William Henry Fox Talbot

"Some Account of the Art of Photogenic Drawing" 1839

William Henry Fox Talbot (1800–1877), an English mathematician, scientist, and linguist, began experiments with photography in 1833 with objects placed directly on sensitized paper and exposed to the sun. He proceeded to work with the camera obscura; a tiny negative of a window, taken in 1835, still survives. Evidently he did not know of Daguerre's research until the announcement of 1839; he hurriedly delivered a paper on his work to establish priority. Shortly thereafter he began printing from his paper negatives. In the result lay the future of photography, but for the moment, the daguerreotype held the field. Talbot later invented a process that was the forerunner of photomechanical reproduction.

1.

In the spring of 1834 I began to put in practice a method which I had devised some time previously, for employing to purposes of utility the very curious property which has been long known to chemists to be possessed by the nitrate of silver; namely, its discoloration when ex-

posed to the violet rays of light. This property appeared to me to be perhaps capable of useful application in the following manner.

I proposed to spread on a sheet of paper a sufficient quantity of the nitrate of silver, and then to set the paper in the sunshine, having first placed before it some object casting a well-defined shadow. The light, acting on the rest of the paper, would naturally blacken it, while the parts in shadow would retain their whiteness. Thus I expected that a kind of image or picture would be produced, resembling to a certain degree the object from which it was derived. I expected, however, also, that it would be necessary to preserve such images in a portfolio, and to view them only by candle-light; because if by daylight, the same natural process which formed the images would destroy them, by blackening the rest of the paper.

Such was my leading idea before it was enlarged and corrected by experience. It was not until some time after, and when I was in possession of several novel and curious results, that I thought of inquiring whether this process had been ever proposed or attempted before? I found that in fact it had; but apparently not followed up to any extent, or with much perseverance. The few notices that I have been able to meet with are vague and unsatisfactory; merely stating that such a method exists of obtaining the outline of an object, but going into no details respecting the best and most advantageous manner of proceeding.

The only definite account of the matter which I have been able to meet with, is contained in the first volume of the Journal of the Royal Institution, page 170, from which it appears that the idea was originally started by Mr. Wedgwood, and a numerous series of experiments made both by him and Sir Humphry Davy, which however ended in failure. I will take the liberty of quoting a few passages from this memoir.

" The copy of a painting, immediately after being taken, must be kept in an obscure place. It may indeed be examined in the shade, but in this case the exposure should be only for a few minutes. No attempts that have been made to prevent the uncoloured parts from being acted upon by light, have as yet been successful. They have been covered with a thin coating of fine varnish; but this has not destroyed their susceptibility of becoming coloured. When the solar rays are passed through a print and thrown upon prepared paper, the unshaded parts are slowly copied; but the lights transmitted by the shaded parts are seldom so definite as to form a distinct resemblance of them by producing different intensities of colour.

" The images formed by means of a *camera obscura* have been found to be too faint to produce, in any moderate time, an effect upon the

nitrate of silver. To copy these images was the first object of Mr. Wedgwood, but all his numerous experiments proved unsuccessful."

These are the observations of Sir Humphry Davy. I have been informed by a scientific friend that this unfavourable result of Mr. Wedgwood's and Sir Humphry Davy's experiments, was the chief cause which discouraged him from following up with perseverance the idea which he had also entertained of fixing the beautiful images of the *camera obscura*. And no doubt, when so distinguished an experimenter as Sir Humphry Davy announced " that all experiments had proved unsuccessful," such a statement was calculated materially to discourage further inquiry. The circumstance also, announced by Davy, that the paper on which these images were depicted was liable to become entirely dark, and that nothing hitherto tried would prevent it, would perhaps have induced me to consider the attempt as hopeless, if I had not (fortunately) before I read it, already discovered a method of overcoming this difficulty, and of *fixing* the image in such a manner that it is no more liable to injury or destruction.

In the course of my experiments directed to that end, I have been astonished at the variety of effects which I have found produced by a very limited number of different processes when combined in various ways; and also at the length of time which sometimes elapses before the full effect of these manifests itself with certainty. For I have found that images formed in this manner, which have appeared in good preservation at the end of twelve months from the time of their formation, have nevertheless somewhat altered during the second year. This circumstance, added to the fact that the first attempts which I made became indistinct in process of time (the paper growing wholly dark), induced me to watch the progress of the change during some considerable time, as I thought that perhaps *all* these images would *ultimately* be found to fade away. I found, however, to my satisfaction, that this was not the case; and having now kept a number of these drawings during nearly five years without their suffering any deterioration, I think myself authorized to draw conclusions from my experiments with more certainty.

2. EFFECT AND APPEARANCE OF THESE IMAGES

The images obtained in this manner are themselves white, but the ground upon which they display themselves is variously and pleasingly coloured.

Such is the variety of which the process is capable, that by merely varying the proportions and some trifling details of manipulation, any of the following colours are readily attainable:

Sky-blue,	Brown, of various shades,
Yellow,	Black.
Rose-colour,	

Green alone is absent from the list, with the exception of a dark shade of it, approaching to black. The blue-coloured variety has a very pleasing effect, somewhat like that produced by the Wedgwood-ware, which has white figures on a blue ground. This variety also retains it colours perfectly if preserved in a portfolio, and not being subject to any spontaneous change, requires no preserving process.

These different shades of colour are of course so many different chemical compounds, or mixtures of such, which chemists have not hitherto distinctly noticed.

3. FIRST APPLICATIONS OF THIS PROCESS

The first kind of objects which I attempted to copy by this process were flowers and leaves, either fresh or selected from my herbarium. These it renders with the utmost truth and fidelity, exhibiting even the venation of the leaves, the minute hairs that clothe the plant, &c.

It is so natural to associate the idea of *labour* with great complexity and elaborate detail of execution, that one is more struck at seeing the thousand florets of an *Agrostis* depicted with all its capillary branchlets (and so accurately, that none of all this multitude shall want its little bivalve calyx, requiring to be examined through a lens), than one is by the picture of the large and simple leaf of an oak or a chestnut. But in truth the difficulty is in both cases the same. The one of these takes no more time to execute than the other; for the object which would take the most skilful artist days or weeks of labour to trace or to copy, is effected by the boundless powers of natural chemistry in the space of a few seconds.

To give an idea of the degree of accuracy with which some objects can be imitated by this process, I need only mention one instance. Upon one occasion, having made an image of a piece of lace of an elaborate pattern, I showed it to some persons at the distance of a few feet, with the inquiry, whether it was a good representation? when the reply was, " That they were not to be so easily deceived, for that it was evidently no picture, but the piece of lace itself."

At the very commencement of my experiments upon this subject, when I saw how beautiful were the images which were thus produced by the action of light, I regretted the more that they were destined to have such a brief existence, and I resolved to attempt to find out, if

thus prepared will stand the sunshine; while the unpreserved ones, however well they last in a portfolio or in common daylight, should not be risked in a very strong light, as they would be liable to change thereby, even years after their original formation. This very quality, however, admits of useful application. For this semi-durable paper, which retains its whiteness for years in the shade, and yet suffers a change whenever exposed to the solar light, is evidently well suited to the use of a naturalist travelling in a distant country, who may wish to keep some memorial of the plants he finds, without having the trouble of drying them and carrying them about with him. He would only have to take a sheet of this paper, throw the image upon it, and replace it in his portfolio. The defect of this particular paper is, that in general the *ground* is not even; but this is of no consequence where utility alone, and not beauty of effect is consulted.

6. PORTRAITS

Another purpose for which I think my method will be found very convenient, is the making of the outline portraits, or *silhouettes*. These are now often traced by the hand from shadows projected by a candle. But the hand is liable to err from the true outline, and a very small deviation causes a notable diminution in the resemblance. I believe this manual process cannot be compared with the truth and fidelity with which the portrait is given by means of solar light.

7. PAINTINGS ON GLASS

The shadow-pictures which are formed by exposing paintings on glass to solar light are very pleasing. The glass itself, around the painting, should be blackened; such, for instance, as are often employed for the magic lantern. The paintings on the glass should have no bright yellows or reds, for these stop the violet rays of light, which are the only effective ones. The pictures thus formed resemble the productions of the artist's pencil more, perhaps, than any of the others. Persons to whom I have shown them have generally mistaken them for such, at the same time observing, that the *style* was new to them, and must be one rather difficult to acquire. It is in these pictures only that, as yet, I have observed indications of *colour*. I have not had time to pursue this branch of the inquiry further. It would be a great thing if by any means we could accomplish the delineation of objects in their natural colours.

I am not very sanguine respecting the possibility of this; yet, as I have just now remarked, it appears possible to obtain at least *some indication* of variety of tint.

8. APPLICATION TO THE MICROSCOPE

I now come to a branch of the subject which appears to me very important and likely to prove extensively useful, the application of my method of delineating objects to the solar microscope.

The objects which the microscope unfolds to our view, curious and wonderful as they are, are often singularly complicated. The eye, indeed, may comprehend the whole which is presented to it in the field of view; but the powers of the pencil fail to express these minutiæ of nature in their innumerable details. What artist could have skill or patience enough to copy them? or granting that he could do so, must it not be at the expense of much most valuable time, which might be more usefully employed?

Contemplating the beautiful picture which the solar microscope produces, the thought struck me, whether it might not be possible to cause that image to impress itself upon the paper, and thus to let Nature substitute her own inimitable pencil, for the imperfect, tedious, and almost hopeless attempt of copying a subject so intricate.

My first attempt had no success. Although I chose a bright day, and formed a good image of my object upon prepared paper, on returning at the expiration of an hour I found that no effect had taken place. I was therefore half inclined to abandon this experiment, when it occurred to me, that there was no reason to suppose that either the nitrate or muriate of silver, as commonly obtained, was the most sensitive substance that exists to the action of the chemical rays[1]; and though such should eventually prove to be the fact, at any rate it was not to be assumed without proof. I therefore began a course of experiments in order to ascertain the influence of various modes of preparation, and I found these to be signally different in their results. I considered this matter chiefly in a practical point of view; for as to the theory, I confess that I cannot as yet understand the reason why the paper prepared in one way should be so much more sensitive than in another.

The result of these experiments was the discovery of a mode of preparation greatly superior in sensibility to what I had originally em-

1. *Sir H. Davy somewhere says that the iodide is more sensitive, which I have hardly found to be the case in my experiments.*

ployed: and by means of this, all those effects which I had before only anticipated as theoretically possible were found to be capable of realization.

When a sheet of this, which I shall call "*Sensitive Paper*," is placed in a dark chamber, and the magnified image of some object thrown on it by the solar microscope, after the lapse of perhaps a quarter of an hour, the picture is found to be completed. I have not as yet used high magnifying powers, on account of the consequent enfeeblement of the light. Of course, with a more sensitive paper, greater magnifying power will become desirable.

On examining one of these pictures, which I made about three years and a half ago, I find, by actual measurement of the picture and the object, that the latter is magnified seventeen times in linear diameter, and in surface consequently 289 times. I have others which I believe are considerably more magnified; but I have lost the corresponding objects, so that I cannot here state the exact numbers.

Not only does this process save our time and trouble, but there are many objects, especially microscopic crystallizations, which alter so greatly in the course of three or four days (and it could hardly take any artist less to delineate them in all their details), that they could never be drawn in the usual way.

I will now describe the *degree of sensitiveness* which this paper possesses, premising that I am far from supposing that I have reached the limit of which this quality is capable. On the contrary, considering the few experiments which I have made (few, that is, in comparison with the number which it would be easy to imagine and propose), I think it most likely, that other methods may be found, by which substances may be prepared, perhaps as much transcending in sensitiveness the one which I have employed, as that does the nitrate of silver which I used in my first experiments.

But to confine myself to what I have actually accomplished, in the preparation of a very sensitive paper. When a sheet of this paper is brought towards a window, not one through which the sun shines, but looking in the opposite direction, it immediately begins to discolour. For this reason, if the paper is prepared by daylight, it must by no means be left uncovered, but as soon as finished be shut up in a drawer or cupboard and there left to dry, or else dried at night by the warmth of a fire. Before using this paper for the delineation of any object, I generally approach it for a little time towards the light, thus intentionally giving it a slight shade of colour, for the purpose of seeing that the *ground* is *even*. If it appears so when thus tried to a small extent, it will generally be found to prove so in the final result. But if there are some

places or spots in it which do not acquire the same tint as the rest, such a sheet of paper should be rejected: for there is a risk that, when employed, instead of presenting a *ground* uniformly dark, which is essential to the beauty of the drawing, it will have large white spots, places altogether insensible to the effect of light. This singular circumstance I shall revert to elsewhere: it is sufficient to mention it here.

The paper then, which is thus readily sensitive to the light of a common window, is of course much more so to the direct sunshine. Indeed, such is the velocity of the effect then produced, that the picture may be said to be ended almost as soon as it is begun.

To give some more definite idea of the rapidity of the process, I will state, that after various trials the nearest evaluation which I could make of the time necessary for obtaining the picture of an object, so as to have pretty distinct outlines, when I employed the full sunshine, was *half a second*.

9. ARCHITECTURE, LANDSCAPE, AND EXTERNAL NATURE

But perhaps the most curious application of this art is the one I am now about to relate. At least it is that which has appeared the most surprising to those who have examined my collection of pictures formed by solar light.

Every one is acquainted with the beautiful effects which are produced by a camera obscura and has admired the vivid picture of external nature which it displays. It had often occurred to me, that if it were possible to retain upon the paper the lovely scene which thus illuminates it for a moment, or if we could but fix the outline of it, the lights and shadows, divested of all *colour*, such a result could not fail to be most interesting. And however much I might be disposed at first to treat this notion as a scientific dream, yet when I had succeeded in fixing the images of the solar microscope by means of a peculiarly sensitive paper, there appeared no longer any doubt that an analogous process would succeed in copying the objects of external nature, although indeed they are much less illuminated.

Not having with me in the country a *camera obscura* of any considerable size, I constructed one out of a large box, the image being thrown upon one end of it by a good object glass fixed in the opposite end. This apparatus being armed with a sensitive paper, was taken out in a summer afternoon and placed about one hundred yards from a building favourably illuminated by the sun. An hour or two afterwards I opened the box, and I found depicted upon the paper a very distinct

representation of the building, with the exception of those parts of it which lay in the shade. A little experience in this branch of the art showed me that with smaller *cameræ obscuræ* the effect would be produced in a smaller timer. Accordingly I had several small boxes made, in which I fixed lenses of shorter focus, and with these I obtained very perfect but extremely small pictures: such as without great stretch of imagination might be supposed to be the work of some Lilliputian artist. They require indeed examination with a lens to discover all their minutiæ.

In the summer of 1835 I made in this way a great number of representations of my house in the country, which is well suited to the purpose, from its ancient and remarkable architecture. And this building I believe to be the first that was ever yet known *to have drawn its own picture*.

The method of proceeding was this: having first adjusted the paper to the proper focus in each of these little *cameræ*, I then took a number of them with me out of doors and placed them in different situations around the building. After the lapse of half an hour I gathered them all up, and brought them within doors to open them. When opened, there was found in each a miniature picture of the objects before which it had been placed.

To the traveller in distant lands, who is ignorant, as too many unfortunately are, of the art of drawing, this little invention may prove of real service; and even to the artist himself, however skilful he may be. For although this natural process does not produce an effect much resembling the productions of his pencil, and therefore cannot be considered as capable of replacing them, yet it is to be recollected that he may often be so situated as to be able to devote only a single hour to the delineation of some very interesting locality. Now, since nothing prevents him from simultaneously disposing, in different positions, any number of these little *cameræ*, it is evident that their collective results, when examined afterwards, may furnish him with a large body of interesting memorials, and with numerous details which he had not had himself time either to note down or to delineate.

10. DELINEATIONS OF SCULPTURE

Another use which I propose to make of my invention is for the copying of statues and bas-reliefs. I place these in strong sunshine, and put before them at a proper distance, and in the requisite position, a small camera obscura containing the prepared paper. In this way I have

obtained images of various statues, &c. I have not pursued this branch of the subject to any extent; but I expect interesting results from it, and that it may be usefully employed under many circumstances.

11. COPYING OF ENGRAVINGS

The invention may be employed with great facility for obtaining copies of drawings or engravings, or facsimiles of MSS. For this purpose the engraving is pressed upon the prepared paper, with its engraved side in contact with the latter. The pressure must be as uniform as possible, that the contact may be perfect; for the least interval sensibly injures the result, by producing a kind of cloudiness in lieu of the sharp strokes of the original.

When placed in the sun, the solar light gradually traverses the paper, except in those places where it is prevented from doing so by the opake (sic) lines of the engraving. It therefore of course makes an exact image or print of the design. This is one of the experiments which Davy and Wedgwood state that they tried, but failed, from want of sufficient sensibility in their paper.

The length of time requisite for effecting the copy depends on the thickness of the paper on which the engraving has been printed. At first I thought that it would not be possible to succeed with thick papers; but I found on trial that the success of the method was by no means so limited. It is enough for the purpose, if the paper allows any of the solar light to pass. When the paper is thick, I allow half an hour for the formation of a good copy. In this way I have copied very minute, complicated, and delicate engravings, crowded with figures of small size, which were rendered with great distinctness.

The effect of the copy, though of course unlike the original, (substituting as it does lights for shadows, and *vice versa*,) yet is often very pleasing, and would, I think, suggest to artists useful ideas respecting light and shade.

It may be supposed that the engraving would be soiled or injured by being thus pressed against the prepared paper. There is not much danger of this, provided both are perfectly dry. It may be well to mention, however, that in case any stain should be perceived on the engraving, it may be readily removed by a chemical application which does no injury whatever to the paper.

In copying engravings, &c. by this method, the lights and shadows are reversed, consequently the effect is wholly altered. But if the picture so obtained is first *preserved* so as to bear sunshine, it may be

afterwards itself employed as an object to be copied; and by means of this second process the lights and shadows are brought back to their original disposition. In this way we have indeed to contend with the imperfections arising from two processes instead of one; but I believe this will be found merely a difficulty of manipulation. I propose to employ this for the purpose more particularly of multiplying at small expense copies of such rare or unique engravings as it would not be worth while to re-engrave, from the limited demand for them.

I will now add a few remarks concerning the very singular circumstance, which I have before briefly mentioned, viz. that the paper sometimes, although intended to be prepared of the most sensitive quality, turns out on trial to be wholly insensible to light, and incapable of change. The most singular part of this is the very small difference in the mode of preparation which causes so wide a discrepancy in the result. For instance, a sheet of paper is all prepared at the same time, and with the intention of giving it as much uniformity as possible: and yet, when exposed to sunshine, this paper will exhibit large white spots of very definite outline, where the preparing process has failed; the rest of the paper, where it has succeeded, turning black as rapidly as possible. Sometimes the spots are of a pale tint of cœrulean blue, and are surrounded by exceedingly definite outlines of perfect whiteness, contrasting very much with the blackness of the part immediately succeeding. With regard to the theory of this, I am only prepared to state as my opinion at present, that it is a case of what is called " unstable equilibrium." The process followed is such as to produce one of two definite chemical compounds; and when we happen to come near the limit which separates the two cases, it depends upon exceedingly small and often imperceptible circumstances, which of the two compounds shall be formed. That they are both definite compounds, is of course at present merely my conjecture; that they are signally different, is evident from their dissimilar properties.

I have thus endeavoured to give a brief outline of some of the peculiarities attending this new process, which I offer to the lovers of science and nature. That it is susceptible of great improvements, I have no manner of doubt; but even in its present state I believe it will be found capable of many useful and important applications besides those of which I have given a short account in the preceding pages.

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AN EXCERPT

In a century that believed strongly in progress, and in the potential of the machine for conferring good on mankind, photography appeared to some as an almost unlimited blessing, "as great a step in the fine arts as the steam engine was in the mechanical arts." This account extols photography's value to both science and art, as did several early observers. It tries to assess fairly the relative merits and drawbacks of daguerreotypes and Talbotypes, remarking of the latter's painterly qualities that they are a match for Rembrandt's sketches. The first publications concerning photography preserve some of the wonder occasioned by this invention.

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In following the steps of social improvement, and tracing the rise of those great inventions which add to the happiness of our species, we can scarcely fail to recognise the law of progressive development under which the efforts of individual minds are regulated and combined, and by which reason is destined to attain its maximum of power, and knowledge to reach its limits of extension. Under the influence of a similar law, our moral and religious condition is gradually ascending to its climax; and when these grand purposes have been fulfilled—when the high commission of the Saint and the Sage has been executed—