Etchings of Light

"He has made Apollo his own engraver"
Brighton Gazette, 1858[1]

It often surprises people that the inventor of photography on paper, William Henry Fox Talbot, was also the father of photogravure, the artistic and practical process that was so successful in bringing photographs to the printed page. Equally striking is the fact that Talbot actively worked on photogravure for the last twenty-five years of his life, a span of time more than double that which he devoted to photography itself. Perhaps this is fitting, for throughout his life Talbot displayed a passion for the world of books, printing and publishing. Indeed, he personally placed the real value of his invention of photography within the domain of publishing, a perception especially apparent in his bold and provocative 1844 *The Pencil of Nature.* Talbot literally died with his boots on, working on photogravure until the end. Sadly, his son Charles had to observe that if he "had lived only a few weeks longer, he would have given his own account of this invention."[2] Although copious notes and thousands of actual examples survive, very little of this work has been studied in any detail, and the modern literature is as skeletal as it is indicative of the potential for further study.[3] Starting with Joseph Nicéphore Niépce and his heliographs, many experimenters attempted to transfer photographs to the printed page. As will be seen, Talbot's work was the direct forerunner of the photogravure process, and many of his techniques are still used today by modern photogravure artists, mostly unaware that they are applying his inventions.[4] Just as it had been in photography, the hand of Nature was of paramount importance to Talbot when he started making printing plates for the press. Unlike most of his contemporaries, he did everything he could to avoid the intervention of the human hand on his plates.[5]

SILVER'S FATAL FLAW

The history of Talbot's invention of photography and examples of the fine images he created have been covered in previous *Sun Pictures Catalogues.* The enormous beauty of his photographs was dependent on the metal silver; bright and alluring, capable of exhibiting itself in many forms, but ultimately a very vulnerable medium that suffered from the ravages of time. When negatives and prints were carefully hand-made at Lacock Abbey, Talbot's personal attention overcame many of the vexing problems that could arise in silver printing. To a great extent, he was able to maintain this control even when he and his assistant Nicolaas Henneman ventured out to places such as Oxford, Scotland and even France. When Talbot was producing prints in limited quantities, largely for his personal use, he had the choice of printing on the sunniest days. On days when the chemicals were troublesome, he could turn to many other activities. This situation changed completely once production began to be commercialized at Henneman's printing establishment in Reading. Craftsmanship was forced to yield to expediency and as a fatal consequence, permanency suffered. Henneman had to meet print quotas in the range of hundreds per week, and could not afford the luxury of suspending production on a dull day. It is a characteristic of print-out photographs that those made with an extended exposure to weak light will never possess the robust tonalities of those made in unclouded daylight. Even more seriously, prints made in feeble light were more susceptible to fading. Another problem was chemical in nature. Although Talbot had originally fixed his prints with a solution of table salt, these prints were only stabilized, for the light-sensitive silver compounds remained in the paper. His friend and scientific supporter, Sir John Herschel suggested an alternative approach, using sodium thiosulphate (familiar to this day as *hypo*). Hypo actually dissolved the remaining silver salts and allowed them to be washed out of the paper. But hypo was a fickle ally; if it was not washed out thoroughly, it would destroy the image over time. Chief among Herschel's recommendations for the successful use of this fixer was proper washing to thoroughly remove the hypo from the print after it had done its work. Copious quantities of clean water were required; for the small number of prints made at Lacock, ample supplies of water were available, and the kitchen could easily warm it to a suitable temperature. Henneman could not obtain sufficient water to begin with. The town of Reading was undergoing a debilitating water crisis at precisely the time he was trying to produce his prints. The supply flowing through the ancient wooden pipelines was erratic, often limited to

certain hours of the day, and the pollutants in the water were so severe that they became the subject of a Parliamentary enquiry. Chemical reactions slow down at lower temperatures and this applies to the dissolving of the products of hypo. Henneman faced ruinously high fuel costs to heat the much larger quantity of water that he required. The frigid tap water supplied during many months was an inefficient solvent. However regrettable it may have been, it is not surprising that the Reading prints were washed to less than ideal standards.[6]

The final blow to silver printing came early in 1846 when Talbot agreed to supply 7,000 original prints for inclusion in the influential monthly periodical, *The Art-Union.*[7] This project was undertaken with the best of intentions, in order to bring photographs before a wider public, but the effort went disastrously wrong. Each of these sheets of paper had to be prepared by hand, exposed in sunlight under a negative, and then fixed and washed and dried. Under the relentless pressures of scheduling, every available negative was brought into play, but the supplies of reliable sunlight and clean warm water were stretched beyond their limits. This soon evolved into a disaster, spreading hundreds of defective and fading prints throughout the art community. To his further horror, Talbot was becoming aware that many of the prints in *The Pencil of Nature* were beginning to fade. Perhaps some of this can be attributed to the glue used in their mounting, or indeed to the mounts themselves, but the basic problem was grounded in the ambitious attempt to take a technology that had been refined for hand production and too quickly expanding it to a commercial scale. With the death of his mother, Lady Elisabeth Feilding, in 1846, Talbot lost one of his chief motivations for attempting to reach a mass market. Lady Elisabeth realized the importance of bringing photography before a wider public, but her son was more reticent about public exposure and was content to work quietly in private. *The Pencil of Nature* was suspended after six of its planned twelve parts. In 1849, working with the chemist Thomas Malone, Talbot retained hope that the concept of printing in silver might be redeemed by improved processing. However, it was becoming clear to him that the basic concept was flawed. Editions of prints in silver, no matter how carefully they were produced, remained vulnerable. His print-out prints on uncoated paper, with their exceptionally delicate silver deposits, could never be relied upon in the long run. And permanence, the ability to transmit knowledge down through the ages, was the very essence of the book.

THE BEGINNINGS OF PHOTOGRAVURE

It is not clear exactly when Talbot began to think in terms of using printer's ink instead of silver, for there are scattered references to printing plates throughout Talbot's earliest research notes. Even in 1838, on the very threshold of photography's debut with the public, he recorded a scheme for using the heat of the sun's rays to make a printing plate: "let a shadow of a plant be thrown on a copper plate covered with wax or something more fusible, so that the heat of the sun may uncover the plate by melting the wax. Then let it be etched with aqua fortis. Some amalgams are fusible at that low temperature, & might answer better."[8] Right from the beginning of 1839, paralleling his work in photography on silver, one can find references in his notebooks to the production of metal plates. It seems likely that Talbot was influenced by the scanty information emerging from Paris. He knew that Daguerre operated on metal plates, yet he did not know how or even why. Photography became such a success for Talbot by 1840 that it is difficult to assess how much importance he himself put on scattered references in his notes to printing plates. However, with photography on silver becoming more troublesome by the late 1840s, one manuscript document of his stands out. On 28 November 1847, Talbot drafted a "Proposed method of transferring Photography to Steel Engraving."[9] Not a very practical process (it involved selectively corroding a plate through the action of electricity), nonetheless the direction of its stated intent was clear. That goal was to be manifested in a patent application five years later. Looking back at this period, his son Charles concluded that "the precise date at which Talbot first turned his attention to the photographic etching of metal plates cannot be exactly determined…his family remember that he was actively engaged in experiments in 1852," and, indeed, it is from this date that we can begin to map out his progress.[10]

PHOTOGRAPHIC ENGRAVING (1852)

The first clearly identifiable photogravure process was laid out in Talbot's patent No. 565, titled *Improvements in the Art of Engraving*; he filed the preliminary specifications on 29 October 1852 and finalized them on 24 January 1853. The patent consisted of producing a photographic image on a metal plate, using this image as a *resist* to control the etching of that plate, and then printing the resulting plate using a conventional printing press and standard printer's ink. He

restricted his description to steel plates, mentioning in passing that zinc plates or lithographic stones might also be used, but notably he made no reference to copper plates at this time.

The photographic part of this process was a refinement of Mungo Ponton's 1839 discovery that potassium bichromate could be used to make an image.[11] Once the blank steel plate was carefully cleaned, Talbot coated it with a warm solution of gelatin and potassium bichromate in water, spreading it evenly with a glass rod. The plate was then dried with gentle heat, leaving a thin uniform yellow-orange film of bichromated gelatin. This operation had to be conducted in reduced light, for the plate was now light sensitive. An object such as a leaf, or a photographic positive, was superimposed on the plate under a sheet of glass and the sandwich was placed in daylight for a period of half a minute to five or more minutes. When removed from the light, the plate would exhibit a very weak image, remaining orange where the object blocked the light, but having turned a muddy green where light exerted its action. This greenish image actually represented areas of the gelatin that had been *tanned* or hardened by the action of the bichromate under the influence of light. This hardening had the effect of raising the melting point of the gelatin in the exposed areas, thereby making it less permeable to water. A brief wash in warm water removed the unhardened areas of gelatin, leaving a photographic image on the plate. Dark areas of the original were rendered as bare metal, whereas the lighter areas were protected by a film of hardened gelatin. Talbot then etched this with a solution of platinum bichloride brushed on the plate. Within a minute or two, the acidic solution ate away the steel in the areas lacking the protection of a gelatin layer, leaving shallow pits in the surface of the steel wherever there had been dark areas in the original. A vigorous scrubbing removed the remaining gelatin and any residual chemicals. At this point, photography's work was done. It had performed its magic of transferring nature and the resulting plate could be printed commercially just like any conventional engraving.

This *photographic engraving* process (as it was termed in the popular press) showed great promise in Talbot's quest to harness nature as his etcher, in much the same way as he had previously sought her aid in his sketching through the invention of photography. Results with fine opaque objects such as grasses were truly beautiful. Talbot had invented the first photogravure process.

THE HALF-TONE DOT

As promising as it was, Talbot's *photographic engraving* process had serious shortcomings, poorly reproducing intermediate tones and failing in larger areas of high density. Part of the difficulty stemmed from the fact that the gelatin began hardening from the outer surface, not always reaching down to the surface of the plate. When the exposed plate was washed, some of the middle tones were undercut and lost. Other than employing thin layers and cautious washing, there was little Talbot could do about this (the resolution of this problem would come decades later with the use of carbon transfer tissue). This was further complicated by a mechanical effect. Broad dark areas were reproduced by a strong outline surrounding a weak inner expanse. In order to print any *intaglio* plate, it is first covered with ink and then the excess is wiped off with a cloth or with a blade (called a doctor) prior to printing. Surface tension over a broad area causes the ink to cling to the blade or cloth and literally be pulled out of the trough, leaving only the ink clinging to the periphery of the area.

In order to overcome this problem, Talbot suggested applying an aquatint ground, although there is little evidence that he practiced this with any regularity. By dusting the etched plate with a resin powder, and then melting it into the surface, he could create a fine granularity that would retain the ink. But this innovation was eclipsed by one of Talbot's brilliant observations. He recorded that "when the object placed on the steel plate to be engraved is a piece of black crape or gauze, an engraving of it is obtained…which truly depicts the object, representing every thread in its proper place by a corresponding engraved line; but when two or three thicknesses of this gauze are employed instead of one, and are placed obliquely to each other at various angles, then the resulting engraving offers a mass of lines intersecting each other in different directions which cover the whole plate, and which, when printed off upon paper, produced a result which, to an eye at a little distance, appears like a uniform shading." He was able to turn this phenomenon to good effect by sensitizing his steel plate and placing it in the sun under two or three folds of fine cloth. Within a minute or two a complex image of the crossed threads covered the plate. Without any processing, he next placed his broad leaf of a plant, or a photographic positive, on the plate and returned it to the sun. In those areas of the background where the light could now reach the gelatin, the pattern of the cloth was obliterated by full exposure. When the plate was brought back into the darkened room, the background was uniformly hardened gelatin, but the previous image of the cloth was retained in those areas where the leaf blocked the second

exposure to sunshine. After etching, "when this is printed off, the impressions offer the appearance of a leaf nearly uniformly shaded."

Talbot had invented the essence of the half-tone dot.[12] By breaking up large tonal areas into small dots, he created a way for a single ink of standard density to provide the appearance of intermediate grays. In addition to common gauze, Talbot experimented with various finely woven cloths and with mechanically ruled lines and screens.[13] "These things, which I believe have not been heretofore used in the fine arts, I would denominate photographic screens or veils." Although an aquatint ground could also be used, this was tricky and had to be applied to each plate, whereas Talbot pointed out that a single *photographic veil* could serve for numerous plates. The noted photohistorian and printing historian, Edward Epstein, observed that "Talbot was not only the first to use potassium bichromated gelatin on metal (steel), but he was also the first to employ both the term and the use of 'photographic screens.' Historically this lays the foundation of the present-day reproduction processes."[14]

These early *photographic engravings* have several distinguishing characteristics. Like Talbot's earliest contact *photogenic drawing negatives*, their subject matter was dominated by botanical specimens and pieces of fabric. For a brief period at the beginning, Talbot also produced positives from his own earlier calotypes. In many ways, his cameraless original images are the most seductive to us now, tying his new invention back to his first one, but Talbot soon became caught up in creating the perfect printing plate more than in making totally new images. Talbot acquired his own printing press, but he clearly saw his contribution as being in the making of the plates, and most of these he had printed by commercial printers such as George Barclay in London and later Thomas Brooker in London and Alexander Banks in Edinburgh.[15] He soon began relying on glass positives made by other photographers, typically French, and had no concerns about the authorship of the image. Weak inking in broad areas of tonality is a characteristic of his earliest plates. The presence of a *photographic veil* most likely dates a proof to these early years.

PHOTOGLYPHIC ENGRAVING (1858)

It was again a patent that publicly signaled Talbot's next major advance in photogravure. Filed on 21 April 1858 and finalized on 14 October 1858, No. 875 carried the same title as his 1852 patent: *Improvements in the Art of Engraving.* In the text of his patent specification, Talbot declared, "to the processes here described I have given the name of photoglyphic engraving" (from the Greek for carving with light). In an 1858 letter to William Crookes, editor of the *Photographic News*, Talbot explained how he arrived at this name: "the new art has received the name of Photoglyphic Engraving an appellation suggested by the analogy of Hieroglyphic and some other words – such an engraving can be called simply a Photoglyph if a single term to express it should be found requisite or convenient."[16] For photoglyphic engravings, Talbot repeated the initial steps of his first process, coating a steel, zinc, or now copper plate with bichromated gelatin and exposing this under an object or a positive photograph. But in a radical departure, he did not wash the image before etching, having realized that not only was this unnecessary, but in fact it was "injurious to the beauty of the result...much more beautiful engravings are obtained upon plates which have not been washed, because the more delicate lines and details of the picture have not been at all disturbed." As soon as the exposed plate was removed from the printing frame, he dusted it with resin and heated the plate over an alcohol lamp. This melted the resin but (contrary to expectation) did no damage to the gelatin; in fact, the layer of gelatin facilitated an even coating of resin grains. Talbot claimed that "this process may be called the laying of an aquatint ground upon the gelatine, and I believe it to be a new process." This aquatint ground replaced his *photographic veils*, which had seemed so promising. Perhaps Talbot's goal of making nature be his etcher informed this decision. Talbot's son, Charles Henry, later felt the veils were "discarded, probably because it was a desideratum that the *structure* of the ground should not appear." [17] The random granularity of resin grains was a phenomenon of nature; the artificial pattern of man-made cloth was not.

Talbot had discovered a startling new *etchant* which he called perchloride of iron (ferric chloride). Much cheaper than his original platinum etchant, when compared to the nitric acid commonly employed by engravers, this new etchant had many advantages: it did not discharge noxious fumes, nor did it injure the hands or clothing of the workers, and it could also be adjusted in strength to allow control over the tonalities in etching. It was rapidly adopted by engravers throughout the printing industry. Talbot also conceived of the approach used by photogravure artists to this today. Modern practitioners will keep several different strengths of etchant at hand (loosely called Baumé, after a measure of specific gravity), using each as needed

for a particular plate. Talbot generally worked with three strengths. The first was a saturated solution of ferric chloride. The second had one part of water added to five or six parts of the ferric chloride solution. The third was diluted 50-50. Paradoxically, the strongest solution had the least effect, for the molecules in the saturated solution had a much more difficult time penetrating the gelatin layer and were consequently slow in their action. Dilution with water produced a solution that would penetrate more quickly. Talbot would start etching with a strong solution and then move on to more diluted (more active) ones as needed. This could even be done selectively in areas of unusual density, such as the shadows of buildings.

Unlike his photographs, sold by Henneman and other printsellers, none of Talbot's photogravures was ever offered for commercial sale. His 1858 photogylypic engraving process was sufficiently practical to make its way into actual publications. The steel plates that Talbot used in his first process could hold up to fairly substantial print runs, even into the thousands of prints (although Talbot had no need for so many and most of his photogravures survive in only a handful of prints.) In addition to being expensive and difficult to manipulate, steel plates often did not etch as well as did copper ones. One solution was to use multiple nearly-identical copper plates, replacing each as it wore out after perhaps two hundred prints. A better solution was to make the etching on a copper plate which was then electro-plated with a steel face. Fine etching and a durable printing surface was the result. In the first practical demonstration, multiple plates were used by William Crookes who was so enthusiastic that he included an original example in each copy of the *Photographic News* on two occasions in 1858 and 1859.[18] Talbot additionally published a botanical example in an 1863 article, noting that "if this art had been invented a hundred years ago, it would have been very useful during the infancy of botany, when communications with distant countries were so difficult. It would have been easy for botanical travellers...to have taken with them a small printing-press, and to have worked off a small edition of fifty copies of each engraving they made...it would have greatly aided modern botanists in determining the plants intended by these authors, whose descriptions are frequently so incorrect that they are like so many enigmas, and have proved a hindrance and not an advantage to science."[19]

One of the most interesting practical applications of photoglyphic engraving was by the Scottish Astronomer Royal, Charles Piazzi Smyth. At his request, Talbot produced a large photoglyphic plate to illustrate part of Smyth's official report on his 1856 expedition to Teneriffe; an

additional four photographs were represented by albumen prints. Published in 1863, 250 copies were sent to the Observatory's world-wide list, and an additional 250 photoglyphs were distributed at that year's meeting of the British Association for the Advancement of Science. As Smyth astutely observed in his introduction, "to the inventor alike of photography and photoglyphy, it must be comparatively indifferent by which of his two methods these unusual Teneriffe landscapes are introduced into this book, though to readers in a future century it may make a great difference; for the photoglyph must last as long as the paper it is printed on, but the photograph may go the way of some of those beautiful specimens exhibited last year at the International Exhibition, and which faded before the eyes of the nations then assembled."[20] In fact, Talbot was awarded a medal for photoglyphic engraving at this same 1862 International Exhibition.

Examples from the period of *photoglyphic engraving* tend to be made from other photographer's glass positives (as previously mentioned, these were often French); the most common size was a half-stereo plate. They will usually exhibit an aquatint ground, normally easily visible under magnification. Experimental examples from the early 1860s often have a very faint three digit number scratched into the plate. Reproduced in reverse just outside the image area, these hair-line numbers correlate to surviving Talbot notes, and make it possible not only to date the plate, but often allow precise identification of the working procedure.

"PHOTO-SCULPSIT" (ca. 1866)

In the late 1850s and into the 1860s Talbot increasingly resided in Scotland, in and around its capitol of Edinburgh. An important center of printing activity, Edinburgh provided industrial resources critical for Talbot's productions, along with a pool of talented people from whom he could draw inspiration for his researches. Although Talbot's public contacts became less frequent, it is clear from his correspondence and notes that his interest in photogravure was central to his intellectual activities. In 1861, his daughter Rosamond wrote excitedly about the possibility of renting Millburn Tower, on the railway line just west of Edinburgh. The family found it quite agreeable, "but what would please you, Papa, beyond anything is the existence of a large empty room, separated from, though close to the house, with three south windows looking out on the garden, and a good fire-place, just the place for your engravings."[21]

In 1877, the publishers of a translation from the French of Tissandier's *History of Photography* asked Talbot to write an appendix, balancing the story from an English perspective.[22] In parts I and II, Talbot covered his invention of *photogenic drawing* and the subsequent improvement of the *calotype* process. His third section was to be devoted to *photoglyphic engraving*. In connection with this, Talbot supplied a thousand copies of two different photoglyphic engravings so that originals could be bound into each copy of Tissandier. On 12 September 1877, the publishers received a letter from Talbot, saying that he had not been feeling well, but that "the third part is in preparation & will complete the Appendix."[23] Within the week, however, on 17 September, Henry Talbot died. His son, Charles Henry, searched carefully for the draft manuscript but could not locate it. He covered his father's work in photoglyphic engraving the best he could, summarizing the contents of the 1852 and 1858 patents. More importantly, he revealed some details of his father's last process: the standard method of producing the aquatint ground "was uncertain and troublesome, and was superseded by a much better and very ingenious method, discovered since the enrollment of the specification in 1858, and never yet published. Common resin and camphor are dissolved in chloroform." Pouring this on the exposed plate, "the chloroform immediately evaporates, leaving a film of resin and camphor on the surface of the gelatine. The plate is then warmed over a spirit lamp, which causes the camphor to evaporate, leaving the resin in minute particles adhering to the surface of the gelatine. This method insures a much more even distribution of the resin than the former."[24] In a later letter, Charles Henry revealed that his father's final process "was within my knowledge, though not published by him. He must have devised it after taking out his last patent, and would not allow me to divulge it, under the impression, I suppose, that it might possibly be included in some future patent. He remembered that "there were occasional small explosions of the camphor vapour during the plate-warming." These did not seem to hurt the plate! "Also, my father's latest practice was to employ, not steel, but copper plates, and to have them afterwards coated with steel."[25]

The origin of the term *Photo-sculpsit* (sculpted by light) for this family of later processes is a mystery. Talbot's son, Charles Henry, opined that it was introduced in 1877 by the publishers of *Tissandier*: "the word photosculpsit was probably introduced on the plates, in the absence of instructions from M^{r} Talbot as to the lettering. He invariably called his invention photoglyphic engraving, and would not be likely to suggest the above word, which is open to the objection that

photosculpture has been adopted to denote another and a totally different process."[26] But this cannot be correct, for the term was in use by 1866, well within Talbot's lifetime (see item 53). It does not appear anywhere in Talbot's correspondence and thus far has not been traced in any of his research notes.[27] Perhaps Talbot did approve of it or even conceived it, or perhaps the unknown publisher of the 1866 prints applied it and Talbot objected to it then, but Sampson Low picked it up in ignorance after his death. In any case, the prints from this third period are less common but in some cases easily identified. Under magnification, swirl marks from the liquid aquatint are visible. The structure of the ground is more worm-like than the sandy appearance of the 1858 grounds. Most strikingly, the best of Talbot's photogravures from this period approach the standard of quality of later productions by artists such as J. Craig Annan.[28] In the last years of his life, Talbot achieved a number of large (whole plate size) architectural views with fine detail, full tonality, and an evenness of tone.

In 1859, Warren Beatty of Dublin observed that he had "from time to time tried all the processes for engraving of photographic pictures, including the daguerreotype: and, as a practical engraver and a photographer of upwards of twenty years' practice, I consider the photoglyphic process far superior to all others…I consider that this, the last of the many inventions and improvements of Mr. Fox Talbot, crowns the capital of photography." [29] A short time later he called photoglyphy "one of the most extraordinary of the many remarkable inventions of the present age," saying that Talbot was a man "to whom photography owes nearly all its beauties…the results to science, art, and education, which must flow from the practical development of this new process…cannot be easily foreseen…Science…has called into action the finger of nature, ever faithful and true, and inscribed upon her production, not the words 'painted by Nicholl, and engraved by Beatty,' but 'painted by light, and engraved by chemistry'." [30]

When Henry Talbot announced the first of his photogravure work in 1852, he modestly claimed that "I have recently had the good fortune to advance another step in the path of photographic discovery...I am in hopes that what I have accomplished will prove of great practical utility."[31] And of great practical utility it would be. In 1879, just two years after Talbot's death, Karl Klí_ introduced his *photogravure* process, based so closely on Talbot's inventiveness and creativity that it became known as the *Talbot-Klí_ process*.[32] For Henry Talbot, photogravure had been the logical evolution of his original invention of photography. Nature would not only do his

sketching for him, but would transform these sketches into editions in permanent – and beautiful – printer's ink.

"Etchings of Light" written as the introduction to the exhibition catalog, *Sun Pictures; Talbot and Photogravure* that accompanied an exhibition of the same title at the gallery, Hans Kraus, Jr., in October of 2003. Included in this catalog is a selection of outstanding Fox Talbot photogravures and it alone is an invaluable resource for anyone serious about studying the history of photogravure.

Many thanks to Dr. Schaaf and Hans Kraus for allowing the inclusion of this important essay on this site and their continued support.

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[1] "Fine-Art Gossip," *Brighton Gazette*, 28 October 1858, p. 7.

[2] Charles Henry Talbot, "Some Account of Fox Talbot's Process of Photographic Engraving," *Penrose's Pictorial Annual,* v. 8, 1902-1903, p. 9.

[3] The largest collection of Talbot's printing plates and photomechanical prints is held at the National Museum of Photography, Film & Television in Bradford, England; this is the collection formerly in the Science Museum in London. It was actually his interest in photomechanical processes that led Alexander Barclay, a curator at the Science Museum, to approach Matilda Talbot in the 1930s about donating her grandfather's work. Proportionately, he selected more of Talbot's work in ink than he did his work in silver. Barclay intended to publish on this subject but never really completed any text. The first significant analytical publication in this area was done by A.J. Bull and H. Mill Cartwright, "Fox Talbot's Pioneer Work in Photo-Engraving," *The Photographic Journal*, v. 77, May 1937, pp. 307-313. This was later expanded on by Eugene Ostroff, curator of photography at the Smithsonian Institution. See his "Etching, Engraving & Photography: History of Photomechanical Reproduction," *The Journal of Photographic Science,* v. 17 n. 1, 1969, pp. 65-80; and his "Photography and Photogravure: History of Photomechanical Reproduction," v. 17 n. 4, 1969, pp. 101-115.

[4] An excellent guide to modern practice, recording the personal experiences of a photogravure artist, is Johan DeZoete's *A Manual of Photogravure: A Comprehensive Working-Guide to the Fox Talbot Klí_ Dustgrain Method*, translated by Christopher Harrison (Haarlem: Joh. Enschedé, 1988).

[5] For Talbot, the retouching of photographic negatives and prints was anathema. This contrasted, for example, with the attitude of the artist and photographer David Octavius Hill. See Larry J. Schaaf, "Science, Art and Talent: Henry Talbot and Hill & Adamson," *History of Photography*, v. 27 n. 1, Spring 2003, pp. 13-24.

[6] See the discussion of this in Larry J. Schaaf, *Introductory Volume to the Anniversary Facsimile of H. Fox Talbot's The Pencil of Nature* (New York: Hans P. Kraus, Jr., 1989), pp. 40-42.

[7] These were issued in the June 1846 *Art-Union*, v. 8. In the July issue, the editor explained that "the whole of the Talbotypes issued with the June Number of the ART-UNION were taken from the actual objects they represent; they were, strictly, copies from NATURE; in no case had a print been made use of for the purpose of transfer. It is needless to state that prints or drawings may be easily multiplied by this process; but Mr. Talbot, in selecting examples for our Journal, carefully omitted all specimens of that class - confining himself entirely to SUN-PICTURES FROM NATURE." p. 195.

[8] Talbot, *Notebook O*, entry for 21 January 1838. The Fox Talbot Museum, Lacock.

[9] LA47-95, Fox Talbot Museum, Lacock.

[10] Charles Henry Talbot, "Some Account of Fox Talbot's Process of Photographic Engraving," *Penrose's Pictorial*

Annual, v. 8, 1902-3, p. 9.

[11]Although modern usage among chemists favors dichromate over bichromate, the historic term will be found in most literature on the subject and has been employed throughout this text. Although he pioneered the use of bichromate to make images, Ponton had no idea of the role that it could play in hardening substances such as gelatin. He merely soaked plain paper with the bichromate and exposed it to light, yielding a weak image, but no physical effect that could be further applied. Mungo Ponton, "Notice of a cheap and simple method of preparing paper for photographic drawing, in which the use of any salt of silver is dispensed with," Read before the Society, 29 May 1839, *Transactions of the Royal Scottish Society of Arts*, v. 1, pp. 336-338.

[12] While Talbot's procedure differed from modern half-tone practice, the conceptual basis was the same. When the nineteenth century printing historian William Gamble wrote his "History of the Half-tone Dot," he pointed out that "it matters not whether the screen be of gauze, or of ruled lines, or of geometrical stipple, or irregular stipple, there are underlying principles common to all...the object in all cases is to break up the photographic image into a grain...the credit of the idea of breaking up the tones by means of a screen undoubtedly belongs to Fox Talbot, who...suggests fully what was afterwards adopted in the practice of the half-tone process." *The Photographic Journal,* n.s. v. 21 n. 6, 6 February 1897, pp. 126-127.

[13] Talbot's screen was actually too fine for the printing techniques of the day. In modern times, Harold White enlarged Talbot's screen somewhat and successfully used it to print a copy of an Antoine Claudet portrait daguerreotype of Talbot. The successful experiment is reproduced in Harold White, "A Note on W.H. Fox Talbot and Photo-engraving," *Journal of the Printing Historical Society*, n. 13, 1978/1979, pp. 64-66. White's creation was convincing – it was mistakingly published as an original Talbot in Hubertus von Amelunxen's *Die Aufgehobene Zeit; Die Erfindung der Photographie durch William Henry Fox Talbot*, with Michael Gray, "Zunächst verborgen, erscheine ich schließlich doch" (Berlin: Verlag Dirk Nishen, 1988), p. 31.

[14] Edward Epstein, "William Henry Fox Talbot," *The Photo-Engravers Bulletin*, v. 23 n. 11, June 1934, p. 29.

[15] These practical men also supplied a good deal of information to Talbot and greatly influenced the course of his work. This is best seen in his correspondence with them. Full transcriptions of Talbot's letters will be published late in 2003 by the Talbot Correspondence Project at the Univeristy of Glasgow; for progress on this, see http://www.foxtalbot.arts.gla.ac.uk.

[16] Letter, Talbot to William Crookes, 16 September 1858. LA58-75, Fox Talbot Museum, Lacock. *Talbot Correspondence Project Document No. 07695*.

[17] Charles Henry Talbot, "Some Account of Fox Talbot's Process of Photographic Engraving," *Penrose's Pictorial Annual,* v. 8, 1902-3, p. 13.

[18] One of seven half-stereo sized plates from negatives by the Parisian photographers Clouzard & Soulier was included in *The Photographic News*, v. 1 n. 10, 12 November 1858. A larger print of the Tuilleries was included in the issue of 16 September 1859.

[19] Talbot, "Photoglyphic Engraving of Ferns; with Remarks," *Transactions of the Botanical Society of Edinburgh*, v. 7, June 1863, pp. 568-570. This was not their first photoglyph, however. Charles Piazzi Smyth included one of "Young Dragon Trees, near Orotava, Teneriffe" to illustrate his "On the Manner of Growth of Dracæna Draco in its Natural Habitat, as Illustrating some Disputed Points in Vegetable Physiology," *Transactions of the Botanical Society of Edinburgh*, v. 1, March 1859, pp. 250-261, plate 4.

[20] Charles Piazzi Smyth, *Astronomical Observations made at the Royal Observatory, Edinburgh*, v. XII, 1855-1859 (Edinburgh: Neill and Company, 1863). For a fuller discussion of Talbot's experiments in this period, see Larry J. Schaaf, "Piazzi Smyth at Teneriffe: Part 2, Photography and the Disciples of Constable and Harding," *History of Photography,* v. 5 n. 1, January 1981, pp. 27-50.

[21] Letter, Rosamond Talbot to Henry Talbot, 9 March 1861. LA61-40, Fox Talbot Museum, Lacock. *Talbot Correspondence Project Document No. 08331*.

[22] Gaston Tissandier, edited by J. Thomson, *A History and Handbook of Photography,* second and revised edition (London: Sampson Low, Marston, Searle, & Rivington, 1878); Talbot's appendix is on pp. 345-382.

[23] A zinc plate facsimile of this letter is reproduced on p. 367 of Tissandier.

[24] Tissandier, p. 372.

[25] Charles Henry Talbot, letter of 29 January 1893, "Fox Talbot's Photoglyphic Process," *The British Journal of Photography,* 3 February 1893, pp. 76-77.

[26] Manuscript note in Charles Henry Talbot's hand, collection of the Royal Photographic Society, now in the NMPFT. The process he refered to, a mechanical technique for producing busts, was invented by François Willème and patented in France in 1860.

[27] As mentioned previously, these are voluminous, complex, scattered between several collections, uncatalogued, and for the most part, unexamined.

[28] See Larry J. Schaaf, *Sun Pictures Catalogue Eleven: St. Andrews and Early Scottish Photography Including Hill & Adamson* (New York: Hans P. Kraus, Jr., 2002), pp. 79-80.

[29] Francis Beatty, letter to the editor, *The Photographic Journal*, v. 6 n. 92, 15 December 1859, p. 111.

[30] *The Northern Whig, Belfast*, 28 December 1859.

[31] Talbot, letter of 4 April 1853, "Photographic Engraving," *The Athenaeum,* n. 1328, 9 April 1853, pp. 450-451. *Talbot Correspondence Project Document No. 06749*.

[32] Fascinating magnified photographs vividly demonstrate the similarity between Talbot's etching, Klí_'s commercial method, and twentieth century rotogravure when it was at the height of its glory in A.J. Bull and H. Mill Cartwright, "Fox Talbot's Pioneer Work in Photo-Engraving," *The Photographic Journal*, v. 77, May 1937, pp. 307-313.