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Béatrice Laurent

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Victorian Designs of Industrial Desire

Dess(e)ins industriels à l'époque victorienne

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Victorian Designs of Industrial Desire

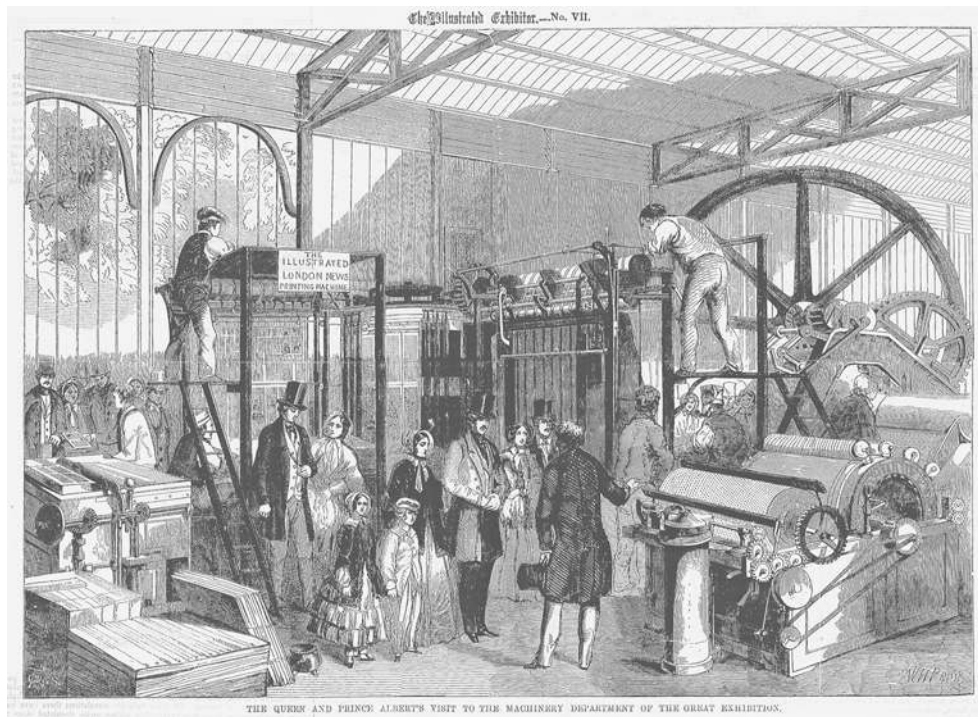
Dess(e)ins industriels à l'époque victorienne

Béatrice Laurent

- 1 'Pride, admiration, awe, even a strong sense of beauty in the locomotive, the automatic spinning machine, the steam-hammer, informed the Victorian imagination' (Sussman 2000, 197). Herbert Sussman is right: when we read of visitors at the Great Exhibition of 1851 'watching intently the operations of the moving mechanism' of the press, or 'with their mouths wide agape, leaning over the bars to see the self-acting mills at work' (Mayhew & Cruikshank 161), we need to remember that the factory system of production solicited both curiosity and admiration because, at that time, it was far from universal. As Elaine Freedgood reminds us, 'many modes of production were still in active coexistence in the mid-nineteenth century', a fact that has been obscured by 'thousands of pages of industrial writing [which] helped to write into existence a "system" that was still taking shape' (3). Many visitors at the Great Exhibition, from Her Majesty the Queen to those who attended the 'penny days', had never seen a real machine and were understandably eager to see one, preferably in motion. The machinery courts at the Great Exhibition drew the largest crowds of people and Queen Victoria herself visited these more times than any other section of the Exhibition. On June 7, 1851, she wrote in her journal: 'Went to the machinery part where we remained two hours, and which is excessively interesting and instructive, and fills one with admiration for the greatness of man's mind, which can devise & carry out such wonderful inventions, contributing to the welfare & comfort of the whole world' (31: 283). Four days later, after another visit to the machinery section, she noted: 'We came home shortly before 12, and I felt quite done and exhausted, mentally exhausted' (31:291).
- 2 One of the beautiful machineries that so exhausted the royal brains was a printing machine of a new type, a press 'on the vertical principle, by which numbers of sheets are printed, dried and everything done in a second' (31: 291). As noted by Paul Fyfe, that was the Applegath printing press: images were drawn and printed to commemorate the encounter between the monarch and the machine. Points of view however differ in these

visual recordings, and choose to illustrate either the exhibit, or the encounter. While the *Illustrated London News* issue of 31 May 1851² shows the printing press as if it were the unique object of the exhibit, the *Illustrated Exhibitor* of July 1851 boasts of the Royal visit, and presents the press among various other machines, and with a lot more emphasis on the background (fig. 1).

Fig. 1. Engraving



The Illustrated Exhibitor published in July 1851

- 3 The royal visit, it seems, eclipsed the machine, a fact clearly indicated in the title of the illustration, *The Queen and Prince Albert's Visit to the Machinery Department of the Great Exhibition*. By contrast, the *Illustrated London News's* title is simply *Patent Vertical Printing Machine, in the Great Exhibition - Class C. No. 122* and its focus is on the machine and on those who operate it: five³ anonymous and similarly dressed men, judiciously placed to form a symmetrical composition around the central hatless figure of the engineer, who is explaining the processes to a visitor donning a top hat—a patron of the mechanical arts. Three social classes, represented by their attires as high, middle and working classes, or as the purse, brains and hands are shown banding together for the greatest advantage of Britain, perhaps, indeed, of the whole world. This *Illustrated London News* illustration provided its public with what it wanted to see: it illustrated the harmonious cooperation of man and machine. It made visible social harmony as the making of the mechanical device which gave each worker a task appropriate to his inclination and skills. In short, it presented what Louise Purbrick has described as 'an ideal industrial world' (2001, 2).
- 4 The Great Exhibition was compared to a 'great Open Book' (Briggs 61), and I would like to suggest that its paradigm is precisely to be sought in the printing practices of the Victorians. The Exhibition was a huge illustrated book of the most fascinating type. It was as exciting as the increasingly popular pop-up book which was stepping down from its anatomical and scientific niche to reach adult and children readers of fiction—because it

offered a third dimension, and most of the time animation, to still images that were already implanted in the collective imagination. These pre-existing two-dimensional pictures of machines had multiplied in the decades between 1820 and 1850, a fact lamented by the author of 'The New Art of Printing' in *Blackwood's Magazine* of January 1844, who wrote that 'the pictorial printing-press is now your only wear! Everything is communicated by delineation. We are not *told*, but *shown* how the world is wagging' (47). The 'Designing Devil', as the author styled himself, erroneously foresaw the extinction of the writing profession, but he correctly assessed the overwhelming persuasiveness of the visual experience which triumphed in 1851. The success of the Great Exhibition, I suggest, was due not only to the beauty and novelty of the objects exhibited, but also to the disclosing of the secret processes by which these commodities had been manufactured, a revelation made possible because the Great Book contained machines that were already familiar to the public imagination. There, the public could see materialized before their very eyes pictures that had hitherto existed in books and in their minds only. The experience of a physical encounter with objects remote from everyday circumstances resulted from a paradigm shift that affected British culture in the early decades of the nineteenth century and implied new ways of engaging with the world. The move from a distanced to a close look, and from a domineering vantage point to a level one with the object studied yielded a more active participation of the viewer. Curiosity about the natural and man-made objects spread rapidly in the decades 1820s-1850s, as did the yearning to comprehend the invisible mechanisms that had brought even the most humble of articles into existence. These intellectual dispositions implied a demanding effort of abstraction but were well redeemed by a new form of intelligence that more surely saw connections between parts and the whole than had hitherto been available to common people. The move from general views to detailed pictures was answered partly in a genre of industrial literature that had flourished since the 1820s, offering precise descriptions of a factory, and the explanation of every tool, machine and activity.

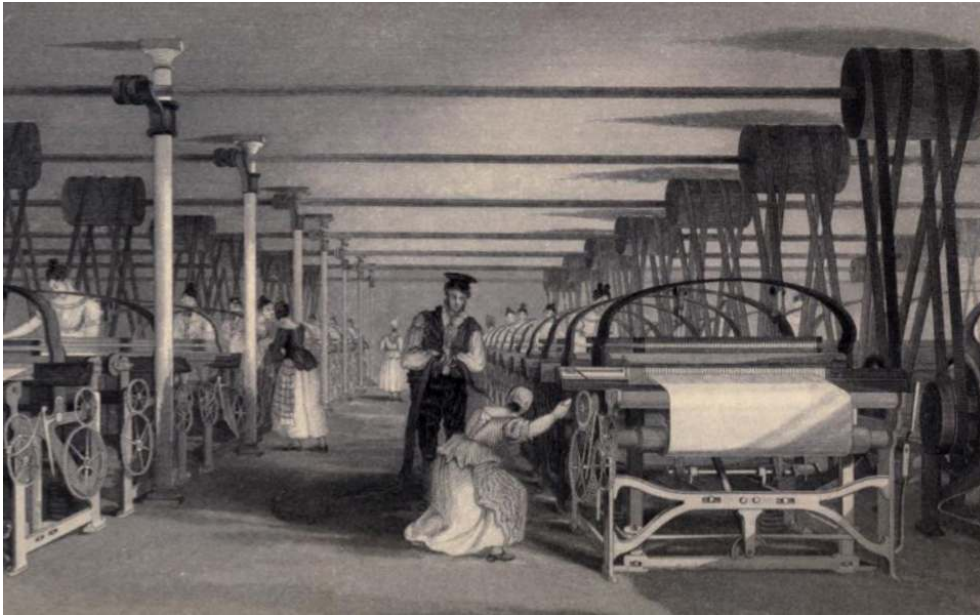
- 5 The literary genre that paved the way to success for the machinery courts may be called the 'factory-tour-logue', consisting most of the time of illustrated articles which took the form of 'visits' conveying 'information to those who, although not engaged in these manufactures, would like to know by whom, and from whence, and in what manner, the familiarly known commodities of life are produced' (Dodd 15). The tone was didactic and sustained a moralistic narrative delivering a tale of evolution through the division of labour afforded by the machine. The success of 'factory-tour-logues' was concomitant with, and probably fuelled by, progress in technical drawing. Periodicals such as *The Mechanics' Magazine* (founded 1823), *The Mechanic's Weekly Journal; or, Artisan's Miscellany of Inventions, Experiments, Projects, and Improvements in the Useful Arts* (1824), *The Mechanics' Chronicle* (1824), *The Mechanic's Oracle and Artizan's complete Laboratory and Workshop* (1824), *The Glasgow Mechanics Magazine* (1824), *The Mechanic's Gallery of Science and Art* (1825), *The Scots Mechanics' Magazine* (1825), *The London Mechanics' Magazine* (1829), notwithstanding many other very short-lived journals, testify to a veritable boom in mechanical literacy in the 1820s. 'Factory-tour-logues' prove that 'technology had become so popular a subject' that journalists such as George Dodd (1808–1881) or newspaper editors such as Sir Edward Baines (1800–1890) 'could describe their factory tours and observations on industrial processes with as much alacrity as they had once reported voyages to distant lands', and indeed, 'even highly technical accounts of the steam engine acquired an avid readership' (Berg 180). Sir Edward Baines's *History of the Cotton Manufacture* (1835), George Dodd's series for the *Penny Magazine* (assembled and republished in book form as *Days at*

the Factories: Or, the Manufacturing Industry of Great Britain (1843)) were so successful as to invite a host of successors, including Harriet Martineau's series of articles for *Household Words* on manufacturing processes, which had been designed, 'for ultimate republication' (Martineau 2: 68). In her article 'What there is in a Button' (*Household Words*, 1852), Martineau (1802–1876) followed the example of other factory-tour-logue writers and spared no step of the manufacture, praising the perfection and regularity of the mechanical device. Indeed, the machine seemed to have a moral lesson to deliver to mankind: 'There is surely something charming in seeing the smallest thing done so thoroughly, as if to remind the careless, that whatever is worth doing at all, is worth doing well' (Freedgood 44). Essayists who had a moral bent—as George Dodd, Harriet Martineau, Robert Scott Burn and Charles Babbage (1791–1871) undoubtedly had—exalted the virtues of modern technology: regularity, exactness, thrift. In their prose, these authors turned machines into paragons of efficiency, Babbage regarding the machine 'as a great corrective of the indiscipline of labour: it could function as a check against the inattention, idleness, and dishonesty of human labour' (Berg 186). In short machines were exemplary workers which should be imitated, or at least served with respect.

A New Genre Scene: The Factory Interior

- 6 This ideal industrial world was illustrated in the Factory interior, a new kind of genre scene—a type of picture representing scenes or events from everyday life, particularly fashionable in Britain in the nineteenth century. The Factory sub-genre depicted idealized, peopled scenes of work being carried out with machines, and included anecdotal interaction between the various characters represented: workers, overseers, visitors. The two illustrations of the Applegath printing machine commented at the beginning of this paper belong to this sub-genre. *The Illustrated Exhibitor*, for instance, contrasted Victoria and Albert's absorbed countenance, and the children's dutiful attention to the explanation delivered by the man in the foreground seen from the back, with the less patient attitude of the young couple behind them, he checking his pocket watch, she anxiously pleading to stay a while longer. In the *Illustrated London News*, the distinguished visitor is being instructed by the engineer while crowds squeeze against the banister in the background. One of the great masters of the Factory interior sub-genre was Thomas Allom (1804–1872), an architect and topographical illustrator, a founding member of the Royal Institute of British Architects, sadly neglected by posterity. In *Powerloom Weaving* (fig. 2), an engraving Allom made after his own drawing, linear perspective creates the illusion of depth thanks to the symmetrical rows of vertical objects: pillars on the left and drive belts on the right, which seem to recede in the distance.

Fig. 2. « Powerloom weaving »



Illust. T. Allom, pl. 13, p. 239 in Edward Baines, *The History of the Cotton Manufacture in Great Britain*, 1835

- 7 The composition of the picture is simply and powerfully organized along the two diagonals which intersect on the figure of the overseer. Despite his central position, the only male character in the picture is not a towering figure of authority, but a benevolent workmate coming to assist the girl who seems to be having a problem with a shuttle. On either part of this central group, rows of heads topped with buns are dutifully bending toward their looms. To alleviate the strict composition and the presumably equally strict working conditions, the artist introduced movement: the girl in the foreground is crouching down; a visitor in a checked apron is leaning from the central passage to have a word with one of the factory girls; in the distance a worker is seen from the back, leisurely walking back to her loom. The machines, though solid, are not infallible, and provide gentle occupation to a large anonymous sisterhood. The anecdotal situations of human interaction included in the picture locate it in the genre tradition of Factory interiors described above.
- 8 More important perhaps than words in ‘factory-tour-logues’ were the illustrations that accompanied the descriptions and made them an enjoyable and accessible reading. These pictures filled pages of the popular as well as the more specialized press from the 1820s onwards, so that even if visitors of the Great Exhibition ‘had never been inside a textile mill, they had almost surely seen pictures of the stationary engine and spinning machinery’ (Sussman 1968, 17). From the Romantic depiction of the forge⁴ by Joseph Wright of Derby (1734–1797) to the heroic *Iron and Coal*⁵ by William Bell Scott (1811–1890), the Industrial Revolution was often idealized and factory interiors turned into genre scenes. Illustrators of books dealing with the topic of manufactures played a crucial role in providing visualities that could make the factory system understandable, and eventually acceptable, even to an initially hostile public, such as those who had supported the Luddites between 1811 and 1816. Unfortunately, the names of these illustrators have largely been forgotten. The portrait painter and engraver Wilson Lowry (1762–1824)

made a specialty of engraving architectural and mechanical topics which found their ways in the *Philosophical Magazine*, the *Journal of the Society of Arts*, and the *Encyclopaedia Metropolitana*, George Walker (1781–1856) was a book author and illustrator with an interest in natural history. One of his illustrations in *Costume of Yorkshire* (1814) is thought to contain the first ever painting of a locomotive. John Farey Jr. (1791–1851) was a mechanical engineer and patent agent of great reputation, as well as an inventor in his own right. He was considered an expert in mechanics and was referred to for parliamentary enquiries. He contributed both texts and drawings to periodicals and encyclopaedias. Wilson Lowry's son, the engraver Joseph Wilson Lowry (1803–1879) helped significantly to the visual appeal and the understanding of machines through his illustrations for John Weale's 'Rudimentary Series', especially his *Rudimentary Dictionary of Terms used in Architecture, Building and Engineering* (1849–50), a work that was so popular that it reached a fifth edition in 1876. Both Thomas Allom and J. W. Lowry provided plates for the richly illustrated *History of the Cotton Manufacture* by Sir Edward Baines (1834).

- 9 When the focus was on the interaction between man and the machine, the reference was art, and the result the Factory interior. Yet, for all they contributed to make the factory system acceptable, and in many ways admirable, these documents did not help to understand mechanical operations. This task required a type of machine illustrators who looked at machines as machines, not as accessories in a genre scene.

Machine Illustrations

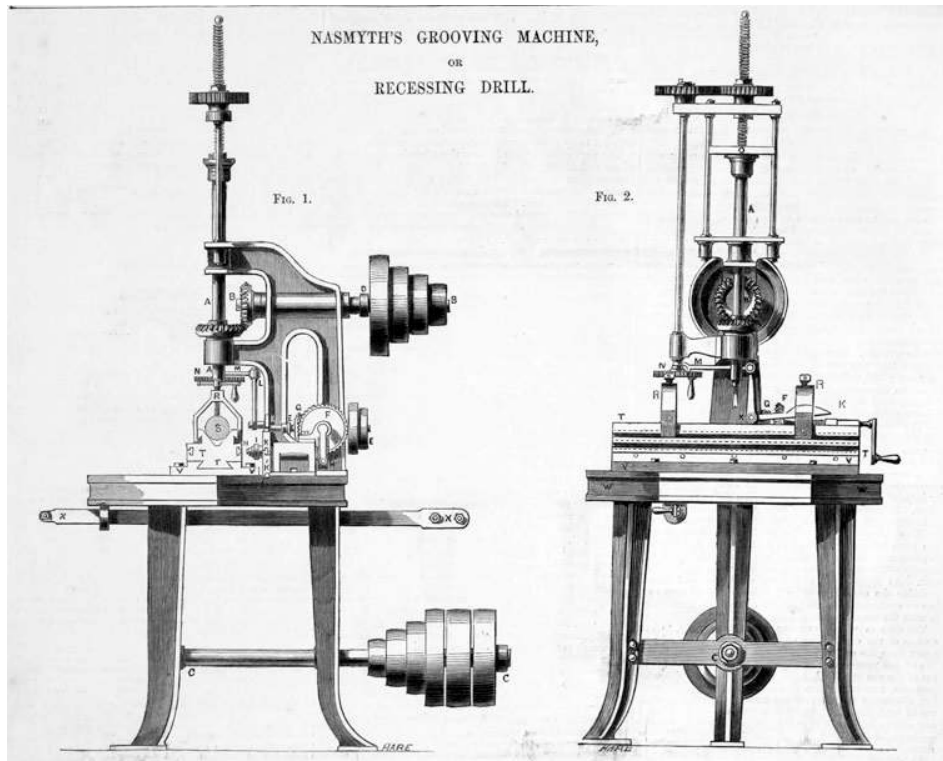
- 10 'The demand for knowledge of the new technology was so great in the century as to call into being the new profession of machine illustrator' (Sussman 1968, 17). Indeed, books and periodicals required visual material and this job opportunity boosted the specialization of would-be artists, if it did not provoke the sudden birth of a new profession, as Sussman suggested with maybe a hint of overenthusiasm. Little training was available to machine illustrators in Britain, because this specialty was considered as the lowest form of art. Art and mechanics were usually considered as distinct pursuits. The traditional profession that required a training of both practical mind and artistic eye was architecture, which explains why Thomas Allom was so much in demand. The new profession was engineering. Yet, in the early part of the nineteenth century most engineering drawings were produced by engineers or skilled mechanics with little if any instruction in drawing.
- 11 The activity of drawing machines is as ancient as machines themselves, and history has many examples—the most illustrious being Leonardo—of engineers, architects, or inventors with sufficient artistic skill to represent their inventions. In the early decades of the nineteenth century the works of inventor, engineer, and draftsman were most of the time carried out by the same person, a polymath in the image of James Watt, whose interests embraced science, mechanics and art, a fact that explains why machine illustration as a sub-branch of art was unheard of before the Victorian age. As the progressive specialization and professionalization of these various fields of interest took place, the polymaths grew fewer in number. Yet, James Nasmyth (1808–1890) was one of them: an engineer, artist and inventor all at once, he was also arguably the greatest contributor to visual technical literacy in Victorian Britain.
- 12 In the preface to Nasmyth's *Autobiography*, Samuel Smiles, the moralist who edited the *Lives of Engineers* series in 1862 pointed out that, according to Nasmyth, 'Drawing is the

Education of the Eye. It is more interesting than words. It is graphic language' (vii). Nasmyth, the son of a landscape and portrait artist, was highly aware of the importance of correct drawing, and consequently urged the teaching of drawing in all public schools. The *Autobiography* is illustrated by Nasmyth himself, and the quality of these illustrations led Smiles to consider that 'had he not devoted his business life to Mechanics, he [Nasmyth] would, like his father . . . have taken a high position as an artist' (vii). Nasmyth was equally at ease with mechanics and drawing. This made him one of the few highly-rated mechanical draftsmen. 'Without the alphabet of mechanical drawing', he wrote, 'the workman is merely "a hand". With it he indicates the possession of "a head"' (125). The translation of material things into concepts through the use of graphic alphabet was initiated at the Great Exhibition. This fact was acknowledged by one of the Exhibition's masterminds, the Reverend William Whewell (1794–1866), who confidently announced that the 'permanent and generally accepted classification' of the myriad things displayed at the Crystal Palace, would serve as a 'common language [between] the manufacturer, the man of science, the artisan, [and] the merchant' (Whewell 25). Yet, Whewell belonged to a generation born in the eighteenth century who had a bird's eye view of the world and sought to classify its elements according to the method devised by Linnaeus for natural things and beings. The process sanitized the specimen and converted it into an abstract thing with a Latin name, to which specifications and illustrations were appended, that removed it from its earthly context. Similarly, machine illustrators removed their subjects from their factory surrounding, sanitized and then described the operations with a view to making them artistic and, according to the prevailing aesthetics of the day, sublime.

- 13 Referring to his first visit in 1829 to the father of machine-tool technology, Henry Maudslay (1771–1831), Nasmyth remembered: 'I was most desirous of exhibiting the ability which I possessed in mechanical draughtsmanship, as I knew it to be a somewhat rare and much-valued acquirement' (125). Maudslay must have been totally conquered by the unusual skills of the young Nasmyth and set him to make a perspective drawing of engines he had invented. 'In due time I completed a graphic portrait of these noble engines, treated, I hope, in an artistic spirit. Indeed, such a class of drawing could not give a proper idea, as a whole, of so grand a piece of mechanism. It required something of the artistic spirit to fairly represent it' (174). This representation—a Factory interior in the genre tradition—was made artistic by the application of perspective and the addition of figures. It represented an ideal view of what the eye was supposed to see on a visit to the factory, but it was not graphic, in the sense that the mechanisms of the machines remained invisible. Other drawings depicting Nasmyth's inventions, such as his grooving machine, or recessing drill (1856), are machine illustrations proper. This double illustration (figure 3) in two figures, representing the side section and front view of the same machine, oscillates between the imperatives of realism (some shading on the legs explains the projection of the table), and the codes of industrial drawing (the cross-view and numbered captions). Nasmyth, who may well be the draughtsman as well as the inventor of the grooving machine, possessed both artistic and graphic fluency. In a 'Scheme book' which he carried with him at all times, he used his graphic alphabet to jot down his ideas in pictorial form, he 'generally thought out, with the aid of pen and pencil, such mechanical adaptations as [he] had conceived in [his] mind, and was thereby enabled to render them visible' (240). It is in this 'Scheme book' that, says Nasmyth, 'I rapidly sketched my steam hammer, having it all clearly before me in my mind's

eye' (240). This was a phenomenal success and steam hammers were hammering throughout the world according to Nasmyth's design up until the end of the century.

Fig. 3. Nasmyth's Grooving Machine, or Recessing Drill, 1856



The Engineer, May 23, 1856, 280

Technical Drawing

- 14 Nasmyth, the self-proclaimed inventor of the graphic alphabet by means of which he translated images 'in his mind's eye' onto paper in a language that was intelligible worldwide, was so intent to show that his mechanic and artistic skills were a rare combination that he admitted to having met only two like-minded men in his life. One was a Frenchman, the other was dead. Nasmyth made no mention of the Brunels, father and son, whom he must have met, and for whom he designed the steam hammer. Maybe he could not bear the comparison with the 'nineteenth century engineering giant' Isambard Kingdom Brunel (1806–1859) who, beside his accomplishments as an architect and civil engineer, was also an art collector, considered by the painter John Callcott Horsley RA to have 'a remarkably accurate eye for proportion, as well as a taste for form' (Brunel 507). Isambard Kingdom Brunel, had the good fortune to be taught by his French father, the engineer and pioneer of mechanical production Marc Brunel, who had studied at Rouen under Gaspard Monge (1746–1818), the inventor of mechanical drawing. Marc Brunel also expressed his ideas by the means of drawing, considering drawing techniques to be the true 'alphabet of the engineer' (Beamish 321). With his father, Brunel learnt to understand how perspective had yielded the concepts of plan, elevation and section which were integral parts of architectural rendering since the Renaissance.

- 15 Nasmyth also omitted to mention other predecessors. The emergence of industrial drawing in Britain is credited to Matthew Boulton and James Watt who needed a way to divide up the various parts of their production process. These first industrial drawings used the codified depictions made through the use of plans, elevation and section. They were significantly improved by William Farish (1759–1837), a professor of chemistry and natural philosophy at Cambridge, who was the first man to teach the construction of machines as a subject in its own right, and also developed the isometric projection. This became rather rapidly adopted as a practical way of drawing machines because it did not use the traditional laws of geometrical perspective. In a way, it freed the machine illustration from the diktat of Fine arts. Still, at the beginning, users of the isometric projection, such as the engraver Thomas Edward Nicholson who illustrated Hargreave's spinning jenny (Fig. 4) used shading for the frame of the machine, to indicate volume, as well as cast shadow, to give a sense of the stability of the apparatus.

- 16 Fig. 4. T. E. Nicholson, 'Hargreave's Spinning Jenny'

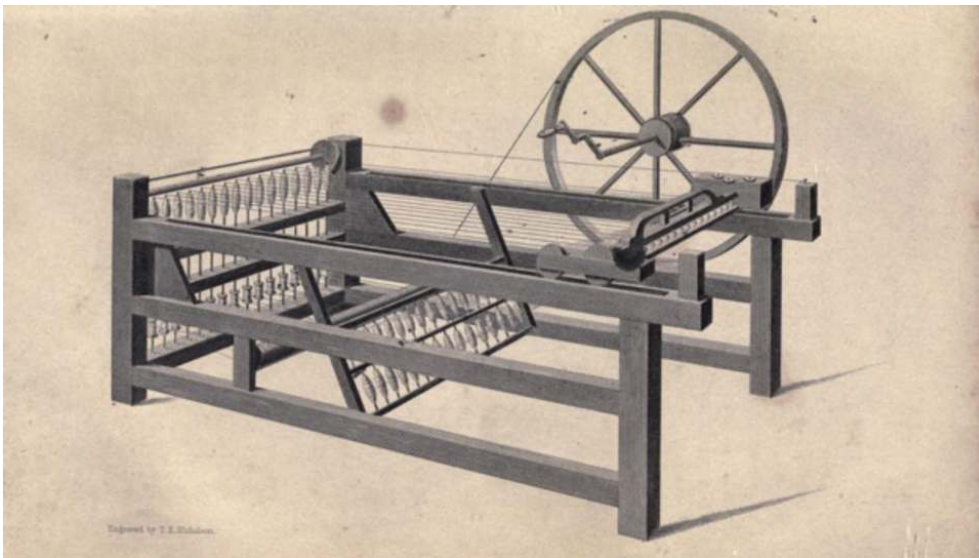


Plate 4, p. 158 in Edward Baines, *The History of the Cotton Manufacture in Great Britain*, 1835

- 17 These illusionistic techniques were progressively discarded as technical drawings became more common: 'after the 1820s . . . artisans and mechanics were increasingly required to read and understand [technical plans, patterns and diagrams] as a routine part of their work' (Denis 61). In *Iron and Coal*, the workers are presumed to be literate in word and image, as the newspaper and the blueprint in the bottom right hand corner of the painting suggest. This technical drawing literacy was only attained after half a century of active campaigning.
- 18 True, the Smeatonian Society⁶ had been founded in 1771 but it was very exclusive, and then, in 1818 a new Institution for Civil Engineers was formed. In his opening lecture, the young engineer Henry Robinson Palmer (1795–1844), 'the moving spirit of the ICE' (Buchanan 61) argued: 'An engineer is a mediator between the philosopher and the working mechanic, and, like an interpreter between two foreigners, must understand the language of both' (Armytage 131), hence the necessity to master the language of drawing which could make the translation understandable to both philosopher and mechanic. Indeed, not only Nasmyth but a vast majority of engineers and polymaths possessed a visual imagination (Ferguson 834) and agreed that 'drawing is a universal language' that

needed to be cultivated and taught. Yet, in 1850, the members of the Institution for Civil Engineers, together with those of the newly formed Institution of Mechanical Engineers, amounted to 900 only. How to cultivate the ‘visualizing faculty’ was, in the opinion of Francis Galton (1822–1911), ‘one of the many pressing desiderata in the yet unformed science of education’ (Ferguson 834).

- 19 In the wake of the Institution for Civil Engineers, Mechanics Institutes were developed to bridge the gap between art and mechanics. In 1824, Birkbeck had opened his first Mechanics’ Institute in London and offered classes in architectural, mechanical, perspective and ornamental drawing, figure modelling and landscape. Mechanics institutes with drawing schools were subsequently established in other manufacturing towns (Bell 48). Their classes, lectures and libraries were planned as hubs for technical drawing literacy, hoping to make workers better than ‘parts of the machine around them’ (Berg 148). The purpose was to train these men into ‘general workers’ with both hands and a head, ‘it was this concept of the “general workman”, able to make the connections between his activities and to perceive the principles behind his toil, which was so important at this time to the rhetoric of the Mechanics’ Institute Movement’ (Berg 215). This Movement was complemented by the Society for the Diffusion of Useful Knowledge (founded 1826), which was set up by a number of the founders of the Mechanics’ Institute Movement. The purpose of this society was to publish cheap editions and pamphlets and to solicit popular or simplified texts tending to democratize general knowledge on various subjects (Berg 292). However, writes Quentin Bell ‘as teaching establishments [Mechanics’ institutes] seem to have had a poor reputation’ (48–49) and even the SDUK’s efforts were probably deemed insufficient: a Select Committee on Arts and Manufactures was set to inquire what was being done to improve the drawing literacy of the working population. The report published in August 1836⁷ created ‘a great stir’ for it concluded that ‘from the highest branches of poetical design down to the lowest connection between design and manufacture, the arts have received little encouragement in this country’. The committee considered ‘the want of instruction in design among our industrious population’ (Bell 58) to be one of the major causes of this sad situation. It led the Hampshire and Wiltshire Adult Education Society, at its third annual meeting in 1856 to call for the general instruction of drawing, and the *Spectator* to publish a paper which reacted with surprise to the suggestion made by a Government official to ‘extend to the agricultural districts “a knowledge of drawing”!’, which the reporter commented as one of the ‘wonderful phenomena’ which ‘in our day . . . pass as commonplaces’. The reported contents of the suggestion will not, however, strike the twenty-first century reader as curious:

Drawing is useful; and if every labourer cannot learn it, many a labourer may, and may thus get a clearness of ideas most beneficial to himself and his fellows. For there is no practice which so disentangles the ideas, and makes them distinct and plain, as drawing. It materially assists the understanding of machinery, not only by illustrations, but by teaching the mind to separate the parts of a whole and to note their relation; and if farmers want hands to use machines, they will acquire what they want if the hands be guided by eyes that would reduce the machine to a diagram (*Spectator* 12).

- 20 The Hampshire and Wiltshire Adult Education Society was in fact following the lead of the 1836 Select Committee on Art and Manufactures, and participated in a larger movement generated by the Great Exhibition of 1851. Throughout the decade following the Exhibition, writes Quentin Bell ‘authors of drawing manuals and other educational

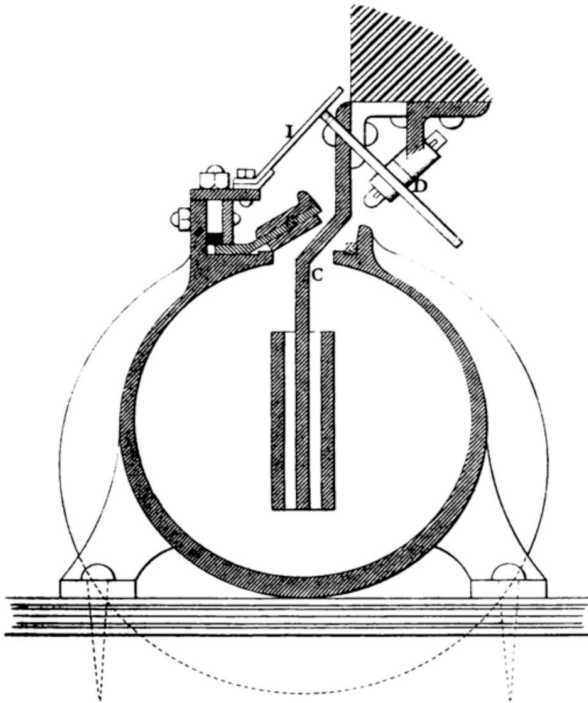
authorities . . . characterize[d] drawing as the exact language for this purpose. A veritable national campaign for the promotion of drawing instruction came into being' (Bell 53). The extension of drawing instruction to agricultural counties that scandalized the *Spectator* journalist in 1856 became commonplace by the mid-1860s when 'drawing was widely seen to provide the universal material language of industry, [and] it was being taught to over 90 percent of British schoolchildren as well as to a large portion of working-class adults' (Bell 54). The proposition exposed by the government official at the 1856 meeting came to be accepted as logical: 'Drawing instruction was used not only to disseminate an industrial language but also to inculcate an industrial vision, and one erected on the foundation of an underlying division of mental and physical labour, as manifested in endless discussions regarding the training of eye and hand' (Bell 54).

- 21 Engineering drawing in the nineteenth century was, as all intellectual productions are, an expression of the ideals, interests and aesthetic sensibility of its age. It testifies to three different points of view perceptible in three contrasting genres of machine illustrations: the factory interior, the 'artistic' view of the whole machine seen in perspective and with some shading and background, and the 'graphic', codified technical drawing of the machine in plan, elevation or section which became more and more common from the 1860s onward. The first two were engaging because they were not reduced to a system of lines and measurements. Sometimes machines were depicted at work, but in a sanitized way. At other times, they were isolated from their normal surroundings; they seemed to float, accompanied by their plans and sections. The stances of these three kinds of representation are opposite, the first presuming that the beholder is at a distance from the machine, the second closer, the third, inside. Of course, the move from one type of representation to another was not immediate: graphic plans did not supersede the 'artistic views' and many illustration plates oscillate between or juxtapose both, and the volumes in which they are reproduced often has full pages of Factory interiors.

Reaching Towards Abstraction

- 22 Progressively, the artifices of realism were abandoned: workers, and even shading and perspective disappeared from the mechanic illustrations as technical drawing became codified in the 1860s. Thomas Bradley, professor of geometrical drawing made this difference explicit by distinguishing 'pictorial' from 'graphical' representations. While the former depicted apparent forms, he stated, the latter 'could only suggest the thing represented to a mind trained to interpret rightly the mode of representation' (Bradley 3). These codified renderings of objects or machines were being perfected and simplified by highly skilled draughtsmen such as J.W. Lowry, whose illustration to Samuel Clegg and Joseph Samuda's *Treatise on the adaptation of atmospheric pressure to the purposes of locomotion on railways* (fig. 5) is a veritable work of art.

Fig. 5. J. W. Lowry, illustration to Samuel Clegg and Joseph Samuda's *A treatise on the adaptation of atmospheric pressure to the purposes of locomotion on railways*, 1841



- 23 It still looks surprisingly modern more than a hundred and fifty years after it was made. In 1841, it addressed the few brains versed in both atmospheric pressure and locomotive building. Two decades later, the conjoined efforts of the Educational authorities and Professional Institutes made Lowry's and Nicholson's drawings accessible to a wider readership:

By the 1860s, a new visual literacy was already widely disseminated among a certain segment of the working-class public, which took for granted that readers possessed a basic familiarity with plans, sections, elevations and other such schematic representations. . . . As W. S. Binns pointed out in his *Treatise on Orthographic Projection*, orthographic projection had become more than just one among several systems of representation. It was by that time the accepted conventional form of communicating knowledge about machines, without reference to models or to the machines themselves (Denis 61).

- 24 Louise Purbrick has defined what Denis rightly calls 'a crucial epistemological difference' (62) between the 'realistic' perspective representation which attempts 'to recover appearance as it is constituted in the measured distance between eyes and objects' (Purbrick 1998, 289), and abstract orthographic projection which 'reveals only the object and never refers to what surrounds it' (Purbrick 1998, 291). Vision and conceptualization are thus polarized in these two systems of representation. Indeed, while perspective drawing creates the illusion of a visual experience, 'reading geometrical projection involves a process of seeing that which cannot be observed, of grasping an impossible view which is not a likeness but a *translation* of the object, breaking it down into parts which can only be joined together again in the mind of the observer' (Denis 62). Considering the illustrations in encyclopaedias such as Burn's or Cassell's, Denis notes the homogeneity of treatment involved in their description: objects

are 'detached from any background or function, as if on display in an imaginary museum' (Denis 72). They exist virtually as artefacts, and I would suggest, have more to do with art than with mechanics. Non-figurative art at the end of the nineteenth century assumed that the observer would look for clues within his or her own mind rather than on the canvas. This process may well have been facilitated by the groundbreaking work of machine illustrators and industrial designers who had trained the public eye to look beyond the surface at invisible connections and fluxes. As the competition between different ways of seeing necessitated many decades of negotiations and adaptations, nineteenth-century examples of mechanical drawings show the process in the making. It is curious and fascinating to see how 'the nature of the representations themselves reflects a curious duality of concern with three-dimensional structure as well as an exaggerated focus on pictorial or surface detail . . . these are impossible views uniting near and far, inside and outside, surface and structure' (Denis 72). They show the oscillation between two points of view and illustrate two different understandings of the machine, as artefact and as production tool.

Conclusion

- 25 Encyclopaedias, magazines and factory-tour-logues included increasingly sophisticated illustrations which taught their readers to look at objects and machines differently. The two great periods of 'mechanical publications' hinge around the Great Exhibition and relate respectively to the how-shall-we-educate-the-Mechanic age in the 1820s–50s and the drawing-literate age of the 1860s–1890s. The necessity to look beyond the surface and into the hidden mechanical devices demanded a level of abstraction that seems to have been reached in the second half of the nineteenth century. This form of industrial education, made necessary by the increasing sophistication of machinery, resulted in a training of the eye and the mind to operate according to non-mimetic, purely conceptual codes. The cultural impact of this revolution in the act of seeing reached far beyond the field of technical drawing. Indeed, it was reflexive, and the newly acquired habit of considering objects as an assemblage of interconnected parts led, in turn, to a new vision of work, of man, and of society itself, where mechanical principles were substituted to the earlier organic ones.
- 26 In the early decades of the nineteenth century, mechanical study had been borne by the hope that better understanding the function of individual parts would yield a wider wisdom in the understanding of the whole, as the polymaths of the late eighteenth century had promised. Faithful to this program, the prospectus for the *Encyclopedia Metropolitana or Universal Dictionary of Knowledge* drafted by Samuel Taylor Coleridge in 1817 wished that the encyclopaedia would illustrate 'the manifest tendency of all the arts and science at present, from the most purely intellectual events to the labours of the common mechanic, to lose their former insulated character, and organize themselves into one harmonious body of knowledge' (Berg 180). This happy union between macroscopic and microscopic visions was also called for by John Ruskin, in his concern for the 'vital facts of form', by Cassell's *Technical Educator* and Burn's 'object teaching'. Yet these dreams of the 'harmonious body of knowledge' in which every particle of the visible universe would be located and understood as part of a larger picture, turned short when the makeshift appearance of the mechanical body raised nightmarish visions of automata by the end of the century and seemed to prove true early apprehensions, such as the one

voiced by the industrialist Galloway who testified before the Select Committee on the Export of Tools and Machinery in 1825 that, ‘too great a division of labour . . . is the great mischief of abstract employment; it makes men mere machines, and we find that the Manchester and other country workmen who are brought up to abstract employment, can do little else’ (Berg 215). By the second half of the century, abstraction was universally embraced by the engineering profession and would overflow from technical design into art at the turn of the century, puzzling the advocates of narrative realism and impacting art, literature and technology with non-verbal communication. Visual communication through technical drawing was envisaged in the nineteenth century as the esperanto of the future, yet, as Norman Bryson has brilliantly demonstrated, ‘between the subject and the world is inserted the entire sum of discourses which make up visibility, that cultural construct . . . a screen of signs’ (Bryson 91–92). Technical drawing fulfilled a two-fold strategic purpose in Victorian Britain: as art, it held up the mirror of the greatest industrial nation of the age; as codified mathematical language, it helped her look like that image.

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NOTES

1. 'An "unlearned people" made learned in "common things"', *Spectator* 29, 1856, 1080.
2. Reproduced as fig. 2 in Paul Fyfe, 'A Great Exhibition of Printing'.
3. Four operatives are clearly represented at both ends of the press, the head of a fifth one is merely delineated, at the top, right of the central cylinder.

4. Joseph Wright of Derby painted five paintings on the theme between the years 1771 and 1773: *The Blacksmith's Shop*, 1771, Derby Museum and Art Gallery; *The Blacksmith's Shop*, 1771, Yale Centre for British Art; *An Iron Forge*, 1772, Tate; *The Iron Forge*, 1772, Private collection; *An Iron Forge Viewed from Without*, 1773, Hermitage Museum, St Petersburg.
 5. *Iron and Coal*, 1861, oil on canvas, 186.6 × 187.9 cm, National Trust, Wallington, Northumberland.
 6. Originally known as the Society of Civil Engineers, it was the world's first engineering society.
 7. *Report from the Select Committee on Arts and their Connexion with Manufactures; with the Minutes of Evidence, Appendix, and Index. Ordered by the House of Commons to be Printed, August 16, 1836.* Luke Hansard and Sons: London, 1836.
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ABSTRACTS

The Victorian fascination with the world of manufacture—exemplified in the Great Exhibition of 1851—was concomitant with, and probably fuelled by, progress in technical drawing fluency and literacy. Periodicals such as *The Mechanics' Magazine* (founded 1823) and *The English Mechanic and World of Science* (founded 1865) included increasingly sophisticated illustrations which taught their readers to look at objects and machines differently. The necessity to look beyond the surface and into the hidden mechanical devices demanded a level of abstraction that some philanthropists deemed essential to improve the condition of the artisans. Their self-appointed 'mission' to make 'an 'unlearned people' learned in 'common things' contended that technical drawing 'materially assists the understanding of machinery, not only by illustrations, but by teaching the mind to separate the parts of a whole and to note their relation'¹. This form of industrial education resulted in a training of the eye and the mind to operate according to non-mimetic, purely conceptual codes. The cultural impact of this revolution in the act of seeing reached far beyond the field of technical drawing, as this paper proposes to demonstrate.

Les Victoriens étaient fascinés par l'univers de la manufacture. Leur engouement pour les machines présentées lors de la Grande Exposition de 1851 le démontre. Une meilleure compréhension du dessin industriel permit et entretint cette fascination. Les périodiques tels que *The Mechanics' Magazine* (fondé en 1823) et *The English Mechanic and World of Science* (fondé en 1865) incluent des illustrations toujours plus nombreuses et plus sophistiquées qui enseignèrent à leurs lecteurs une manière de voir les objets et les machines différemment. La nécessité de regarder, au-delà de la surface, à l'intérieur des dispositifs mécaniques cachés exigeait un niveau d'abstraction que quelques philanthropes considéraient comme essentiel pour améliorer la condition des ouvriers et artisans. La mission qu'ils embrassèrent, de transformer un 'peuple illettré' en une population au fait des choses communes était portée par la conviction que le dessin industriel aide matériellement la compréhension des machines non seulement parce qu'il les illustre, mais aussi parce qu'il exerce l'esprit à séparer les parties d'un ensemble et à comprendre les relations que ces parties entretiennent entre elles et avec le tout. Cette éducation du regard et de l'esprit à la conceptualisation entraîna les lecteurs à partir des années 1860 à comprendre des codes non-mimétiques. L'impact culturel de cette révolution dans l'acte de voir fut sensible jusque dans des domaines très éloignés du dessin industriel.

INDEX

Mots-clés: art, gravure, illustration, industrialisation, exposition universelle, dessin industriel, abstraction, alphabétisation visuelle

Keywords: art, printing, illustration, industrialisation, Great Exhibition, draughtsmanship, abstraction, visual literacy

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