantation was using hoes in the fields to prepare the ground and to weed plantings, rather than in the more frequently illustrated and more dramatic stages of harvesting, milling, and processing. He warned that plantation managers were pushing their enslaved workers to their limits: "from what I have said above, it is clear how difficult it is for the Negro slaves, who are usually malnourished, to work in the sugar mill without perishing."³⁶ Accordingly, he explained how to reduce industrial accidents at the mill by weekly alternations of gangs' work between eighteen-hour days at the sugar works and six-hour days at the purging house.

But Labat's humanity nearly disappeared in his illustrations of sugar technology. Only one of his images of sugar mills shows the workers who ran them. The prints that he designed depict several types of mills in geometrical elevation (including a Portuguese wind vane and another one with horizontal rollers), plans of a boiling room and a purging house, and several hand tools for sugar-processing—none with human figures using them. (See Figure 10.) Labat's skillful natural history drawings show that he had the ability to represent figures on a sugar plantation, and his analyses of plantation work indicate an appreciation of its skills and stresses, but his visual representations of the sugar-slave complex do not include the enslaved people.

Denis Diderot and Jean d'Alembert's *Encyclopédie* could have been the perfect vehicle to bridge this gap between the moral and the technical. It contained Louis de Jaucourt's ringing condemnation of slavery ("slavery is a humiliating state not only for the people who suffer it, but also for humanity itself, which is degraded by it"), and it affirmed the dignity of artisans and their mechanical arts: "We need a man to rise up in the academies and go down to the workshops and gather material about the arts to be set out in a book that will persuade artisans to read, philosophers to think along useful lines, and the great to make at least some worthwhile use of their

³⁵ For the code's text, see <http://yekrik.yekrak.pagesperso-orange.fr/codenoirtxt.pdf>.

³⁶ Jean-Baptiste Labat, *Nouveau voyage aux îles de l'Amérique: Contenant l'histoire naturelle de ces pays, l'origine, les mœurs, la religion & le gouvernement des habitants anciens & modernes. Les guerres & les evenemens singuliers qui y sont arrivez pendant le long séjour que l'auteur y a fait. Le commerce & les manufactures qui y sont établies, & les moyens de les augmenter. Avec une description exacte & curieuse de toutes ces îles. Ouvrage enrichi de plus de cent cartes, plans & figures en taille-douce*, 6 vols. (Paris, 1722), quote from 3: 216 ("on voit par ce que j'ai dit ci-dessus, ce que c'est le travail d'une sucrerie, & combien il est difficile que des Negres le plus souvent mal nourris puissent le supporter, sans y succomber").

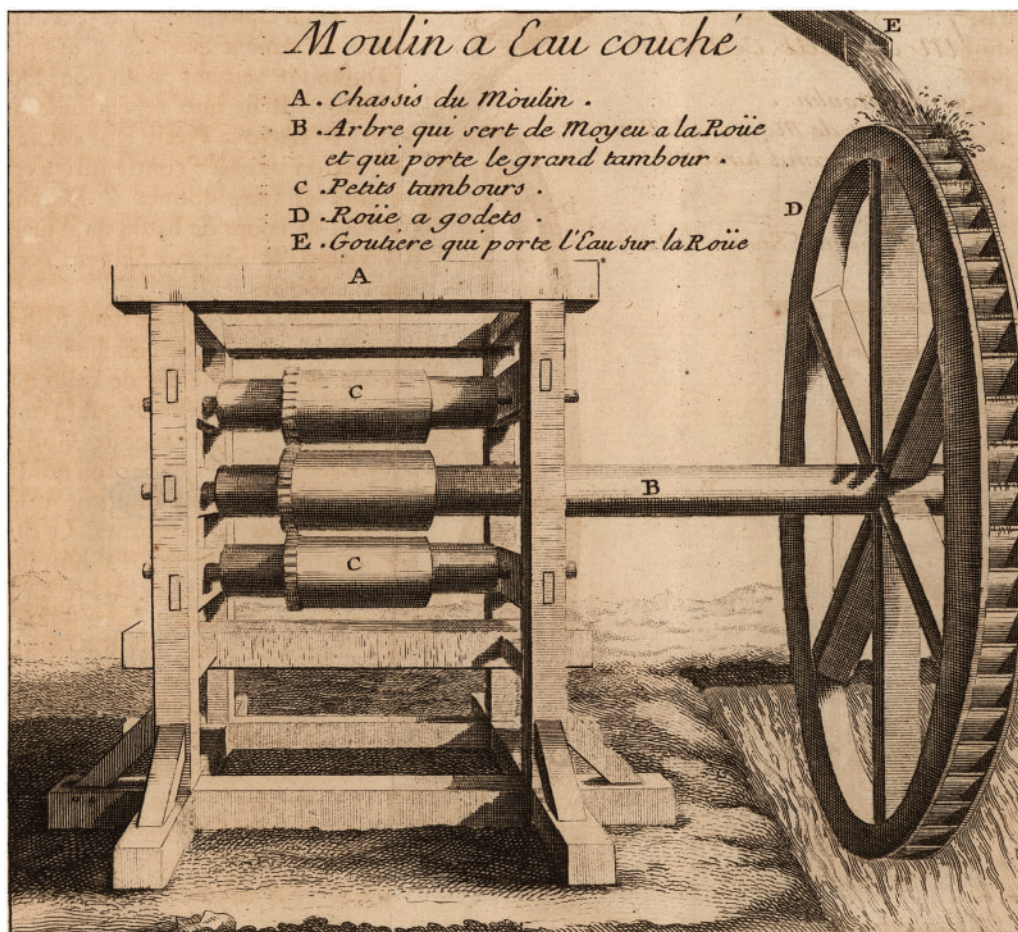


FIGURE 10: Jean-Baptiste Labat's graphics lavishly explored alternatives to the standard vertical three-roller mill, while ignoring the plantation workforce. "Moulin à eau couché," engraving, from Labat, *Nouveau voyage aux isles de l'Amérique*, 3 vols. (Paris, 1742), 3: following 436. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 35892-54.

authority and their wealth."³⁷ Diderot answered his own call with the *Encyclopédie*'s eleven volumes of technical and scientific illustrations in 2,569 plates. Sugar manu-

³⁷ Le Chevalier Louis de Jaucourt, "Esclavage," in Denis Diderot and Jean le Rond d'Alembert, eds., *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, 17 vols. (Paris, 1751–1765), 5: 934–939, quote from 938 ("l'esclavage n'est pas seulement un état humiliant pour celui qui le subit, mais pour l'humanité même qui est dégradée"). Jaucourt wrote more than 17,000 of the *Encyclopédie*'s articles, roughly one-quarter of its content; Frank A. Kafker and Serena L. Kafker, *The Encyclopedists as Individuals: A Biographical Dictionary of the Authors of the "Encyclopédie"* (Oxford, 1988), 175–180. The *Encyclopédie* is available online through the ARTFL Encyclopédie Project, <http://encyclopedia.uchicago.edu>. [Denis Diderot], excerpt from "Art," in Charles Coulston Gillispie, ed., *A Diderot Pictorial Encyclopedia of Trades and Industry: Manufacturing and the Technical Arts in Plates Selected from "L'Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers" of Denis Diderot*, 2 vols. (New York, 1959), 1: epigraph, quote from ix ("Les artisans se son crus méprisables, parce qu'on les a méprisés; apprenons-leur à mieux penser d'eux-mêmes: c'est le seul moyen d'en obtenir des productions plus parfaits. Qu'il sorte de sein des academies quelqu'homme qui descende dans les ateliers, qui y recueille les phénomènes des Arts, & qui nous les expose dans un ouvrage qui determine les artistes à lire, les philosophes à penser utilement, & les grands à faire enfin un usage utile de leur autorité & de leurs recompenses"; *Encyclopédie*, 1: 717).

facture appears in the section “Agriculture et economic rustique,” the first plate in which shows a landscape of progressive but still low-tech grain agriculture, with wheeled plows and sowing machines in the foreground, but no machinery, such as flour mills. By contrast, the plates illustrating “Sucrerie” begin with a panoramic view that integrates a plantation’s cane fields, mill, refinery, mansion house, and slaves’ cabins. This print’s naturalizing of plantation landscapes harks back to Frans Post. But the *Encyclopédie*’s other illustrations strip the sugar works down to sections of water- and animal-powered mills and to the array of evaporating cauldrons. (See Figure 11.) Token workers appear in each plate, but their efforts hardly distract the viewer from the apparatus itself. The most careful drawings are of the refining stages, in which the human presence is practically eliminated.³⁸

In defiance of Jaucourt’s thoroughgoing repudiation of slavery, Jean-Baptiste-Pierre Le Romain’s entry on “Negres, considérés comme esclaves dans les colonies de l’Amérique” benignly tied racial slavery to Europe’s American colonies: “America’s lands occupied by Europeans would still be uncultivated but for the labor of Negroes who have been brought there from all parts of Guinea.”³⁹ Considerations of humanity did not compromise this economic necessity; enslaved Africans, Le Romain asserted, lived more happily in America than in their native lands, and both humanity and self-interest required planters to attend to their slaves’ well-being. Le Romain had direct knowledge of plantation conditions, having been an engineer in the French Antilles in the 1730s and 1740s. His article viewed plantation slavery from the perspective of the planter: how did differences among slaves depend on their home cultures in Africa, and how could they best be organized for plantation labor, particularly at the sugar works?

IN THE 1770s, BRITISH ARTISTS began broadening representations of sugar plantation regimes to include picturesque landscapes and genre scenes of everyday life.⁴⁰ This broadening was part of a still larger process: since the 1750s, British artists had been visiting colonial territories to create firsthand images of their people and landscapes for

³⁸ “Plan et élévation d’une nouvelle sucrerie sans pots ni charois de liquids jusqu’à la parfaite consommation des sirops, ecumes etc.” and “Coupe relative au plan et élévation d’une nouvelle sucrerie exécutée à Cayenne,” in Jean Antoine Brûletout de Préfontaine, *Maison rustique, à l’usage des habitants . . . de Cayenne* (Paris, 1763), figs. 4 and 5, JCBL Archive 06290-4, 06290-5; Robert Louis Stein, *The French Sugar Business in the Eighteenth Century* (Baton Rouge, La., 1988).

³⁹ Jean-Baptiste-Pierre Le Romain, “Negres, considérés comme esclaves dans les colonies de l’Amérique,” in Diderot and d’Alembert, *Encyclopédie*, 11: 80–83, quote from 80 (“les terres de l’Amérique, occupées par les Européens, seraient encore incultes, sans le secours des *negres* que l’on y a fait passer de presque toutes les parties de la Guinée”). On Le Romain as the *Encyclopédie*’s main authority on the West Indies, see Kafker and Kafker, *The Encyclopedists as Individuals*, 211–212. The immediately preceding entry on the Atlantic African slave trade, “Negres (Commerce),” is condemnatory; *Encyclopédie*, 11: 79–80.

⁴⁰ Susanne Seymour, Stephen Daniels, and Charles Watkins, “Picturesque Views of the British ‘West Indies,’” *The Picturesque* 10 (1995): 22–28; Jean Michel Massing, “From Dutch Brazil to the West Indies: The Paper Image of the Ideal Sugar Plantation,” in Barry Bergdoll and Werner Oechslin, eds., *Fragments: Architecture and the Unfinished—Essays Presented to Robin Middleton* (London, 2006), 275–288; Geoff Quilley, “Pastoral Plantations: The Slave Trade and the Representation of British Colonial Landscape in the Late Eighteenth Century,” in Geoff Quilley and Kay Dian Kriz, eds., *An Economy of Colour: Visual Culture and the Atlantic World, 1660–1830* (Manchester, 2003), 106–128; Tim Barringer, “Picturesque Prospects and the Labor of the Enslaved,” in Tim Barringer, Gillian Forrester, and Barbaro Martinez-Ruiz, eds., *Art and Emancipation in Jamaica: Isaac Mendes Belisario and His Worlds* (New Haven, Conn., 2007), 41–63.

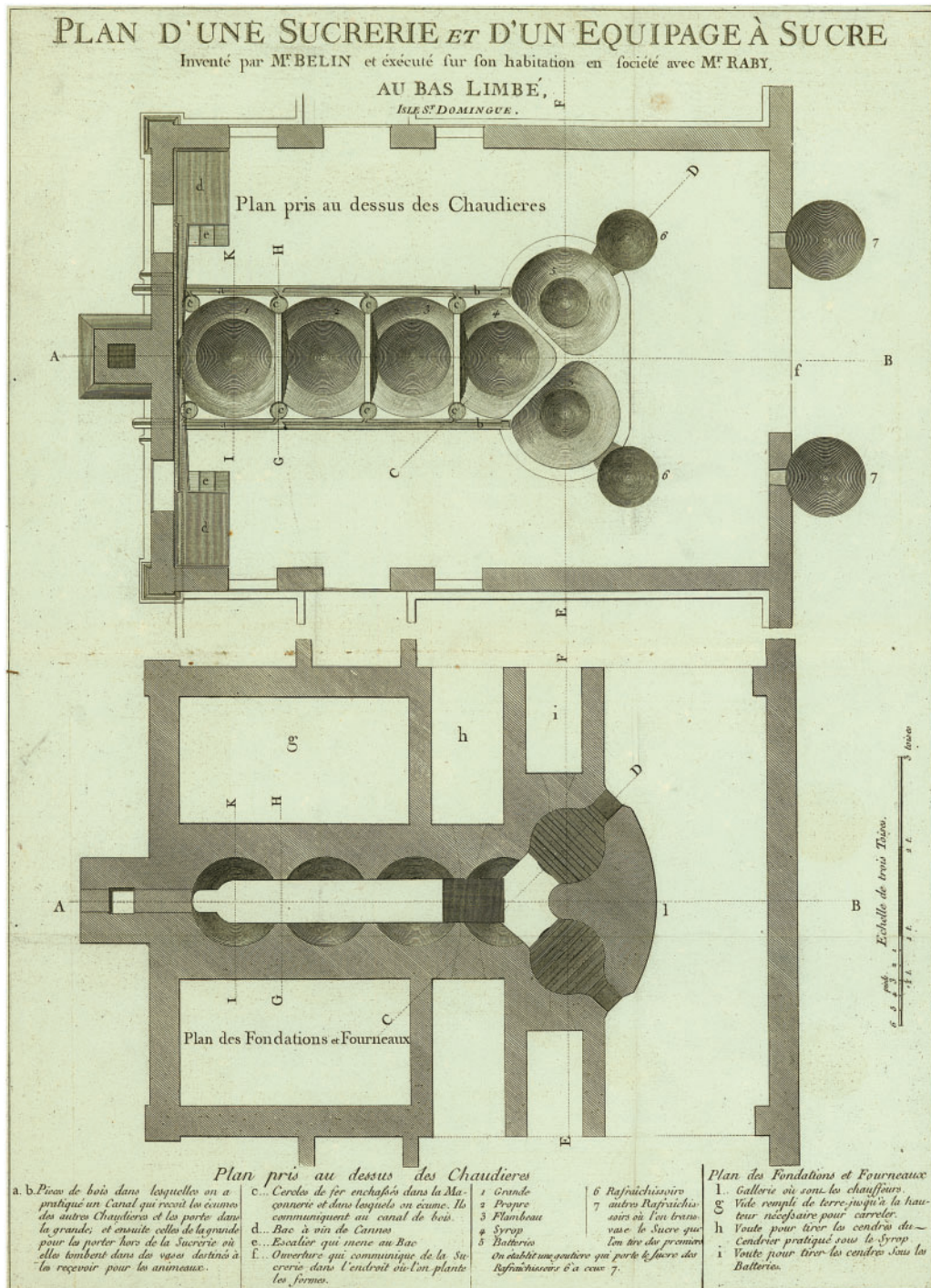


FIGURE 11: As Saint-Domingue came to preeminence among sugar colonies, graphic artists monumentalized its sugar refineries. Nicolas Ponce, "Plan d'une sucrerie et d'un equipage à sucre inventé par Mr. Belin et exécuté sur son habitation en société avec Mr. Raby, au Bas Limbé, Isle St. Domingue," engraving, from Ponce, *Recueil de vues des lieux principaux de la colonie française de Saint-Domingue* (Paris, 1791). Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 03794-3.

metropolitan visual culture.⁴¹ Thomas Hearne, eventually his generation's foremost topographic landscape artist, began his career in Antigua, where he arrived in 1771 as a draftsman for Sir Ralph Payne, the new governor-in-chief of the Leeward Islands. Payne, who owned plantations with more than four hundred slaves, commissioned Hearne to paint landscapes of Antigua, among them an idyllic view titled *Parham Hill House and Sugar Plantation* (ca. 1779). In the foreground a free African Caribbean militiaman strolls with his family, while in the middle ground a gang of slaves cut cane and load it onto a cart for transport to a distant windmill-powered sugar mill and its smoky sugar works.⁴² Similarly, in 1774 William Beckford brought the Grand Tour painter George Robertson to Jamaica with a commission to portray his plantations, valued at more than £100,000. Robertson's *A View in the Island of Jamaica, of Roaring River Estate, Belonging to William Beckford Esqr.: Near Savannah la Marr* (1778) centers on a plantation house with a verandah, a mill and boiling house, and a sugar-curing plant. (See Figure 12.) In the foreground a woman with a rake chats with a dismounted rider on a country road, while another woman carrying a basket on her head walks with a child at her side. Robertson presented Beckford's plantations as models of large-scale, progressive agriculture based on a contented, well-organized workforce. Hearne's and Robertson's contemporary Agostino Brunias, a client of Antigua-born Sir William Young, president of the Commission for the Sale of Lands in the Ceded Islands (Grenada, Tobago, Dominica, and Saint Vincent), reversed this emphasis and made African Caribbeans the focus of his interest, as "West Indians," "Free West Indians," "Negroes," "Mulatresses," and "Free Natives," but, curiously, not as "Slaves." They danced, wrestled, bathed, peddled flowers, and bought fruit, but never worked on plantations.⁴³ Yet Brunias sometimes included sugar works as backgrounds to these genre scenes, and thereby subtly reinforced Hearne's and Robertson's image of the sugar mill as an icon of a humane plantation regime.⁴⁴

This visual humanizing of the plantation landscape and its people—and silence on their enslavement—cannot have been just coincidental with the beginnings of an anti-slavery movement in Anglo-American culture and politics. An "empire without slaves" began to be considered positively for the first time by British pamphleteers in the early 1770s.⁴⁵ In *Somerset v. Stewart* at the Court of King's Bench in 1772, Lord Mansfield had ruled against the forceful removal of slaves from Britain for the purpose of sale: "The state of slavery is of such a nature, that it is incapable of being introduced on any reasons, moral or political; but only positive law . . . It's so odious, that nothing can be suffered to support it, but positive law. Whatever inconveniences,

⁴¹ Crowley, *Imperial Landscapes*.

⁴² Thomas Hearne, *Parham Hill House and Sugar Plantation, Antigua* (1779), http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=749282&partId=1.

⁴³ On Brunias, see Beth Fowkes Tobin, *Picturing Imperial Power: Colonial Subjects in Eighteenth-Century Painting* (Durham, N.C., 1999), chap. 5; Kay Dian Kriz, *Slavery, Sugar, and the Culture of Refinement: Picturing the British West Indies, 1700–1840* (New Haven, Conn., 2008), chap. 2. On Isaac Belisario, a later genre artist of the West Indies, see Kriz, *ibid.*, chap. 4.

⁴⁴ E.g., Agostino Brunias, *Dancing Scene in the West Indies* (n.d.), painting (Tate Britain, inv. T13869; <http://www.tate.org.uk/art/artworks/brunias-dancing-scene-in-the-west-indies-t13869>), whose background shows a hilltop sugar works separated from the African Caribbean scene in the foreground.

⁴⁵ On early abolitionism, see Christopher L. Brown, "Empire without Slaves: British Concepts of Emancipation in the Age of the American Revolution," *William and Mary Quarterly*, 3rd series, 56, no. 2 (1999): 273–306. On the preceding "antislavery without abolitionism," see Brown, *Moral Capital: Foundations of British Abolitionism* (Chapel Hill, N.C., 2006), chap. 1.



FIGURE 12: A picturesque plantation landscape without cane fields and their gangs. Thomas Vivares after George Robertson, *A View in the Island of Jamaica, of Roaring River Estate, Belonging to William Beckford Esqr.: Near Savannah la Marr*, engraving (London, 1778). Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 32878.

therefore, may follow from a decision, I cannot say this case is allowed or approved by the law of England; and therefore the black must be discharged.”⁴⁶ Not surprisingly, Mansfield’s decision was understood at the time as being abolitionist, though historians have shown that was not his original intent.⁴⁷

The anti-slavery uptake on *Somerset* pained slaveholders and aroused a previously unnecessary *anti*-abolitionist movement.⁴⁸ For example, Samuel Martin’s standard how-to manual, *An Essay upon Plantership*, added a new preface in 1773: “Upon the Slavery of Negroes, in the British Colonies. Shewing, that they are much happier than in their Native Country, much happier than the Subjects of Arbitrary Governments, and at least as happy as the Labourers of Britain.” Martin could

⁴⁶ Mansfield’s decision as reported by Capel Lofft, the only law recorder present, quoted in William R. Cotter, “The Somerset Case and the Abolition of Slavery in England,” *History* 79, no. 255 (1994): 31–56, here 35.

⁴⁷ Yet “in limiting the rights of slaveholders in England, the counsel for Somerset seemed to acknowledge the rights of slaveholders in British America”; Brown, *Moral Capital*, 100. See also James Oldham, “New Light on Mansfield and Slavery,” *Journal of British Studies* 27, no. 1 (1988): 45–68; Steven M. Wise, *Though the Heavens May Fall: The Landmark Trial That Led to the End of Human Slavery* (Cambridge, Mass., 2005).

⁴⁸ On West Indian colonists’ previous lack of defensiveness regarding their slaveholding, see Jack P. Greene, “Liberty, Slavery, and the Transformation of British Identity in the Eighteenth-Century West Indies,” *Slavery and Abolition* 21, no. 1 (2000): 1–31, here 8–10 and 14–16.

hardly have made his apologetic intent more explicit; he wanted “to put an end to the many publications upon The Freedom of Negroes in the Colonies.” Abolitionists, he asserted, were intellectually lazy. Were they to inform themselves about Africa, they would learn that “all [people in] the kingdoms of Africa are slaves, from the highest to the lowest, to the arbitrary power of lawless tyrants, who have the lives and properties of their subjects absolutely at their disposal,” a power they exercised by selling even their wives and children “to the traders of all nations upon the sea coasts.” As well, “advocates for the liberty of the Negroes in our colonies” should “look into Ireland, among the common people, where there are no parish taxes, nor any support for the sick and maimed, but by private charities, and importunate beggary,” while “the Negroes in our colonies are not only regularly fed by their owners throughout the year, at a very great expence, but have cloathing, warm houses, and spots of land, in which they produce fruits, roots, pulse, and vegetables, which they sell or apply to their own uses, as they please; besides, they enjoy the liberty of raising hogs, and feathered stock, which they sell or eat at their pleasure.” He further urged that English readers “enquire into the state of our labourers in husbandry, even in this our opulent free country. Are they not slaves to necessity? the most cruel of all Egyptian task masters . . . What is their great boast of liberty, but that of changing their employer? But that can neither mitigate their labours, nor increase their wages; and therefore cannot add any comfort to their existence.”⁴⁹ Martin’s readers must have wondered whether people were thronging Bristol, Liverpool, Nantes, and La Rochelle, hoping for transportation to the West Indies as slaves.

Images of slave ships during early abolitionism might have discouraged such hopes. They showed hundreds of people confined below decks in spaces that did not allow them to stand up or to move when lying down.⁵⁰ Once arrived in the colonies, enslaved Africans inevitably faced sale. Abolitionist art dealt with these realities by emphasizing slavery’s physical coercion, violation of family ties, and dehumanizing humiliation—conditions characterized in the title of George Morland’s celebrated painting *Execrable Human Traffick* (1789).⁵¹ Besides the sale of slaves, abolitionist art chiefly featured their torture.⁵² Here William Blake created the most devastating images, with his gruesome illustrations for John Stedman’s *Narrative of a Five Years’*

⁴⁹ Britannicus, “A Preface upon the Slavery of Negroes, in the British Colonies,” in Samuel Martin, *An Essay upon Plantership, Humbly Inscribed to His Excellency George Thomas, Esq; Chief Governor of All the Leeward Islands*, 5th ed. (London, 1773), i–xv, quotes from iii, vii, viii, and dedication. On enslavement as a means of social relief, see Michael J. Rozbicki, “To Save Them from Themselves: Proposals to Enslave the British Poor, 1698–1755,” *Slavery and Abolition* 22, no. 2 (2001): 29–50.

⁵⁰ Society for the Abolition of the Slave Trade, London Committee, *Description of a Slave Ship*, engraving (London, 1789). On depictions of the slave ship *Brookes*, see Marcus Wood, *Blind Memory: Visual Representations of Slavery in England and America, 1780–1865* (New York, 2000), 16–36, figs. 2.2 and 2.3. On abolitionist art more generally, see Hugh Honour, ed., *The Image of the Black in Western Art*, vol. 4: *From the American Revolution to World War I*, pt. 1: *Slaves and Liberators*, 50–104, 146–155, 162–173; J. R. Oldfield, *Popular Politics and British Anti-Slavery: The Mobilisation of Public Opinion against the Slave Trade, 1787–1807* (Manchester, 1995), chap. 6; Maurie D. McNinnis, *Slaves Waiting for Sale: Abolitionist Art and the American Slave Trade* (Chicago, 2011).

⁵¹ The original of George Morland’s painting *Execrable Human Traffick, or The Affectionate Slaves* (1789) is lost, but the Menil Collection in Houston, Texas, holds a copy (83-110DJ): <https://chnm.gmu.edu/revolution/d/228/>. For a 1791 print by John Raphael Smith after Morland’s painting, but retitled *The Slave Trade*, see <http://www.centerforbritishart.org/slavery-and-portraiture/284/the-slave-trade>.

⁵² A third iconographic theme in abolitionist art was triumphal beneficence; Marcus Wood, *The Horrible Gift of Freedom: Atlantic Slavery and the Representation of Emancipation* (Athens, Ga., 2010).

Expedition against the Revolted Negroes of Surinam (1795), which hardly needed their redundant captions: “A Negro Hung Alive by the Ribs to a Gallows,” “The Execution of Breaking on the Rack,” “A Female Negro Slave, with a Weight Chained to Her Ankle,” “Flagellation of a Female Samboe Slave.”⁵³ Abolitionist art emphasized outrageous violations of enslaved bodies.

For purposes of the present discussion, however, it is the *absence* of a potential visual subject for abolitionists, namely killing labor, specifically on sugar plantations, that is most striking: “By destabilizing the idea that slavery was natural and focusing on the treatment of slaves rather than on the plantation machine as a unit in need of improvement, antislavery and abolition activists helped to transform the ameliorative discussion into one concerned far more with people than with land and cattle. Humanitarian sensibilities were increasingly privileged after the 1780s as the principal justifications for amelioration, signaling the transformation of the ameliorative project.”⁵⁴ For the most part, abolitionists portrayed slaves independently of their labor; apologists of the slave regime readily portrayed plantation workers in relation to sugar technology, but without explicit acknowledgment of their enslavement. Abolitionists’ avoidance of the workings of slave plantations gave anti-abolitionists opportunities to portray the sugar-slave complex as socially and economically natural, after all. And they did.

Simultaneous with Parliament’s abolition of the transatlantic African slave trade, British artists in the Caribbean increased their representations of sugar plantations as landed estates, comparable to English manors with their varied terrain, understated work regime, and prosperous tenants and laborers, but different from them in their intensive technology. As studies for a book on “Costume of Jamaica,” William Berryman worked from 1808 to 1815 making watercolor sketches that for the first time visually recorded the everyday labors of enslaved Jamaicans: digging cane holes, forming field gangs to plant sugarcane, stripping cane, planting corn, and pounding cassava.⁵⁵ (See Figure 13.) William Clark’s 1823 *Ten Views in the Island of Antigua* illustrated sugar production with unprecedented close-up attention to work that slaves in the West Indies had been doing for almost two centuries.⁵⁶ Clark knew plantations firsthand; he had worked for planters as both an attorney and an overseer. His prints systematically explained the stages of sugar production by presenting scenes from specific plantations. Drivers recruited from the enslaved directly supervised work gangs, with whips as mere symbols of their authority. “Digging, or Rather Hoeing, the Cane-Holes” shows a driver directing the layout of squares, while a line of male and female workers use hoes to dig beds for planting corn as a ground-breaking crop; the cattle penned

⁵³ Wood, *Blind Memory*, figs. 2.17, 5.15, 5.16. On themes of torture in representations of slavery, see *ibid.*, chap. 5. On Blake’s engravings, see David Erdman, “Blake’s Vision of Slavery,” *Journal of the Warburg and Courtauld Institutes* 15, no. 3/4 (1952): 242–252. On the relation of abolitionist propaganda to “sadistic pornography,” see Wood, *Blind Memory*, 261; Marcus Wood, *Slavery, Empathy, and Pornography* (Oxford, 2002), chap. 2; Karen Halttunen, “Humanitarianism and the Pornography of Pain in Anglo-American Culture,” *American Historical Review* 100, no. 2 (April 1995): 303–334.

⁵⁴ Roberts, *Slavery and the Enlightenment in the British Atlantic*, quote from 52. See also Ryden, *West Indian Slavery and British Abolition*, chap. 7. Two encyclopedic works on the illustration of slavery and race lack focus on slave plantations: Wood, *Blind Memory*, and Honour, *Slaves and Liberators*.

⁵⁵ Berryman died shortly after his return to England, so he was unable to complete his project. For his draft title page, see <http://www.loc.gov/pictures/resource/cph.3g13407/?co=cph>. On Berryman, see Barringer, Forrester, and Martinez-Ruiz, *Art and Emancipation in Jamaica*, 52–54, 326–331.

⁵⁶ For reproductions of Clark’s prints, see *ibid.*, 318–321.



FIGURE 13: Everyday sugar work: drovers in the foreground, cane cutters in the background. William Berryman, *Sugar Estate—Negroes Cutting Cane*, watercolor (ca. 1808–1815). Courtesy of the Library of Congress, Prints and Photographs Division, DRWG 1–Berryman, no. 5.

nearby would provide manure subsequently. (See Figure 14.) “Planting the Sugar-Cane” features two drivers, one directing children to place cuttings in the holes, the other standing over a gang of men and women as they cover the plantings. Every scene shows workers well clothed in a variety of materials and styles. “Cutting the Sugar-Cane” shows a driver at the head of a long line of vigorous cutters attacking the face of the cane field, while behind them bundlers gather the cane and bring it to a wagon where a mounted overseer is speaking to a driver who has deferentially removed his hat. For the remainder of the processing, managers’ roles become more apparent in coordinating a highly efficient division of labor. In “The Mill-Yard,” a driver directs a crew of women to carry the cane from the wagon to the mill, and afterward to lay out the crushed cane (“trash”) to dry for fuel. In “The Boiling-House,” workers use long-handled scoops to skim the steaming vats and move the progressively concentrated syrup toward cooling pans, which Europeans in frock coats stir to crystallize the sugar. A nighttime view, “Exterior of the Boiling-House,” emphasizes how the mill and its laborers worked around the clock to keep the fires going. “Exterior of Curing-House and Stills” and “Interior of the Distillery” mark European managers’ intensified supervision of the plantation’s two final products, sugar and rum, as they gauged their degrees of refinement. The final scene, “Carting and Putting Sugar-Hogsheads on



FIGURE 14: The first visual study of gang labor in the production of sugar. William A. V. Clark, "Digging, or Rather Hoeing, the Cane-Holes," aquatint, from Clark, *Ten Views of the Island of Antigua: In Which Are Represented the Process of Sugar Making, and the Employment of the Negroes, in the Field, Boiling-House and Distillery* (London, 1823), fig. 2. Courtesy of the Yale Center for British Art, Rare Books and Manuscripts, Folio A 2010 10.

Board," brings the industrial narrative to a close, with a winsome, palm-shaded beach scene in which a manager is certifying a gigantic barrel of sugar before plantation hands roll it onto a skiff. Clark's prints reassured investors and plantation owners, and anyone else of an anti-abolitionist disposition, that the sugar regime was working well, despite the end of the transatlantic African slave trade.

Meanwhile, British landscape artists illustrated sugar plantations as manorial estates. In 1824 James Hakewill, whose previous work included *A Picturesque Tour of Italy*, published a series of aquatints, *A Picturesque Tour of the Island of Jamaica, from Drawings Made in the Years 1820 and 1821*, dedicated "To the Noblemen and Gentlemen, Proprietors of Estates in the West Indies; to the Resident Gentlemen . . . and to the Merchants of the United Kingdom, Connected with Those Valuable Colonies." Hakewill presented plantations as village-like manors, with their inhabitants angling beside streams and ambling along paths amidst barracks for "book-keepers and other white people attached to the estate," the "boiling-house" and "still-house," and the "change-of-air house." While "desirous of being understood as by no means advocating slavery in principle," Hakewill found abundant "evidence of the personal comfort of the negro population."⁵⁷ He reinforced his images

⁵⁷ James Hakewill, *A Picturesque Tour of the Island of Jamaica, from Drawings Made in the Years 1820 and 1821* (London, 1825), quotes from 3–5; for reproductions of Hakewill's prints, see Barringer, Forrester, and Martinez-Ruiz, *Art and Emancipation in Jamaica*, figs. 3.14–15, cat. 42–43, 70–75, 79.



FIGURE 15: Progressive agriculture: workers with hoes over their shoulders returning from a day's work, a pastoral landscape in the foreground, and an impressively engineered aqueduct supplying the mill's waterwheel. Sutherland after James Hakewill, "Trinity Estate, St. Mary's," aquatint, from Hakewill, *A Picturesque Tour of the Island of Jamaica, from Drawings Made in the Years 1820 and 1821* (London, 1824–1825). Courtesy of the Yale Center for British Art, Rare Books and Manuscripts, T 683.

of slaves' physical well-being by portraying them in the context of plantation technology, a token of economic progress. (See Figure 15.)

In explicit reaction to the threat of abolition, representations of sugar plantations in the British West Indies naturalized slavery by masking it with a picturesque aesthetic, albeit one that accommodated industrial technology.⁵⁸ This use of picturesque

⁵⁸ This strategy of social representation parallels contemporaneous landscape art in metropolitan Britain, where "the art of rural life was adapted over the century so that it became able to express ['a ruthlessly prudent management of their estates'] . . . and could satisfy the rich and the leisured in their capacity also as the large minded and benevolent patrons of England's agricultural, mercantile, and industrial progress"; John Barrell, *The Dark Side of the Landscape: The Rural Poor in English Painting, 1730–1840* (Cambridge, 1980), quotes from 11 and 12, emphasis added. See also Ann Bermingham, *Landscape and Ideology: The English Rustic Tradition, 1740–1860* (Berkeley, Calif., 1986); Christiana Payne, *Toil and Plenty: Images of the Agricultural Landscape in England, 1780–1890* (New Haven, Conn., 1993). Nineteenth-century representations of agricultural scenes often played progressive technology against archaic fieldwork; e.g., Tim Barringer, *Men at Work: Art and Labour in Victorian Britain* (New Haven, Conn., 2005), chap. 2. On nineteenth-century European artists' attention to the compatibility possible between picturesque landscapes and industrial technology (particularly the railroad), see Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (1964; repr., New York, 2000), 159–160, 220–221, 251, 271 n.; and T. J. Clark, *The Painting of Modern Life: Paris in the Art of*

landscape art to apologize for the plantation regime in the British West Indies continued into the period of apprenticeship (1834–1838). The most impressive series of Caribbean landscape prints, the fifty lithographs in Joseph Bartholomew Kidd's *West Indian Scenery: Illustrations of Jamaica* (1837–1840), appeared simultaneously with abolition. Kidd had painted estates in Trelawney Parish for two years, readily accommodating intensive plantation technology to picturesque views of estates and their "peasantry" by almost invariably placing sugar mills at the center of his compositions. Then he returned to London to give the West Indies the aesthetic publicity they deserved: "The object of this undertaking is to fill a vacant niche in the Gallery of Pictorial Works, and to give publicity to a series of views, illustrative of a West Indian Clime. The Annuals, Portfolios, Exhibitions, &c., abound in Illustrations of India, China, Canada, and, indeed, almost every other portion of the globe; but the superb and picturesque scenery of the West [Indies] is comparatively unknown in the land that peopled it."⁵⁹

Kidd was being aesthetically parochial. Brazil and Suriname had become the cynosures of "superb and picturesque scenery" in the Americas. As part of a cultural expedition comparable to Johan Maurits's, the Austrian painter Thomas Ender, with Prince Klemens Wenzel von Metternich's patronage, accompanied the archduchess Maria Leopoldina of Austria to Brazil in 1817 for her marriage to Dom Pedro of Bragança, who in 1822 would become independent Brazil's first emperor. Over the course of his one year there, Ender created nearly eight hundred drawings and watercolors of Brazil's urban and rural scenery and architecture.⁶⁰ Following Ender's lead, the Augsburg artist Johann Moritz Rugendas went to Brazil in 1821, where he joined a Russian scientific expedition, toured the country for four years, and then published *Voyage pittoresque dans le Brésil* (1827–1835).⁶¹ Its one hundred prints illustrate Brazil's extraordinary physical and human diversity: waterfalls, grottos, indigenous peoples' material culture and funerary customs, African Brazilian dancing and dress, European costumes in Rio de Janeiro and São Paulo, worksites in mining and ranching districts, diamond caravans, and scenes of planter families.⁶² Meanwhile, Jean-Baptiste Debret was preparing *Voyage pittoresque et historique au Brésil* (1834–1839), arguably the richest

Manet and His Followers, revised ed. (Princeton, N.J., 1999), 150–151, 158, 170–176, 186–190: "There is a rule to these paintings, and it might be stated roughly as follows: Industry can be recognized and represented, but not labour; the factories have to be kept still, as if that were the guarantee of their belonging to the landscape" (189).

⁵⁹ Joseph Bartholomew Kidd, *West Indian Scenery: Illustrations of Jamaica, in a Series of Views Comprising the Principal Towns, Public Buildings, Estates, and Most Picturesque Scenery of the Island* (London, 1837–1840), quote from prospectus. For Kidd's prints, see Barringer, Forrester, and Martínez-Ruiz, *Art and Emancipation in Jamaica*, fig. 3.17, cat. 95–103, 221–225, Kidd quote from 386. On Hakewill and Kidd, see Kriz, *Slavery, Sugar, and the Culture of Refinement*, chap. 5.

⁶⁰ Gloria Kaiser, "Thomas Ender and the Impact of Austria on Brazil," in Gloria Kaiser and Robert Wagner, *Thomas Ender: Brasilien-Expedition 1817: Aquarelle aus dem Kupferstichkabinett der Akademie der Bildenden Künste Wien* (Graz, 1994), 45–48.

⁶¹ Hugh Honour, *The New Golden Land: European Images of America from the Discoveries to the Present Time* (New York, 1975), figs. xxiv (Rugendas), 172–173 (Ender); Honour, *Slaves and Liberators*, 137–147. For reproductions of Ender's watercolors, see Robert Wagner and Júlio Bandeira, eds., *Viagem ao Brasil: Nas aquarelas de Thomas Ender, 1817–1818*, 3 vols. (Petrópolis, 2000). See also Silvia Hunold Lara, "Customs and Costumes: Carlos Julião and the Image of Black Slaves in Late Eighteenth-Century Brazil," *Slavery and Abolition* 23, no. 2 (2002): 123–146.

⁶² Pablo Diener and Maria de Fátima Gomes Costa, *A América de Rugendas: Obras e documentos* (São Paulo, 1999).

visualization of a European colony, with more than 150 lithographs.⁶³ Debret had arrived in 1816, to help establish an academy of arts in Rio de Janeiro, which had become the seat of the Portuguese Empire after Dom João VI fled Napoleon's invasion in 1807. While thriving as a court painter, Debret became fascinated with potential genre subjects in Brazil's streets and countryside, which he painted for fifteen years before returning to Paris to publish his *Voyage pittoresque*.⁶⁴ Both Rugendas and Debret forthrightly showed horrific conditions aboard slave ships and in slave markets, as well as scenes of excruciating public lashings, but overall they conveyed an acceptance of the slave regime, which was now synonymous with an entire society rather than primarily with sugar plantations.⁶⁵ Each of the three artists had only a single illustration of *engenhos* and their machinery: Ender added one as a tiny feature in a panoramic view of a valley; Rugendas portrayed a mill yard; and Debret showed a hand-operated mill for domestic production. (See Figure 16.)

HAD THE TECHNOLOGY OF SUGAR lost its compelling visual interest? No. As though delivered by Minerva's owl, the most impressive illustrations of the sugar-slave complex appeared at its end, in the form of Eduardo Laplante and Luis Marquier's twenty-eight lithographs in Justo Germán Cantero's *Los ingenios: Colección de vistas de los principales ingenios de azúcar de la isla de Cuba*.⁶⁶ They celebrated Cuba's rise to global dominance in the sugar industry: by the 1860s, Cuba supplied 40 percent of the world's cane sugar.⁶⁷ *Los ingenios* attributed this success to Cuban planters' adoption of industrial

⁶³ Jean-Baptiste Debret, *Voyage pittoresque et historique au Brésil, ou séjour d'un artiste français au Brésil, depuis 1816 jusqu'en 1831 inclusivement, époques de l'avènement et de l'abdication de S. M. D. Pedro Ier, fondateur de l'Empire brésilien*, 3 vols. (Paris, 1834–1839), http://www.brasiliana.usp.br/search?filtertype=*&filter=Voyage+pittoresque+et+historique+au+Br%C3%A9sil&submit_search-filter-controls_add=Buscar.

⁶⁴ Kirsten Schultz, *Tropical Versailles: Empire, Monarchy, and the Portuguese Royal Court in Rio de Janeiro, 1808–1821* (New York, 2001), 104. P. J. Benoit, *Voyage à Surinam: Description des possessions néerlandaises dans la Guyane* (Brussels, 1839), <http://nrs.harvard.edu/urn-3:FHCL:8156578>, with its one hundred lithographs of African Brazilians and colonists in a wide variety of activities and settings, bears comparison with Debret.

⁶⁵ Robert W. Slenes, "African Abrahams, Lucretias, and Men of Sorrows: Allegory and Allusion in the Brazilian Anti-Slavery Lithographs (1827–1835) of Johann Moritz Rugendas," *Slavery and Abolition* 23, no. 2 (2002): 147–168. In the first third of the nineteenth century, Brazil's sugar industry added mills and increased exports, but the proportion of enslaved people on sugar plantations became a minority in relation to the rest of the enslaved population, even in the sugar parishes, where half the enslaved people were owned in units of fewer than fifty; Stuart B. Schwartz, *Sugar Plantations in the Formation of Brazilian Society: Bahia, 1550–1835* (Cambridge, 1985), 422–434, tables 16–18.

⁶⁶ Justo G. Cantero, with illustrations by Eduardo Laplante and Luis Marquier, *Los ingenios: Colección de vistas de los principales ingenios de azúcar de la isla de Cuba*, ed. Luí Miguel García Mora and Antonio Santamaría García (facsimile of original 1857 edition with extensive notes, Madrid, 2005); Mora and García, "Introducción: Donde cristaliza la esperanza lectura de *Los ingenios*," *ibid.*, 15–82.

⁶⁷ On the Cuban sugar industry, see Franklin W. Knight, *Slave Society in Cuba during the Nineteenth Century* (Madison, Wis., 1970); Knight, "Origins of Wealth and the Sugar Revolution in Cuba, 1750–1850," *Hispanic American Historical Review* 57, no. 2 (1977): 231–253; Friginals, *The Sugarmill*; Luis Martínez-Fernández, "The Sweet and the Bitter: Cuban and Puerto Rican Responses to the Mid-Nineteenth-Century Sugar Challenge," *New West Indian Guide / Nieuwe West-Indische Gids* 67, no. 1/2 (1993): 47–67; Rebecca J. Scott, *Slave Emancipation in Cuba: The Transition to Free Labor, 1860–1899* (Princeton, N.J., 1985), chap. 1; Dale W. Tomich, "The Invention of the Cuban Sugarmill: Space, Time, and Labor Management, 1820–1860," in Maria Dolores González-Ripoll and Izaskun Álvarez Cuartero, eds., *Francisco Arago y la invención de la Cuba azucarera* (Salamanca, 2010), 133–149. On the relation of technological innovation and slavery more broadly, see Peter Boomgaard and Gert J. Oostindie,

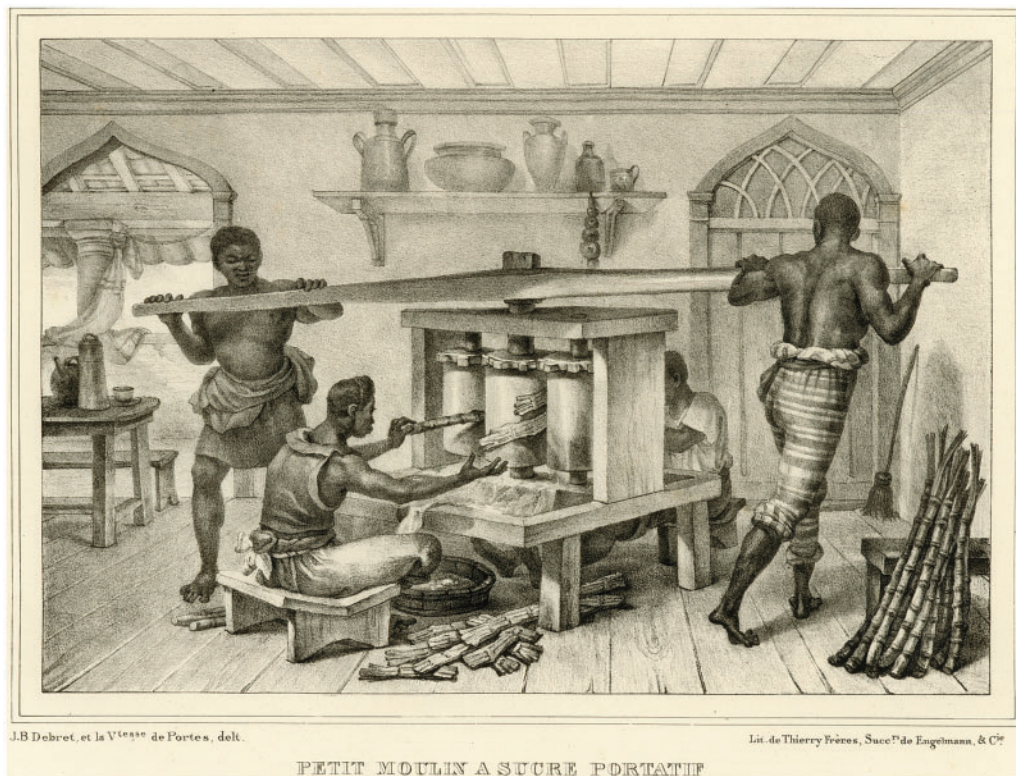


FIGURE 16: Sugar work became one of many occupations in Brazil. Thierry Frères after Jean-Baptiste Debret and la Vitesse de Portes, “Petit moulin à sucre portatif,” lithograph, from Debret, *Voyage pittoresque et historique au Brésil, ou séjour d'un artiste français au Brésil, depuis 1816 jusqu'en 1831 inclusivement, époques de l'avènement et de l'abdication de S. M. D. Pedro 1^{er} Fondateur de l'empire Brésilien*, 3 vols. (Paris, 1834–1839), 2: fig. 27, following 86. Courtesy of the John Carter Brown Library at Brown University, Archive of Early American Images, 07385-78.

technology; the book begins with a scene of Havana featuring a steam-driven crane and ends with a railroad engine crossing in front of a vast plantation complex, with a factory and its three smokestacks on one side and an immense quadrangle of workers' housing on the other.⁶⁸ (See Figure 17.)

“Changing Sugar Technology and the Labour Nexus: The Caribbean, 1750–1900,” *New West Indian Guide / Nieuwe West-Indische Gids* 63, no. 1/2 (1989): 3–22; and Richard B. Sheridan, “Changing Sugar Technology and the Labour Nexus in the British Caribbean, 1750–1900, with Special Reference to Barbados and Jamaica,” *ibid.*, 59–93; Salcedo, *De los bueyes al vapor*, 115–122; Friginals, *The Sugarmill*, chap. 4; Galloway, *The Sugar Cane Industry*, 134–141. For contemporary technical treatises on sugar production, see W. J. Evans, *The Sugar-Planter's Manual: Being a Treatise on the Art of Obtaining Sugar from the Sugar-Cane* (London, 1847); Charles Jay, *Observations on the Manufacture of Sugar, Sugar-Making Machinery, Central Works, and Government Restrictions, with Suggestions for the Improvement of Manufacturing Processes* (London, 1847); John A. Leon, *On Sugar Cultivation in Louisiana, Cuba, &c., and the British Possessions, by an European and Colonial Sugar Manufacturer* (London, 1848).

⁶⁸ Laplante may have had illustrations of the London 1851 Great Exhibition in mind when he designed *Los ingenios*. On the Great Exhibition and its visual fetishism of technology, see Joseph Nash, Louis Haghe, David Roberts, John Waldie, and Dickinson Brothers, *Dickinson's Comprehensive Pictures of the Great Exhibition of 1851: From the Originals Painted for His Royal Highness Prince Albert* (London, 1852); Jeffrey A. Auerbach, *The Great Exhibition of 1851: A Nation on Display* (New Haven, Conn., 1999), especially 104–108; Hermione Hobhouse, *The Crystal Palace and the Great Exhibition: Art, Science*



FIGURE 17: Railroads opened Cuba's interior plains to sugar production, and in this print signified the compatibility of plantation slavery and industrialization. Luis Marquier after Eduardo Laplante, "Ingenio Ácana Propiedad del Señor D. José Eusebio Alfonso," lithograph, from Justo G. Cantero, *Los ingenios: Colección de vistas de los principales ingenios de azúcar de la Isla de Cuba* (Havana, 1857), fig. 28. Courtesy of the Library of Congress, TP378.C22 Folio.

Cuba led the world in the application of modern technology to the production of cane sugar.⁶⁹ Thanks to the six hundred kilometers of railways that had been built by 1860, the industry expanded from Havana's hinterlands to the rest of the island. Meanwhile, horizontal presses powered by steam engines replaced traditional three-roller mills driven by the natural forces of water, wind, and animals. By 1860, 70 percent (about 950) of Cuba's sugar mills used steam power, compared with only thirty of Barbados's five hundred plantations and even fewer in Brazil. (Recently developed Puerto Rico was the technological runner-up: in 1867 it had 161 steam mills and 239 animal-powered mills.)⁷⁰ Horizontal mills could take more power from a steam engine than was possible with the traditional wind- or water-driven vertical three-roller mills. They required only parallel gearing, and they could be set up in series to maximize extraction. Cuban manufacturers also borrowed more efficient processing technology from the nascent European sugar-beet industry. Vacuum pans lowered the

and Productive Industry—*A History of the Royal Commission for the Exhibition of 1851* (London, 2002); Barringer, *Men at Work*, 9–12.

⁶⁹ On the application of science to Cuban sugar production, see María M. Portuondo, "Plantation Factories: Science and Technology in Late-Eighteenth-Century Cuba," *Technology and Culture* 44, no. 2 (2003): 231–257.

⁷⁰ Salcedo, *De los bueyes al vapor*, table 15.4.



FIGURE 18: The raw and the cooked: a sharp divide separated the mill with its oxen and cane debris from the spotless interior for processing. Luis Marquier after Eduardo Laplante, “Ingenio Flor de Cuba (Casa de Calderas) Propiedad de los Señores Arrieta,” lithograph, from Justo G. Cantero, *Los ingenios: Colección de vistas de los principales ingenios de azúcar de la Isla de Cuba* (Havana, 1857), fig. 22. Courtesy of the Library of Congress, TP378.C22 Folio.

boiling point of the syrup and hence increased its rate of evaporation, while requiring less energy and thereby economizing on fuel. Centrifuges replaced clay drainage pots for separating crystalline sugar from molasses, doing in hours what previously had taken weeks. (See Figure 18.) But *Los ingenios* skewed economic realities toward a technological triumphalism: nearly 80 percent of Cuba’s sugar was produced by the nine hundred or so mills that used steam engines but lacked advanced processing equipment such as vacuum pans and centrifuges. Factories of the type shown in *Los ingenios*, with their cutting-edge technology in iconic factory settings, numbered only sixty or so and produced only 15 percent of the island’s sugar.⁷¹

Cuba’s rise to predominance in sugar manufacturing depended critically on *non*-technological factors. The Haitian Revolution provided new markets for Cuba’s investors and planters by destroying Saint-Domingue’s world-leading sugar industry. The second critical factor was Cuba’s underdevelopment: it had extensive cultivable lands to grow sugarcane and large stands of forests to fuel processing. And Cuba had slavery. On the advice of the planter-economist Francisco de Arango y Parreño in a 1792 memo to King Charles IV on agricultural reform, Spain allowed foreigners into the island’s slave trade, lowered duties on slaves, and abolished them on machinery. In 1818 it opened Cuba to free trade. With much of its capital and machinery coming from Britain, Spain agreed in 1817 to a treaty banning the transatlantic African slave trade.

⁷¹ Frangials, *The Sugarmill*, 84, table 3.

It was a dead letter; 400,000 enslaved Africans would be brought to Cuba over the next half-century.⁷² The scale of Cuba's dependence on this slave trade was a grim measure of the growth of its sugar industry. In 1860, two-thirds of the island's population was free (roughly half creole European and one-sixth African Cuban); 300,000 enslaved Africans and their descendants made up the remaining third, and half of them lived on sugar plantations. In defiance of its putative abolition, the transatlantic African slave trade critically maintained this plantation labor force, which otherwise would have diminished owing to an excess of deaths over births among the enslaved workers.⁷³ Cuban slave imports in the five years before the publication of *Los ingenios* totaled 46,000 people, and in the next five years they would exceed 100,000.⁷⁴

The "capitalistic, export-oriented sugar plantations" portrayed in *Los ingenios* have been likened to "prisons," and not just metaphorically. The "*barracón*, a prison-like barracks . . . segregating males and females" (and African Cubans from Chinese indentured laborers), was a proud fixture in *Los ingenios*'s images of industrialized estates: the spacious design of their living, sanitary, and central kitchen facilities marked a supersession of retrograde *bohíos* (huts).⁷⁵ Marginal scenes of workers in Laplante's prints—heading to fields with hoes, cutting cane, delivering cane to mills with oxcarts, feeding cane to mills' rollers, fueling furnaces with *bagasse* (dried sugar-cane refuse), tending factories' vats, and packing sugar in barrels, not to mention the ubiquitous prison-like *barracóns*—reminded viewers, however subliminally, that the production of Cuban sugar depended on hundreds of thousands of forced laborers in the fields as well as in the factories (with enslaved Africans now augmented by Chinese indentured laborers). But the central feature of nearly every print was either machinery or a smokestack.⁷⁶

Yet in retrospect *Los ingenios* marked the apogee of the sugar-slavery nexus, not its promising future. Spain would end the slave trade in its colonies in 1866; Cuba's

⁷² Galloway, *The Sugar Cane Industry*, 163–165; Knight, *Slave Society in Cuba during the Nineteenth Century*, chap. 1. About 5 percent of enslaved Africans en route to Cuba were intercepted by British anti-slaving cruisers; *ibid.*, 53, table 5.

⁷³ Here demographic history diverges from economic and social history, not to say human experience. Jack Ericson Eblen derived "intrinsic" and "natural" rates of increase among enslaved Cubans by constructing "a closed population with a stable age structure," i.e., by eliminating imported slaves from its population at risk; Eblen, "On the Natural Increase of Slave Populations: The Example of the Cuban Slave Population, 1775–1900," in Stanley L. Engerman and Eugene D. Genovese, eds., *Race and Slavery in the Western Hemisphere: Quantitative Studies* (Princeton, N.J., 1975), 211–247, quotes from 214, 218, 245.

⁷⁴ Official Spanish censuses recorded Cuba's enslaved population as 323,759 in 1846 and 368,550 in 1862; British commissioners in Havana estimated that 203,650 enslaved people were imported into Cuba in the meantime (1843–1862); Scott, *Slave Emancipation in Cuba*, 7, 10, 12, 87, tables 1–3, 10.

⁷⁵ *Ibid.*, quotes from 14 and 17; Evelyn Hu-Dehart, "Chinese Coolie Labour in Cuba in the Nineteenth Century: Free Labour or Neo-Slavery?," *Slavery and Abolition* 14, no. 1 (1993): 67–86. A typical description of a *barracón*: "Una de las construcciones que más nos han llamado la atención es el hermoso barracón, todo de mampostería y de capacidad suficiente para 300 negros, rodeado de colgadizos interiormente, con la cocina en el centro, además del lavadero y las necesarias dependencias. No sólo está bien edificado, sino que producen muy buen efecto las columnitas que lo circundan coronadas de graciosas almenas. Las dimensiones son de 100 varas [a vara = roughly a meter] a cada viento. En uno de sus extremos está situada la enfermería atendida con grande esmero y en la cual reciben los pobres pacientes la asistencia que su estado reclama"; "Ingenio San Rafael," in Cantero, *Los ingenios*, 266–270, quote from 268. Immediately preceding the print with the railroad engine (fig. 17) was a contrasting view of old-fashioned technology—a crowded scene of oxcarts delivering cane.

⁷⁶ Even the series' two panoramic landscapes, "Ingenio Buena-Vista" (belonging to Cantero) and "Valle de la Magdalena," center on smokestacks.

Ten Years' War (1868–1878) would arouse abolitionist and racist strategies on both sides; Cuban slavery would be abolished in 1886; and industrial sugar production would concentrate in central factories, whose waged workers no longer lived on-site, as on plantations.

FROM START TO FINISH, technology trumped humanity in visual representations of sugar plantations.⁷⁷ This privileging arose initially with graphic illustrations of the modern era as a time of technological progress over the ancients. As sugar production intensified with colonial plantations, specialized technology developed—vertical three-roller mills and trains of evaporative vats—and the sugar mill became a synecdoche of the most highly integrated and expansive industry in the early modern world. Sugar enjoyed elasticity in consumer demand: people always wanted more. Since sugar consumption increased faster than prices fell, there were always sugar frontiers to expand production. Throughout the early modern era, sugar production increased in conjunction with the transatlantic African slave trade. At least 60 percent of the nearly 13 million people caught up in that trade were destined for sugar plantations. Yet most illustrations of sugar technology minimized its crucial conjunction with slave labor; only the Dutch occupation of Brazil resulted in a visual appreciation that the sugar/slave plantation was at the heart of colonial American society and of the Atlantic economy.

As a humanitarian abolitionist movement mobilized in late-eighteenth-century Britain, it produced visual images that emphasized the abuse of slaves individually, while artistic clients of anti-abolitionist patrons responded with picturesque landscapes and genre scenes showing slave plantations as tranquil manorial communities with impressive technological endowments. And in defiance of abolitionism elsewhere, mid-nineteenth-century Cuba's sugar planters visually advertised their global economic predominance with hyper-technological images of factories requiring only minuscule inputs of enslaved labor. They titled their advertisement *Los ingenios*. This visual privileging of sugar technology manifested how easily Europeans could be distracted from concerns about the millions of enslaved people in their colonies. Apparently, most Europeans associated the production of sugar with the unquestioned good of economic development, despite its inextricable dependence on enslaved labor.

⁷⁷ This tendency is not unknown in modern historiography: the most comprehensive technological history of Caribbean sugar production, both chronologically and geographically, has little to say about enslaved and unfree workforces; Salcedo, *De los bueyes al vapor*, 311–315.

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