

## Lighting the Victorian art school

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The advance of lighting technology is often viewed as analogous to the extension of working hours brought about by the industrial revolution.<sup>1</sup> However, viewing the inexorable advance of illumination in the nineteenth century as a metaphor for societal progress (or ‘the turning of night into day’, literally and figuratively), ignores the fact that both day and night light were commodities of which there was still a limited supply in the smoke-laden skies of the major cities of Britain. The development of an ‘economy’ of light depended on the ability to quantify light accurately.

Following the Municipal Corporations Act of 1882 (permitting the development of public schools, hospitals, libraries and museums), the environmental requirements of many building types would be codified for the first time, including for example, the establishment of a transatlantic standard for the lighting of public libraries<sup>2</sup>, and the lighting and provision of fresh air in school classrooms.<sup>3</sup> The art school in particular represented a building type where the functional requirement for plentiful light was paramount. While it would take another half century to overcome the seemingly insurmountable problem of air pollution (beginning with the Clean Air Act in London in 1952), the use of glass and new forms of artificial light in art schools demonstrate a particularly sensitised architectural response to the atmosphere of the Victorian industrial city – and its myriad problems.

### Studio lighting in the early nineteenth century

In the first decades of the nineteenth century, art education for the professional classes – a luxury that required the support of a well-paid job by day – often took place in the evening or at night. The cost of models and fuel for heat and light would be shared amongst groups of artists, who would make use of the limited light available from the installation of appropriate lamps, shutters and reflectors in a dedicated room. As studio practice became formalised, the issue of the nature of the most appropriate environment for an art school would come to the fore. While the Royal Academy was established in 1768, it was not accommodated in an environment explicitly fit for purpose until 1779, when it moved into the newly completed Great Exhibition Room of Somerset House, designed by William Chambers. This established a principle that had particular resonance in the world of art display: the lantern as a provider of top light for the viewing of art.<sup>4</sup>

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<sup>1</sup> Brian Bowers, *Lengthening the Day: History of Lighting Technology* (Oxford University Press, 1998); William Thomas O’Dea, *A Short History of Lighting* (H.M.S.O, 1958).

<sup>2</sup> Oriël Prizeman, ‘Philanthropy and Light: The Formulation of Transatlantic Environmental Standards for Public Interiors through Andrew Carnegie’s Library Building Programme, 1889-1910’ (unpublished PhD, University of Cambridge, 2010).

<sup>3</sup> Edward Robert Robson, *School Architecture: Being Practical Remarks on the Planning, Designing, Building, and Furnishing of School-Houses* (London: John Murray, 1874); see also Colin Porteous, ‘Sensing A Historic Low-CO2 Future’, in *Chemistry, Emission Control, Radioactive Pollution and Indoor Air Quality* (InTech, 2011) <<http://www.intechopen.com/articles/show/title/sensing-a-historic-low-co2-future>> [accessed 11 November 2011].

<sup>4</sup> This technique would be subsequently replicated and greatly extended by Sir John Soane in his Dulwich Picture Gallery of 1812.

The construction of the gas lit National Gallery on Pall Mall between 1822 and 1834 provided a new home for the Royal Academy, so that in 1836 the Great Exhibition Room in Somerset House was freed up for the newly reconstituted Department of Practical Art, or the first government school of design.

### **The establishment of government-supported art schools**

The Great Exhibition of 1851 acted as a catalyst, both figuratively and financially, for the establishment of the Department of Science and Art at South Kensington and the subsequent expansion of art education to the regions, principally centred in Birmingham, Manchester and Glasgow.<sup>5</sup> The studios at South Kensington were constructed on the second and third storeys of a new wing behind the North and South Courts.<sup>6</sup> The work was completed by Francis Fowke in 1863.

As the teaching of ‘practical art’ opened up the possibility of art training as a vocation, teaching was extended into the day and studios spaces were required to meet a minimum standard in terms of daylight. This was, however, a purely technical requirement to be assessed by measurement of floor and window areas, independent of orientation, context or circumstance. The most detailed instructions concerned studios for life drawing:

This room should be lighted from the north side by a single large window, the top of which (carried up in a dormer if necessary) should be at a height above the floor equal to  $\frac{3}{4}$  the depth of the room, or if the pitch of the roof be steeper than 60°, a skylight should be made in conjunction of the window, so as to gain the same effect in lighting.<sup>7</sup>

More detailed guidance specified that:

The windows should be large, and in Art schools, free from mullions or small panes.<sup>8</sup>

The studios at South Kensington served as an example for the art schools that were to be built in the other major cities of Britain. Daylit by large windows on both façades, the windows on the south side of the studios fold into the roof, casting an even light into the spaces on an overcast day, and troublesome glare in bright conditions. However in the industrial cities of the north daylight was in short supply. Quantifiably, the effects of smoke pollution are illustrated by the smoke charts developed by Max Ringlemann in Paris in 1890, and introduced to Britain by the turn of the century.<sup>9</sup> According to William Nicholson, Sheffield’s first official Smoke Inspector, the average loss of light at any given time in the worst-affected regions of Britain was 45%.<sup>10</sup> One study identified the annual soot fall in the centre of Glasgow as 820 tons per square mile, in comparison to 426 tons in London.<sup>11</sup>

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<sup>5</sup> See for example Francis Fuller, *Shall We Spend 100,000 on a Winter Garden for London, or in Endowing Schools of Design in Birmingham, Manchester, Sheffield, Belfast, Glasgow, Leeds, Etc., Etc.?* (London: John Ollivier, 1851).

<sup>6</sup> John Frederick Physick, *The Victoria and Albert Museum: The History of Its Building* (Oxford: Phaidon Christie’s, 1982), pp. 97–99.

<sup>7</sup> VAA: Department of Science and Art, *Directory, with Regulations for Establishing and Conducting Schools of Art* (London: Department of Science and Art, 1888), p. 114.

<sup>8</sup> VAA: Department of Science and Art, p. 114.

<sup>9</sup> Prizeman, p. 185.

<sup>10</sup> William Nicholson, *Smoke Abatement: A Manual for the Use of Manufacturers, Inspectors, Medical Officers of Health, Engineers, and Others* (London: Griffin, 1905).

<sup>11</sup> H. H. Kimball, ‘The Meteorological Aspect of the Smoke Problem’, *Monthly Weather Review*, 42 (1914), pp. 29–34.

## Art in a factory town: Manchester

The challenge of providing enough light in this context can be seen in the practical difficulties faced by the first established art school in Manchester. The school was accommodated in the basement of the Royal Manchester Institution, a grand neo-classical composition on Mosley Street completed in 1835 to a design by Charles Barry. There was one classroom, lit by day from lights to the pavement above and by gas at night – providing far from ideal surroundings.

Classes were originally held from 7 to 9 pm in the evening, though morning classes were quickly introduced from 8 to 10am.<sup>12</sup> An inherent contradiction Ruskin identified in his speech at the opening of the school in Cambridge (which would significantly influence the evolution not only of the Manchester school but also that of Birmingham and Glasgow) was present from the start. Was the purpose of the school to instruct on the relevance and application of design to manufacturing (represented by a male and working ‘artisan’ class of pupils who attended in the evenings), or to teach the principles of ‘fine art’ for a higher cultural purpose (a more leisurely occupation for wealthier individuals, including young society women and children, pursued during the day)?<sup>13</sup>

The lack of light was a recurring topic at the annual meetings of the school in the years leading up to the construction of a new building. Speakers debated what it would take for Manchester art to match the reputation of art from the Continent. In 1874, Hugh Birley, the local M.P., suggested that the climate was the problem:

Now one argument against us and against our power of doing like they have done is this, that our climate is against us, that it is a cold, foggy, and dark climate, and that its disagreeable qualities are much heightened by excessive smoke.<sup>14</sup>

The Royal Academician George Dunlop Leslie also commented that art in a place like Manchester ‘must necessarily be rather an exotic plant. The stern and grim character of your buildings and occupations prevent it springing up as it does in Italy or other brighter and sunnier climes.’<sup>15</sup> And the Bishop of Salford Dr. Herbert Vaughan claimed that:

The necessity for larger and more suitable premises was evident, and the premises should be built for the purpose, because, in such a climate as Manchester, students could not be expected to draw well by every light. The necessity for adequate provision for the School of Art was more evident in Manchester than in most other towns, because we are not blessed with an atmosphere and a sky which promote Art.<sup>16</sup>

The new school opened in April 1881, designed by George Tunstall Redmayne, brother-in-law and former pupil of Alfred Waterhouse. The contemporary atmosphere of the site of the school, situated to the south side of All Saints Gardens, can be judged from two paintings of Grosvenor Square by Adolphe Valette: ‘Hansom Cab at All Saints’ (1910), where the viewer is positioned on Cavendish Street looking north from the pavement outside the school, and

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<sup>12</sup> Cecil Stewart, *Art in Adversity: A Short History of the Regional College of Art, Manchester* (Manchester: Royal Manchester Institution, 1954), pp. 5–6.

<sup>13</sup> John Ruskin, ‘Mr. Ruskin’s Inaugural Address, Delivered at Cambridge, 29th October, 1858’, in *The Works of John Ruskin*, ed. by Edward Tyas Cook and Alexander D. O. Wedderburn, Library Edition (London: George Allen; Longmans, Green, and Co., 1903), XVI.

<sup>14</sup> MMU-MSAC: Manchester School of Art, ‘1874 Annual Report’, 1874, pp. 6–7.

<sup>15</sup> MMU-MSAC: Manchester School of Art, ‘1876 Annual Report’, 1877, p. 17.

<sup>16</sup> MMU-MSAC: Manchester School of Art, ‘1877 Annual Report’, 1877, p. 12.

‘Old Cab at All Saints’ (1911), painted from a position on Oxford Road, with the school just beyond the edge of the frame on the left.<sup>17</sup>

Two photographs from the turn of the century provide us with clues as to the day-to-day use of the main toplit space, a Gallery of Casts, also used as a drawing studio. The floor was kept as untreated timber while the upper parts of the walls were painted white, with a darker tone beneath. At some point between the dates of the two photographs the timber of the ceiling and upper-level divisions between bays were also painted white, which had the effect of allowing more reflected diffuse light into the space. Initially the bays were divided by makeshift fabric screens, but these were replaced with dark curtains attached to the bay divisions. Gas lights also make way for electric light, with one arc lamp per bay located centrally about 10 or 11 feet from the floor. The luminosity of an arc lamp from the early twentieth century is around 300 candlepower (or the equivalent of a modern 240W incandescent bulb). These arc lamps, therefore, would have been a significant improvement on the gas lamps they replaced. In this way each bay of the space could be screened off in the evening with a single source of directional light from above, as per Hatton’s recommendation in his ‘Guide to the Establishment and Equipment of Art Classes and Schools of Art’ of 1895:

It cannot be too strongly urged upon Committees that the artificial lighting of the rooms should repeat as nearly as possible the effect of the daylight. If this is done there will not have to be a great shifting of casts, after the day classes, to suit the evening students.<sup>18</sup>

### **Perfecting the studio by day: Birmingham**

The Birmingham School of Art, designed by the local Birmingham firm of Chamberlain and Martin, was completed in September 1885, with an extension of 1893. The orientation of the Margaret Street front to the south-west resulted in a more complex lighting arrangement than that of the original buildings at Manchester and Glasgow. In order to capture the valuable north light the studios in the wings at either end of the building have glazed lights on the north-west side of the pitch only.<sup>19</sup>

The Antique room is the culmination of the architectural experience. Having progressed from the entrance along the relative darkness of the corridor to the west stairs, the visitor rises up into the startling brightness afforded by the glass and timber lantern directly over. The door to the Antique room is at the top of the stair under the lantern directly at the end of the first floor corridor. The room is entered almost at the middle of its 65 foot length. The effect of the glass window-wall folding into the pitch of the roof is to fill the space almost to the ceiling with clear bright daylight – above the dado rail the light cream wall finish warms the daylight just enough so that the finished effect is more an interior than an exterior space.

The best contemporary evidence of the internal environment of the new school remains the photographs taken at the time. One image of a ‘figure composition class’, dated around 1901, shows a class of mostly women in what was originally the cartoon/fresco room (the last north-west lit studio in the extension), ranged in perhaps half a dozen rows facing towards the original building. The photograph is taken during the day with no evidence of a photographic

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<sup>17</sup> Cecilia Lyon, *Adolphe Valette* (Chichester: Phillimore & Co., 2006), pp. 92–94.

<sup>18</sup> Richard G. Hatton, *Guide to the Establishment and Equipment of Art Classes and Schools of Art: With Estimates of Probable Cost, Etc.* (London: Chapman & Hall, 1895), p. 54.

<sup>19</sup> Andy Foster and Nikolaus Pevsner, *Birmingham*, Buildings of England (New Haven: Yale University Press, 2005), p. 70.

flash. The light from the windows appears to be well dispersed evenly across the roof without any gloomy patches or disruptive shadows. Three of four gas lamps are in frame supported from the ceiling by solid tubular flues. They come about half way down from the ceiling, and are fitted with adjustable light metallic reflectors that appear to be positioned to reflect light from the lamps towards the windows, perhaps to illuminate casts positioned for a night class.

Another contemporaneous photograph of the studio next door is described as an ‘art laboratory for cartoon and figure design’. The effect of the light from the side is clear – the tall glass panes of the windows turned towards the sky diffuse light right across the plane at which the students are working. The shadow cast by the ceiling from the top of the window cuts a path of approximately 30 degrees from the horizontal across the end wall, but only reaches a level low enough to darken the working plane at the wall opposite the window.

### **By night, electric light: Glasgow**

The Glasgow School of Art was constructed in two phases, the eastern portion between 1897 and 1899, and the western portion between 1907 and 1910. Newbery, the headmaster, prepared the first block plan to inform the architectural competition – and, influenced by his experience of teaching in the south-facing rooms of the McLellan Galleries, recommended that the classrooms should take full advantage of the northern orientation to Renfrew Street.

The importance with which Mackintosh considered the daylight in the new building is evidenced by his radical experimentation in the use of large sheets of plate glass for the 22 foot high studio windows, and his plan (unrealised due to cost) for the basement studios to be fitted with prismatic glass skylights to the streets, the effect of which would have been to diffuse skylight into the space in an almost ethereal fashion.<sup>20</sup> Wood paneling “off the saw”, likely stained dark green, around the base of the studios provided a neutral backdrop free from glare for the composition of figures or still life, while a light plaster frieze above, “finished off the float”, ensured maximum penetration of light from the 22 foot high windows to the back of the studio. While the average daylight factor of 8% is impressive by modern standards, it must be borne in mind that the sky in Glasgow would often have been considerably obscured by smoke.

While the studios in Manchester and Birmingham were originally illuminated by gas at nighttime, Glasgow was the first art school designed with electric light fittings in the studio spaces. The Building Committee hired W. B. Sayers to oversee the installation of electric lighting in the new school. He was instructed to consult with the headmaster ‘in regard to the arrangement and placing of lights’, and experiments were conducted with the fittings before they were permanently fixed.<sup>21</sup> Prior to the opening of the new building, the Building Committee wrote to the Glasgow Corporation, who had municipalised the supply of electricity, to negotiate the rates they would be required to pay:

The Governors of this School have decided to make a complete installation of Electric light in the premises as above with supply from the Corporation Mains. The work of installation will be carried out under the superintendence of W. B. Sayers Electrical Engineer and specifications for the work are now being issued. It is proposed to employ the following lamps

16cp      32 cp      50cp      arcs

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<sup>20</sup> GSAA: Glasgow School of Art Architect’s Correspondence, pp. 214–215.

<sup>21</sup> GSAA/GOV: Glasgow School of Art Building Committee, ‘Minutes’, pp. 61–65.

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The lamps will be run on an average of 12 night hours per week during an annual session of 40 weeks making a total of 480 working hours during the year.... Our greatest demand upon the mains will always be at night and that between the hours of 7-15 and 9-15pm. Fog alone or very dark weather will necessitate the use of the lamps during the day and even in such cases only a limited number will be used.

The Governors understand that the heaviest work falls upon the Corporation mains between the hours of 4 and 7 p.m. and as our evening service is required at times and hours other than when this largest demand is being made namely between 7-15 & 9-15 pm the Governors would ask whether under these circumstances a special rate could be granted them as consumers.<sup>22</sup>

To put these figures into some context, 50 candlepower is approximately the equivalent of a modern 40W incandescent bulb. The Corporation accepted the proposal and the installation proceeded. From the evidence of the photographs of the occupied school, it seems that the installation was a success, and when the school came to be completed in 1909-1910, electric lighting was installed throughout. The ongoing running cost, however, was still a prohibiting factor. The Glasgow Corporation Electricity Department was called upon to advise on how savings might be affected, and an Inspector met with the headmaster to recommend the installation of more efficient bulbs in January 1909:

At present each class-room is lit by a cluster of 18 carbon filament lamps of 16 candle power or a total of 288 candle power in each room. This means that each room when in use will consume 1.15 units per hour and the 18 rooms 20.75 units per hour. By substituting for the 18 – 16 candle power carbon filament lamps 8 metallic filament lamps of 40 candle power, each room would be lit by 320 candle power instead of 288 as at present. These 8 metallic filament lamps would consume .4 units per hour so that in the 18 rooms the consumption would be at the rate of 7.2 units per hour instead of 20.75 showing a clear saving of 13.8 units per hour in the 18 class-rooms.

From the foregoing it appears to me that there is nothing to hinder your accounts for electrical energy being halved. It may cost you a little more for incandescent lamps but this will be more than covered by the saving in your accounts and you will have a very much better light.<sup>23</sup>

Again, to put this in context, the eighteen 16 candle power lamps would have emitted approximately the same amount of light as two 100W incandescent bulbs, and the proposed arrangement slightly more. The effort to provide enough artificial light for classes to progress at nighttime inevitably led to safety concerns regarding the electric current and length of wiring that would be required. The Building Committee asked Sayers and Caldwell to inspect the condition of the existing installation before the extension was completed:

We particularly examined the plug boards in the Basement, which you mentioned, and these we found dry and perfectly safe.

The chief danger from fire in such an institution would be caused by the twin flexible conductors becoming frayed, until a fault developed between conductors of opposite polarity, as although the faulty circuit would then at once be disconnected, the instantaneous flash might meantime have set fire to the rubber and cotton covering of the flexible conductor, and as this is highly inflammable the flame would probably travel the whole length of the wire affected.

We are of the opinion that with ordinary usage such an occurrence is unlikely, as care has been taken to suspend flexible conductors wherever possible on insulated hooks or pulleys to protect it from abrasion.<sup>24</sup>

<sup>22</sup> GSAA/GOV: Glasgow School of Art Building Committee, pp. 79–84.

<sup>23</sup> GSAA/GOV: Glasgow School of Art Building Committee, pp. 69–70.

<sup>24</sup> GSAA/GOV: Glasgow School of Art Building Committee, pp. 126–127.

## Comparison and conclusion

As has been demonstrated, the architects of the art schools in Manchester, Birmingham and Glasgow went out of their way to secure what they considered to be the best sites for daylighting, and to fine tune their designs in order to obtain the most ideal light for studio activities. This was directional north light encompassing a segment of the sky from the horizon to as close to the apex as was practicable without admitting glare. This led to quantifiably more glass being employed in carefully selected areas of the facades, quantifiably more light being admitted into the building, and the deployment of architecturally radical servicing strategies to moderate the unusually thermally sensitive interior environments that were the consequence of the more extensive use of glass.<sup>25</sup>

A comparative study was undertaken to compare the glazing areas and façade ratios of each art school with other building types where daylighting was considered important. Board schools (constructed after the 1870 Education Act), also had to contend with the problem of smoke. The area of glass – while considered essential – was calculated to provide the right *quantifiable* amount of light. The ideal (rarely achieved) was defined by Edward Robson as 30 square inches of glass for every square foot of floor space (0.21 square metres of glass for every square metre of floor space, or a glazing ratio of about 20%).<sup>26</sup>

The glazing ratio expressed as a percentage of floor area in Manchester School of Art is 21%, with 4.24 cubic metres of volume per square metre of floor area. In Birmingham School of Art this increases to 23%, with 5.44 cubic metres of volume per square metre of floor area, and finally Glasgow School of Art, has a glazing ratio of 24%, with 5.70 cubic metres of volume per square metre of floor area. If we examine the glazing ratio in terms of façade area,<sup>27</sup> the importance of orientation in the design of the art school is clearer still. The largest part of the glass area in Birmingham School of Art faces north-west, with a glazing ratio of over 40% façade area. The north elevation of the Glasgow School of Art has a similar ratio (and in both examples the studio windows are turned up towards the apex of the sky, admitting a brighter light).<sup>28</sup>

According to Reyner Banham, it is important to consider ‘the problem of use as well as, or parallel with, or on top of or underneath, the problem of symbolic expression, or whatever else you would like to call it.’<sup>29</sup> In this case how the Victorian art school was lighted remains inseparable from the question of its use, both functionally, and perhaps more intriguingly, in terms of what the buildings would come to represent. The provision of light by day and night was symbolic of a hope for a brighter, cleaner future, metaphorically transforming dark and uncivilised factory towns into refined cities of culture through the diffusion of design to industry and art to the masses.<sup>30</sup>

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<sup>25</sup> For more information see Ranald Lawrence, ‘The Internal Environment of the Glasgow School of Art by Charles Rennie Mackintosh’, *The Journal of Construction History*, 29 (2014), 99–128.

<sup>26</sup> Robson, p. 167; see also N. Baker, A. Fanchiotti and K. Steemers, *Daylighting in Architecture: A European Reference Book* (London: James & James (Science Publishers), 1993), p. 9.

<sup>27</sup> Here, the glazing ratio is the area of glazing expressed as a percentage of the area of the total façade.

<sup>28</sup> This percentage does not include roof glazing areas, which while significant are not affected by orientation unless shaded to the south.

<sup>29</sup> Reyner Banham, ‘Convenient Benches and Handy Hooks: Functional Considerations in the Criticism of the Art of Architecture’, in *The History, Theory and Criticism of Architecture: Papers from the 1964 AIA-ACSA Teacher Seminar* (Cambridge, Mass.: MIT Press, 1965), p. 91.

<sup>30</sup> See also Ranald Lawrence, ‘The Evolution of the Victorian Art School’, *The Journal of Architecture*, 19 (2014), 81–107.