TITLE: **Unlocking the Secret: Hyper-sensitizing Daguerreotypes with Light.**

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INTRODUCTION

One of the best kept secrets of Daguerreotype technology has been that of the effect of light on the speed of the Daguerreotype plate. Fortunately this "Secret of Dark Chamber" has been recently divulged by Bates Lowry in his fascinating article "Secrets of the Light Chamber" published in the 2002-2003 Daguerreian Annual(1).

Although extensively used by such great Daguerreian artists as Southworth and Hawes, this method, which involves painting or lining the interior of the camera with a white paper or paint, was apparently viewed skeptically by many contemporary artists. Fortunately for Daguerreain Society members, the feasibility of this technique has been graphically demonstrated by modern Daguerreotypist Mike Robinson(1).

While this might not induce all modern Daguerreians to rush out to their local Home Depot for a can of white paint, it will certainly lure many to investigate this phenomenon.

Not wanting to be left standing at the gate, I joined this stampeding crowd to confirm and explore this new-old approach to improving the versatility of the Daguerreotype process.

The Daguerreian world may not have given the "light Chamber" its just recognition, but 20th Century photographers have used similar techniques.

Before the development of modern supersensitive photographic films, newspaper photographers of the 1940's and 50's who needed faster film for available light shots, sometimes resorted to pre-flashing with light to hyper-sensitize their film. This method was also used by astronomers and in early spy satellites when the ultimate in high speed photography was required.

Hyper-sensitization (3) is defined as the exposure of a film to light, gases or other chemicals BEFORE the camera exposure. Exposing a film to low intensity light puts silver specks at or just below the minimum number of silver atoms needed for development.

Latensification [3] is a related technique, involving the exposure of film to uniform non-image light ***AFTER*** exposure but before development. The latent image silver specks must contain a certain number of silver atoms to be developable. Adding very weak intensity light can bring a sub-latent silver speck up to the minimum developable level.

The major effect of both techniques is in the shadows, diminishing to zero effect in the highlights. Highlights have received maximum exposure so adding low intensity light has little or no effect.

One website covers current interest in these methods [4].
http://www.google.com/search?hl=en&ie=UTF-8&q=light+fogging+to+hypersensitive+photographic+emulsions&spell=1

In his 1949 book "PHOTOGRAPHY PRINCIPLES AND PRACTICES", C. B. Neblett [5], reported that hyper sensitizing was done with ammonia, mercury, or exposure to a weak light source. An exposure to light of such intensity as to produce a fog density of approx. 0.2 increased the speed 2 xs to 4 xs. The effect was greater on slow emulsions than on faster ones, and contrast was reduced, so greater development was needed.

In his book "The Negative" [6], Ansel Adams describes his method of increasing the sensitivity of film, especially in the shadow areas. He recommended pre-exposing the film at –3 ev to a highlight area and then exposing at -1 ev to the full scene.

Others [4] have recommended an initial exposure at – 3 stops with a sheet of translucent plastic over the lens to boost the deepest zone of the scene from no detail up to "some" detail. One recommendation was to flash the film for 1/10th of a second to light from a 15 watt incandescent bulb covered with a 4 stop ND filter. Various photography magazines[4] featured articles about an in-camera LED pre-flashing technique, claiming it would increase the sensitivity of B/W film by 2 or 3 stops. Also referred to as "Concurrent Photon Amplification", the technique employed tiny lamps at the film plane that exposed the film right as you shot.

PURPOSE

Modern Daguerreotypists all over the world have at one time or another sought to maximize the speed of their plates.
The techniques used usually involve optimizing the ratio of bromine to iodine in the coating process and then allowing the plates to age before exposure[7].

As a confirmed Daguerreian skeptic, I first had to satisfy my curiosity by proving that the white camera method really works. Having done that, I looked at the possible limitations of the original camera modification method. Considering that the application of a white lining to the inside of a normally black camera is a somewhat drastic measure, I decided to explore alternate methods of giving my Daguerreotype plates that little light boost to improve their photographic performance.

Several crucial questions needed to be answered.

- How much light can be applied before the plate ultimately fogs over, and what is the impact on image quality?

- When is the best time other than during the exposure itself, to expose the plate to light?

- Does the extra light only increase the sensitivity of mercury developed Daguerreotypes or can the technique also be used on slower Becquerel developed plates?

The current reputation of the Daguerreotype is that of a technically dead end process, too slow for any practical use? The promise of even a minor improvement in speed seemed to justify further investigation.

WHITE VS BLACK CAMERA INTERIOR

My first objective was to prove to myself that the “white camera” technique really works. I did this by combining an exposure in an ordinary black lined camera, and an exposure in a white lined camera on separate halves of a Daguerreotype, referred to as Plate One. My subject was a random grayscale in direct midday sunlight (EV 15.5).

Prior to exposing the left half of the plate, I lined the camera with a sheet of white inkjet printer paper and gave the plate a 12 second exposure. After the first exposure I removed the white liner gave the right side of the plate a 16 second exposure.

PLATE I

WHITE CAMERA	BLACK CAMERA
EXPOSURE 12 SECONDS @ F/22	EXPOSURE 16 SECONDS @ F/22
ISO = 0.1050	ISO = 0.070

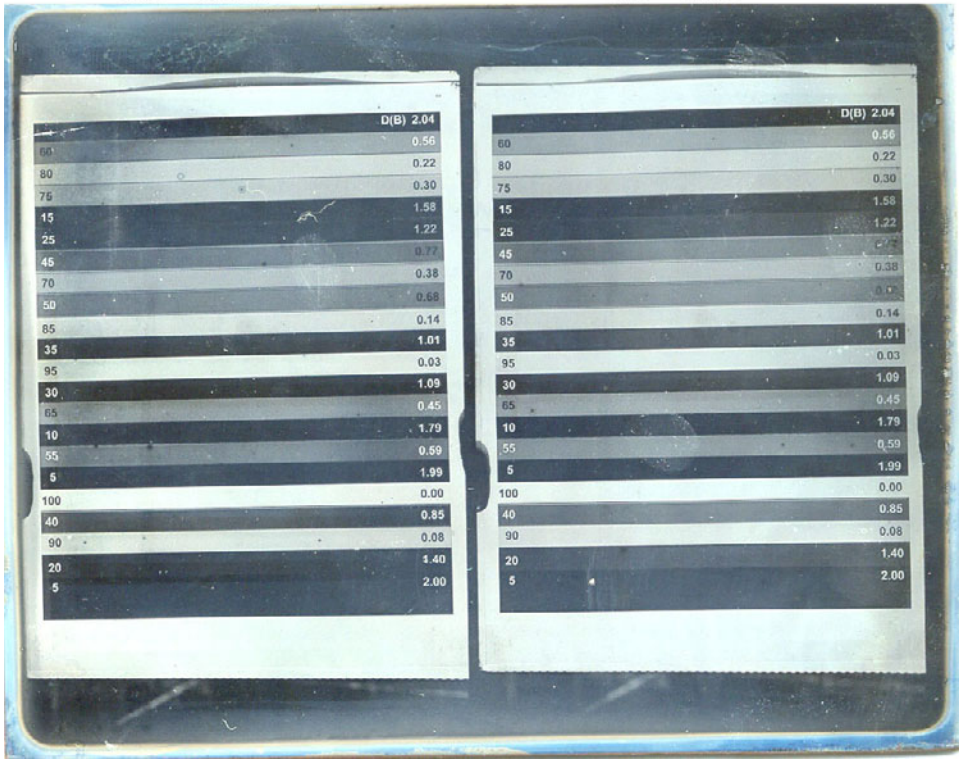
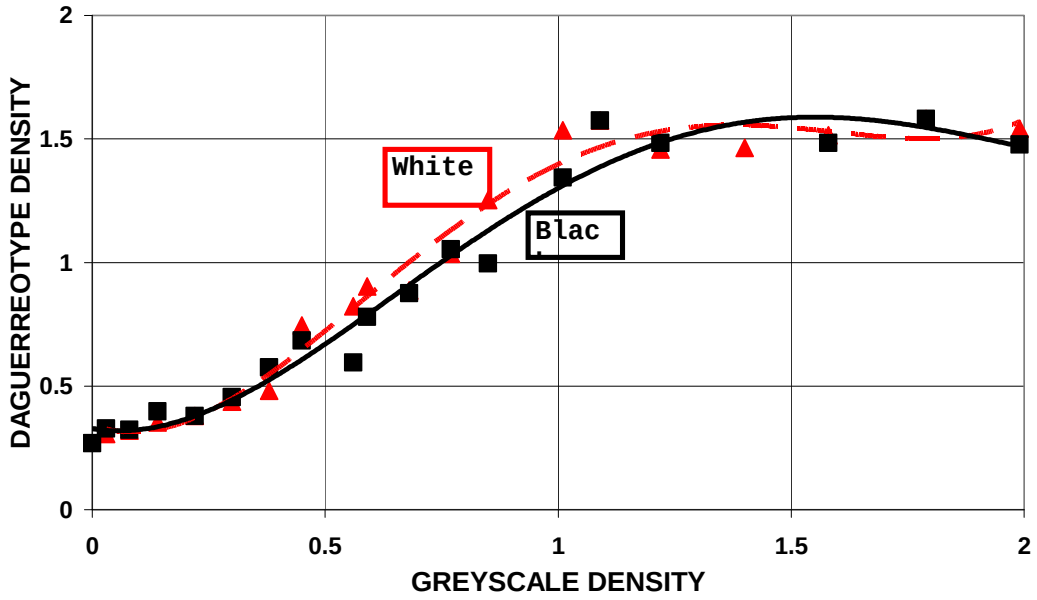


FIGURE 1
DENSITY OF BLACK AND WHITE CAMERA
DAGUERREOTYPES VS GREYSCALE DENSITY



My image density measurements, illustrated in Figure 1, proved that the left half of Plate One that was exposed in the white lined camera required a half stop less exposure than the right half of Plate One that was exposed in a black lined camera. The slope of the density curves are virtually the same, indicating that the increase in speed was achieved with no loss in the contrast of the image.

If exposure to a separate, non-image light source during the primary camera exposure can add a half-stop to the speed of the Daguerreotype, one obvious question arises: would exposure to more non-image white light have an even greater effect of the speed?

In the white lined camera, barring light leaks or lens flare, the amount of supplemental light is directly linked to the primary camera exposure. It is therefore not possible to increase this light hyper-sensitization while at the same time reducing the camera exposure.

A separate camera exposure to a uniform bright subject would provide a means of varying the non-image light exposure independently from the image exposure.

SEPARATE LIGHT EXPOSURE IN CAMERA

To find out if a separate light exposure would work as well as the white camera technique, I tried exposing portions of my next three Daguerreotype plates to a uniform white light source just before the primary exposure. I focused my camera on a sheet of white inkjet paper in bright sunlight. The reflected light intensity was approximately EV 17.5.

By inserting my Seconic Model L-398, light meter into the back of my camera I was able to determine that the incident light intensity at the film plane was approximately 25 foot candles at f/5.6. Thus the light intensity of a pre-exposure flash at an aperture of f/22 would be approximately 1.5 foot candles.

I loaded the plate into the camera holder, and employed the dark slide of plate holder as a mask. I gave each plate up to 4 levels of light flashes, using the camera’s shutter for timing. A series of 3 daguerreotype plates were given in-camera light flashes ranging from a low of 0.3 foot-candle seconds on Plate Two up to up to the maximum of 6.0 fcs on Plate Four,

Within minutes after this light stimulation, I re-focused the camera on the random grayscale in bright sun light. The reflected light intensity was approximately EV 16.5. Then, using the camera’s sliding back, half portions of the Daguerreotype plates were given grayscale image exposures ranging from 12 seconds after the minimum pre-flash down to only 4 seconds @f/22 after the maximum pre-flash.

As the amount of the pre-exposure light flash was gradually increased on each subsequent plate, the corresponding grayscale image exposure was gradually reduced so as to determine the exposure that produced the best image for each level of pre-flash.

PLATE II

EXPOSURE 8 SECONDS @ F/22 — ISO = 0.140

EXPOSURE 12 SECONDS @ F/22 — ISO = 0.105

FLASH 3 fcs | FLASH 1.5 fcs | FLASH 0.75 fcs | FLASH 0.3 fcs

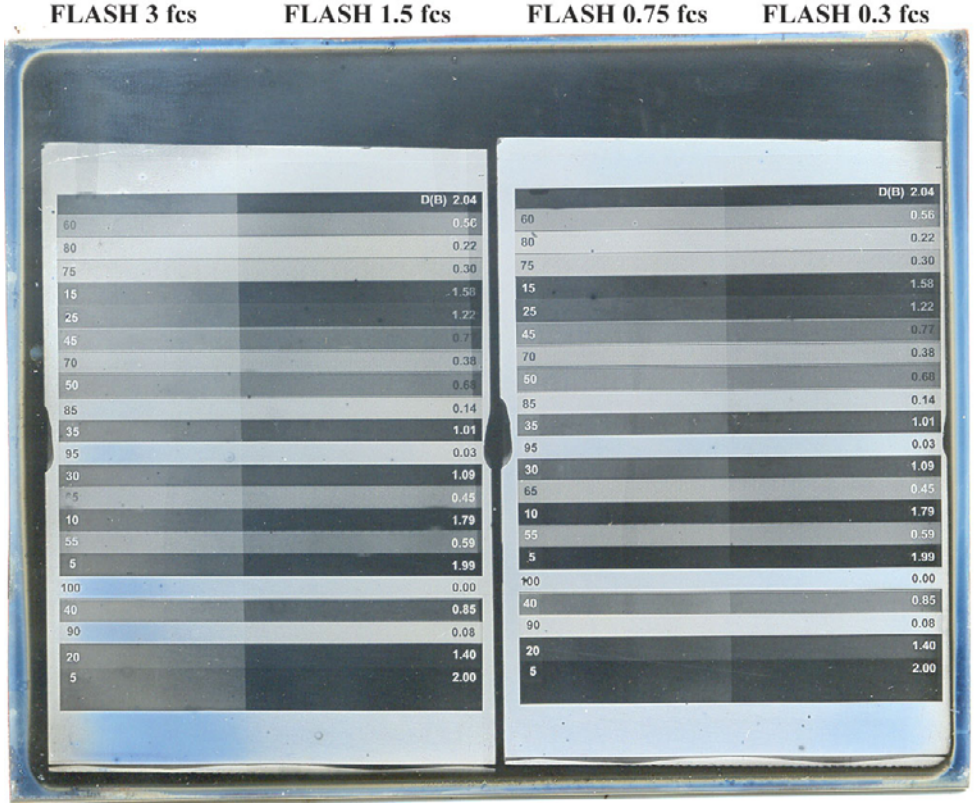
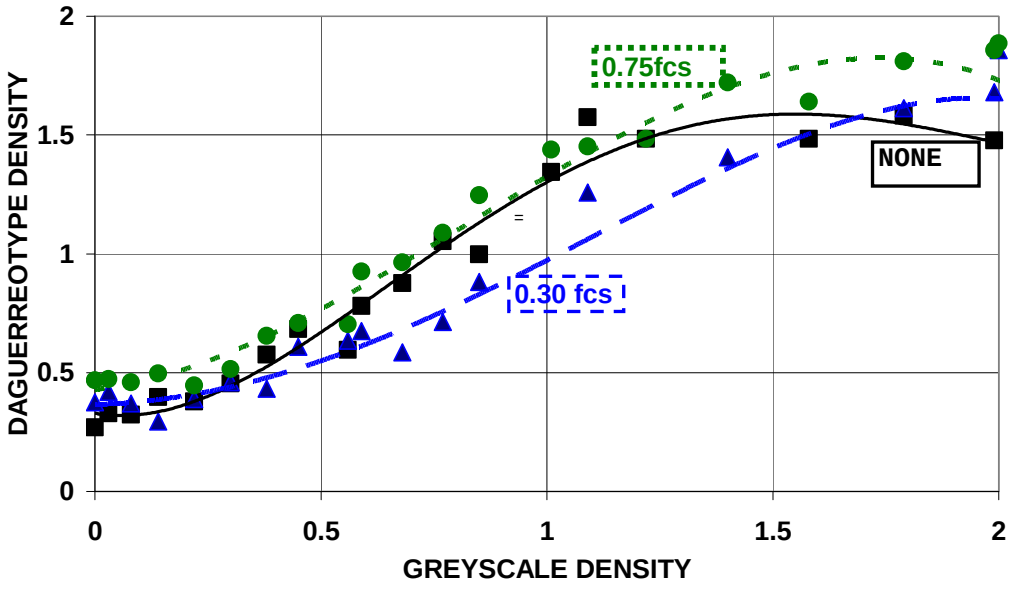


Figure 2 illustrates the density measurement results in Plate Two, the first Daguerreotype in this series of experiments. The far right portion of Plate Two that was given a light flash of 0.30 fcs required an exposure of 12 seconds (ISO = 0.105) The left of center portion of Plate Two that was given a light flash of 1.5 fcs, required an exposure of only 8 seconds (ISO = 0.140).
This proved to me that a separate exposure technique works very well.

I also noticed that a 0.30 fcs light pre-flash effectively duplicated the results that were obtained in the white camera experiment. This indicated to me that the white camera lining reflected approximately 0.3 fcs of light back onto the plate during the exposure.

FIGURE 2
DENSITY OF PRE-FLASHED DAGUERREOTYPES
VS GREYSCALE DENSITY



The density curves of Plate Two, shown in Figure 2 indicate that the increase in speed was achieved with minimal loss of contrast.

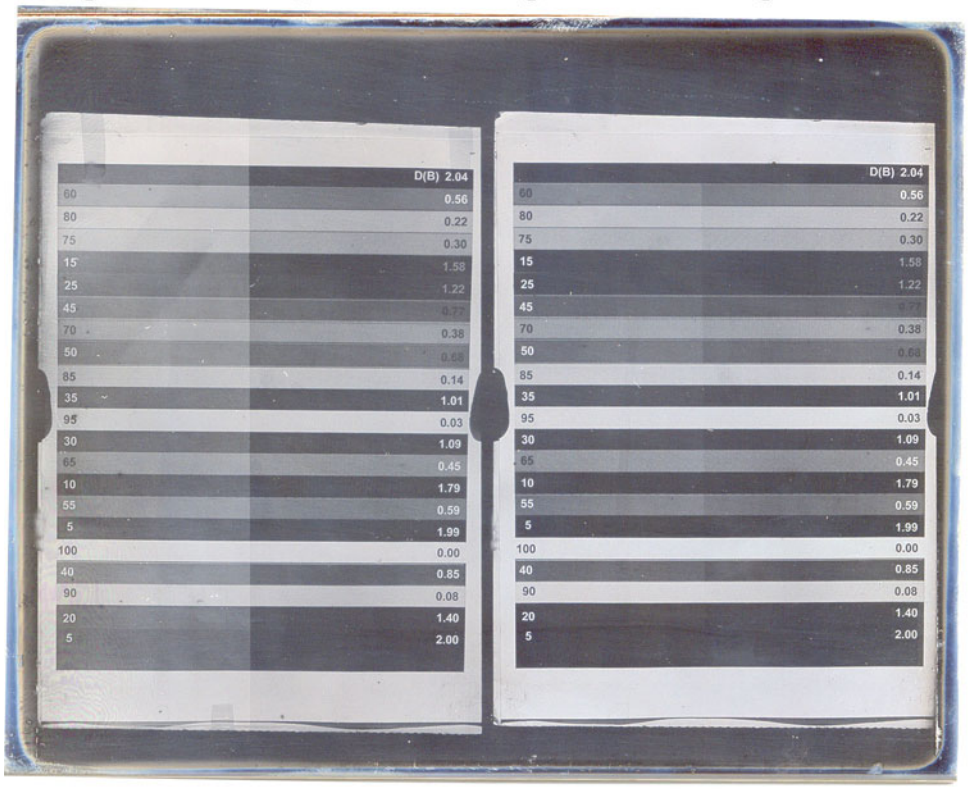
I repeated my experiment on Plate Three, this time increasing the level of pre-flash light to determine its effect on plate sensitivity. Starting with a pre-flash of 0.75 fcs, I gave quarter portions of Plate III pre-flashes of 1.5, 3, or 6 foot candle seconds.

After a few minutes I gave the left half of the plate a grayscale exposure of 6 seconds @f/22 and the right half of the plate a grayscale exposure of 8 seconds.

PLATE III

Exposure 6 seconds @ f/22 **Exposure 8 seconds @ f/22**

Light Flash 6 fcs Light Flash 3 fcs Light Flash 1.5 fcs Light Flash 0.75 fcs



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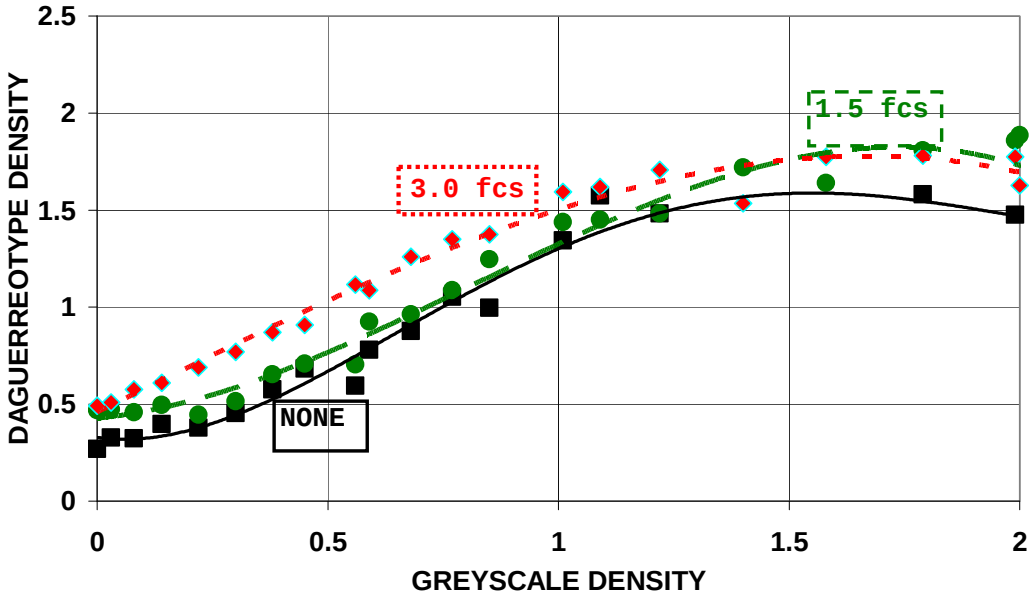
The results of my second experiment in this series are shown in Plate Three. This time the far right portion of the plate that had been given a light flash of only 0.75 fcs produced the best image after an 8 second exposure. Again the effective ISO speed was 0.0150.

The left of center portion of the plate, that had been given a light flash of 3.0 fcs, produced the best image with an exposure of only 6 seconds. The effective ISO speed for this image was 0.0225, twice as sensitive as the white camera Daguerreotype. However the area of the plate that has been pre-flash with 6 fcs appeared slightly fogged.

FIGURE 3
DENSITY OF PRE-FLASHED DAGUERREOTYPES
VS GREYSCALE DENSITY



The density trends in Plate Three, shown in Figure 3, indicate that the increase in speed was not accompanied by a reduction in contrast but there was a significant increase in shadow density. Perhaps I had given the plate too much pre-flash light or possibly I was flashing the plate with a light that was too intense.

Hoping to reduce the pre-flash fogging effect, I reduced the intensity of the pre-flash light by 4 stops and increased the timing of the flash period by a factor of four.

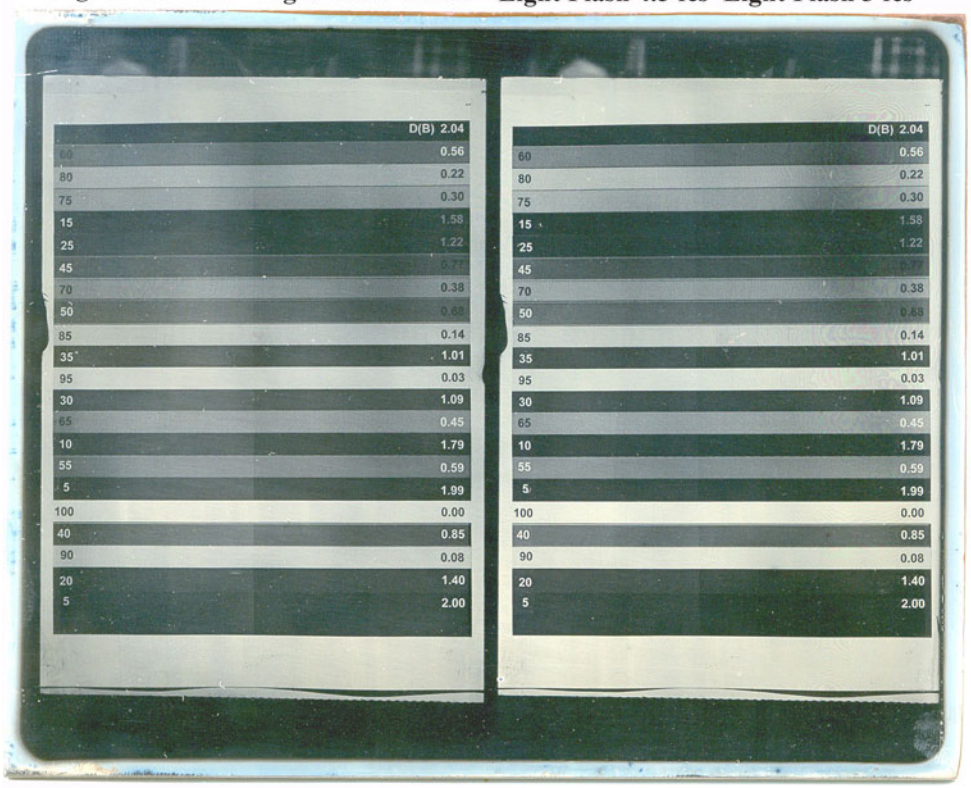
I equipped my camera with a 3D neutral density filter and stopped the lens all the way down to f/32. Then I gave portions of Plate IV in-camera light flashes of 3, 4.5, or 6 foot candle seconds at the reduced intensity level.

Within 5 minutes I gave the right half of Plate IV a grayscale exposure of 6 seconds (ISO 0.21) and then gave the left half of the plate a grayscale exposure of only 4 seconds (ISO 0.28).

PLATE IV

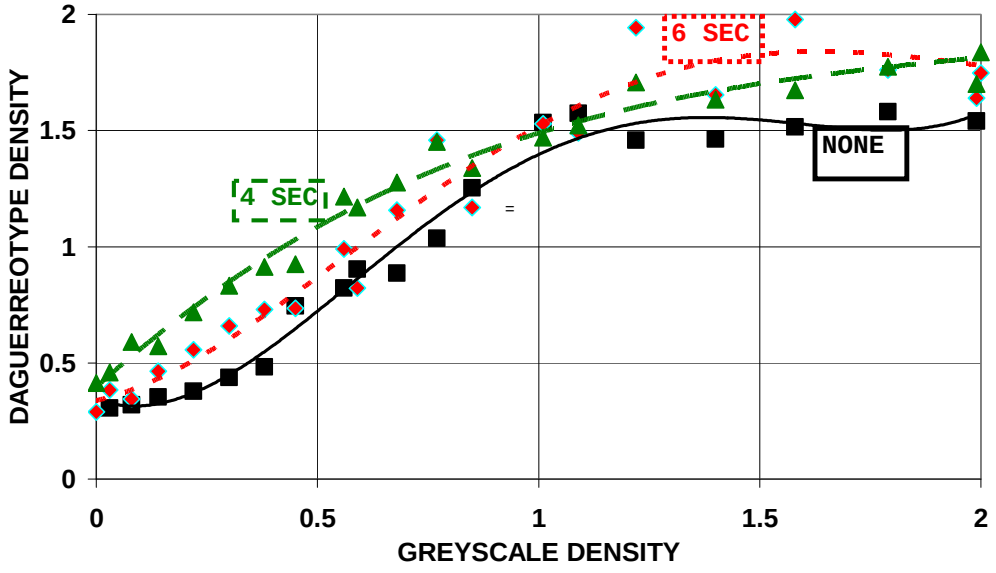
EXPOSURE 4 SECONDS @ f/22 **EXPOSURE 6 SECONDS @ f/22**

Light Flash 6 fcs Light Flash 4.5 fcs Light Flash 4.5 fcs Light Flash 3 fcs



Reducing the intensity of the pre-flash light by a factor of four appeared to increase the amount of pre-flash exposure required by about 50 percent. The best image on of Plate Four appeared on the right of center band after a 4.5 fcs pre-flash followed by a 6 second exposure (ISO 0.21). A somewhat lower contrast image also appeared on the far left band after a 6.0 fcs pre-flash followed by a 4 second exposure (ISO 0.28).

FIGURE 4
DENSITY OF PRE-FLASHED DAGUERREOTYPES
VS GREYSCALE DENSITY



The density trends in Plate Four, shown in Figure 4 confirmed the visual observation that increasing the pre-flash to 6.0 fcs reduced contrast and increase fog slightly.

SUMMARY OF HYPERSENSITIZING RESULTS

My experiments have demonstrated that pre-flashing Daguerreotypes with light can increase their camera exposure sensitivity by as much as 2 stops, up to an ISO speed of 0.28. See Table 1. An increase in the level of background fog appears to limit the practical application of this technique however. In the majority of shooting applications the appearance of a haze in the deep shadow areas would be would begin to have a noticeable effect on image quality after a push of only 1 stop for an effective ISO speed of 0.14.

TABLE 1
SUMMARY OF HYPERSENSITIZING RESULTS

PLATE	FLASH INTENSITY Foot-candles	FLASH fcs	EXPOSURE SEC @ f/22	ISO SPEED
I RIGHT	None	None	16	0.070
I LEFT	White liner	??	12	0.105
II RIGHT	1.5	0.3	12	0.105
II LEFT	1.5	1.5	8	0.140
III RIGHT	1.5	0.75	8	0.140
III LEFT	1.5	3.0	6	0.210
IV RIGHT	0.19	4.5	6	0.210
IV LEFT	0.19	6.0	4	0.280

LATENSIFICATION: LIGHT AFTER THE EXPOSURE

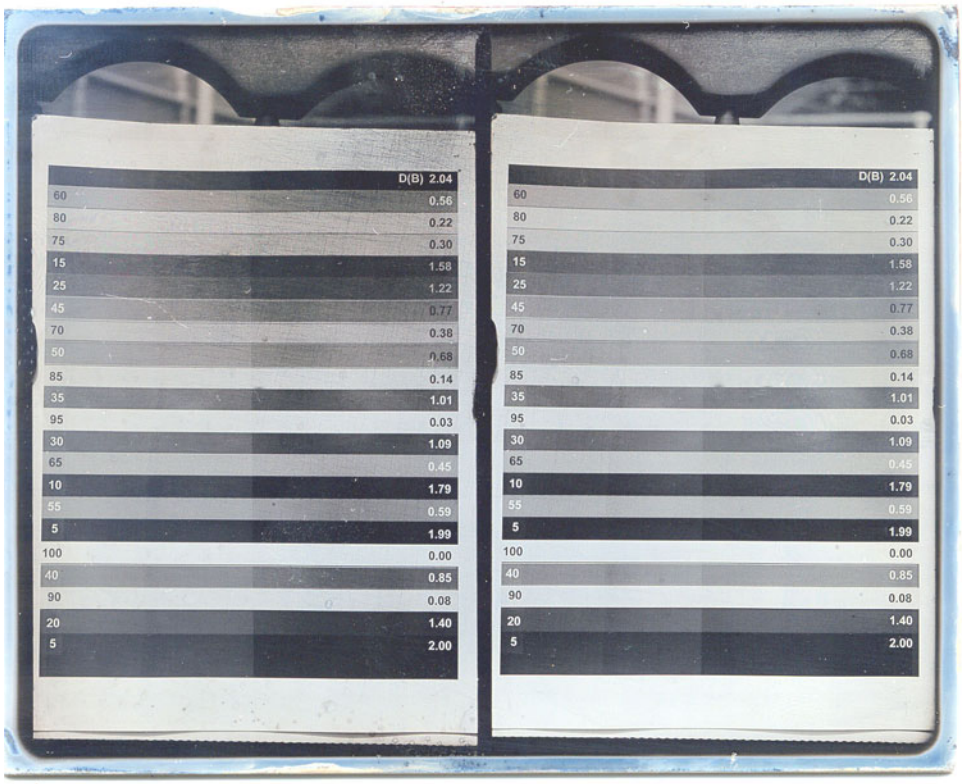
To find out whether the sequence of the flash exposure-main exposure events affected the sensitivity of the plates, I reversed the flashing sequence. In this experiment I first gave Plate Five a grayscale image exposure of 8 seconds on the left side of the plate and 12 seconds on the right side.

Then within minutes after the grayscale exposure, I gave quarter portions of Plate Five in-camera light flashes of 0.3, 0.75, 1.5 or 3 foot-candle seconds. The levels of post-flash I gave Plate Five matched the pre-flash levels that had produced the best grayscale images after exposures of 8 to 12 seconds. (Plate V)

PLATE V

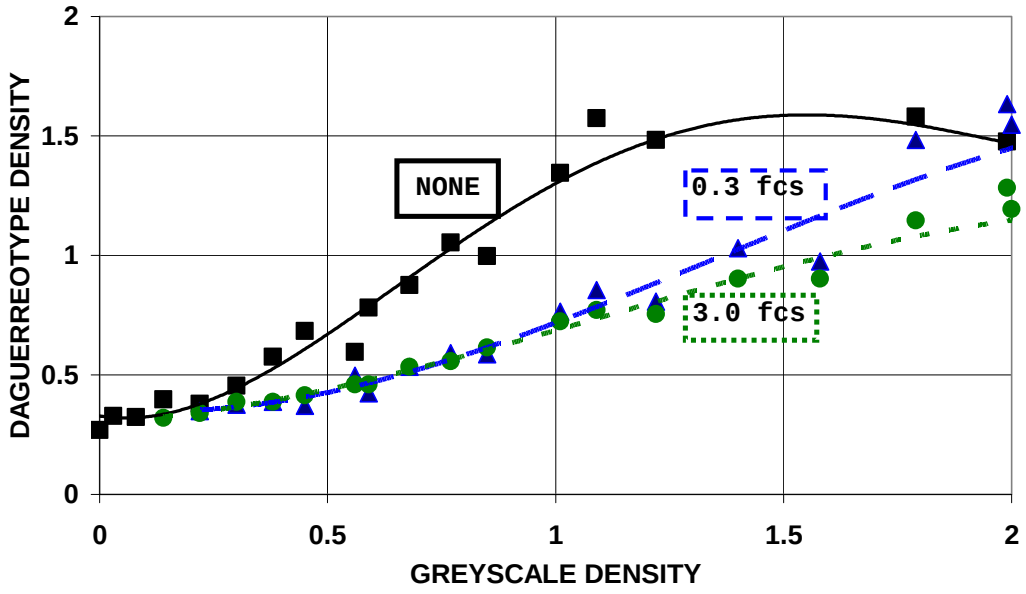
Exposure 8 Sec @ f/22 **Exposure 12 Sec @ f/22**

Post-flash 3.0 fcs **Post-flash 1.5 fcs** **Post-flash 0.75 fcs** **Post-flash 0.3 fcs**



The far right portion of Plate Five that was given a light flash of only 0.3fcs required a Grayscale exposure of 12 seconds (ISO 0.105). The left of center portion of Plate Five that was given a light flash of 3.0 fcs required a Grayscale exposure of only 8 seconds (ISO 0.14). The amount of post-exposure light required for latensification appears to be the same as the amount of pre-exposure light required for a similar level of hyper-sensitization.

FIGURE 5
DENSITY OF LATENSIFIED DAGUERREOTYPES
VS GREYSCALE DENSITY



However, measurements of the densities in Plate Five shown in Figure 5 indicate that the increase in speed brought about by the post-flash treatment was accompanied by a significant decrease in contrast.

HIGHER SPEED MERCURY DAGUERREOTYPE IMAGES

The following series of plates were prepared to examine the effect of supplementary light exposure on typical Daguerreotype images. All plates were fumed to a rose color as in the previous experiments using a 15/4/5 Iodine/Bromine/Iodine timing sequence.

HYPERSENSITIZED

The left half of Plate Six was given a pre-exposure white light flash of 0.75 fcs. The right half was not light-flashed prior to exposure. Then within 5 minutes after the light flash, the left and right halves of Plate Six were given camera exposures of 1.5 and 3 seconds @f/8 respectively. The EV was 15.

PLATE VI
John Hurlock
4x5 Daguerreotype taken May 26, 2004. The left half of the plate required only half as much camera exposure as the right half of the plate. The pre-flash reduced image contrast and eliminated solarization.

LATENSIFIED

The left and right halves of Plate Seven were given camera exposures of 2.5 seconds and 5 seconds @ f/8. The reflected light intensity of the subject was EV 14. Effective speeds of the left and right halves of Plate Seven were ISO 0.0150 and 0.0075 respectively. Five minutes after the image exposure the left half of Plate Seven was given a post-exposure flash of 1.50 fcs of white light. The right half was not post-flashed.

PLATE VII
John Hurlock
4x5 Daguerreotype taken June 16, 2004
The left half of the plate required only one half as much camera exposure as the right half of the plate. The post-exposure light flash reduced harsh image contrast and increased the shadow detail somewhat.

CONCLUSIONS

We have now seen evidence that exposing a Daguerreotype plate to low levels of supplementary light before of after the camera exposure can increase the effective speed of the plate by at least 100% with only a minor effect on image quality.

Given a choice between hyper-sensitizing the plate before the camera exposure or latensifying the image after the camera exposure, how do we decide which is best? Under ideal conditions where the plate can be given supplementary light within 5 to 15 minutes of the camera exposure and developed soon afterwards both methods appear to give equally good results. However in the real world

Daguerreotypes may have to be exposed far from the darkroom and development may be delayed. Due to other constraints it may not be feasible to give the plate supplementary light exposure at the shooting site. If we hyper-sensitize the plate before taking it to the shooting site, considerable time may elapse, between the pre-exposure and the main exposure or the development. Given the short life span of the Daguerreotype latent image[7], the pre-flash effect as well as the primary exposure latent image may fade. Will this fading significantly affect the image?
Would we be better off choosing to latensify the image, thus eliminating one fading variable from the equation?

To help decide this question, I set out on two remote Daguerreian shooting assignments. I fumed two 5 x 7 Daguerreotype plates to a rose color using the previously described Iodine/Bromine/Iodine fuming sequence of 15/4/5 seconds. The shooting site, Sawmill Creek, is a 30 minute drive from my darkroom. Ambient summer weather conditions, of 80 degree temperatures and 50 % relative humidity prevailed. I used a double layer of Ziploc bags containing desiccant to keep the plates as dry as possible. Given the conditions I expected some latent image fading during the approximately 90 minute round trip.

The first, Plate Eight, was first given a hyper-sensitizing exposure of 3.0 fcs. Approximately 45 minutes later it was given primary exposure of 12 minutes @ f/22 (EV 9-11). Development began approximately 45 minutes later.

The second, Plate Nine, was given primary exposure of 12 minutes @ f/22 (EV 9-11). Approximately 45 minutes later the plate was given a latensifying exposure of 3 fcs. Development was begun 5 minutes later.

PLATE VIII
John Hurlock
Hyper-sensitized 5x7 Daguerreotype taken July 9, 2004 of Sawmill Creek. Details of forest floor are recorded but image contrast is low and a light fog veil covers the shadows.

PLATE IX
John Hurlock
Latensified 5x7 Daguerreotype taken July 11, 2004, Sawmill Creek, Dupage County, Illinois. Details of forest floor are recorded without blocking the details of the surface of the swirling water.

CHOOSING BETWEEN LATENSIFYING AND HYPER SENSITIZING

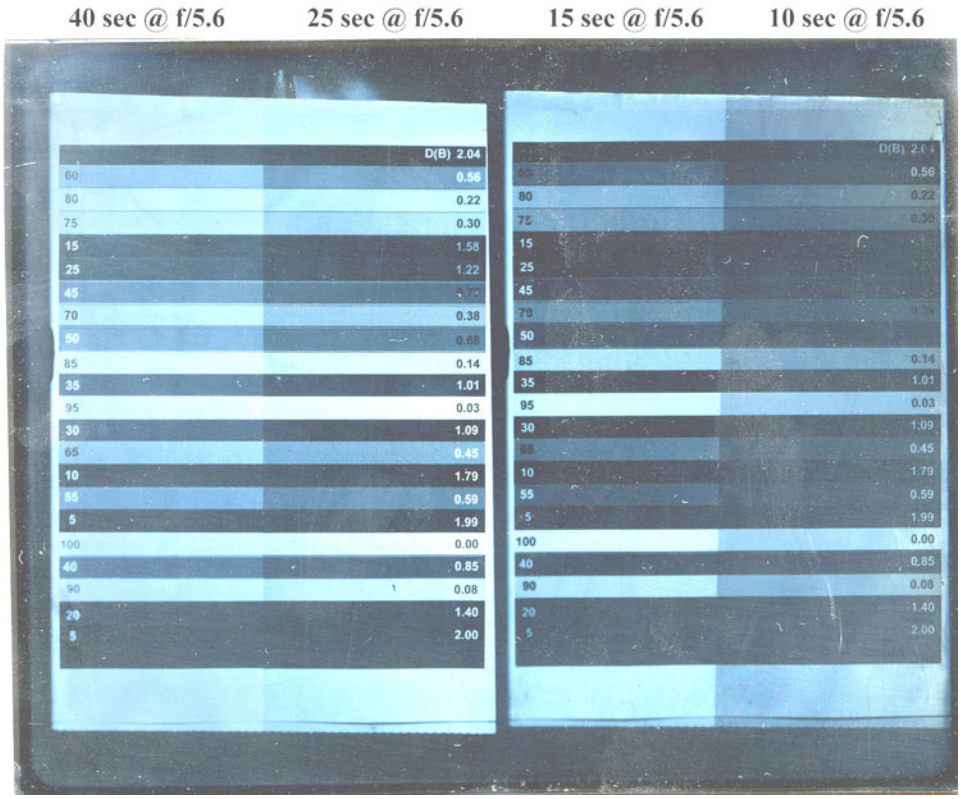
Where prolonged delays between camera exposure and development are likely, latensifying may do a better job of increasing the sensitivity of Daguerreotypes.
In addition, latensification offers the photographer the ability to intensify the latent image after an insufficient camera exposure. The Daguerreotypist can correct an under-exposed plate when the opportunity to re-shoot another image has been lost. However, under controlled studio conditions, hyper sensitizing offers the ability to increase the speed of the plates before the camera exposure without distracting the attention of the photographer away from other details during the shooting operation.

BECQUEREL DAGUERREOTYPES

To many prospective Daguerreotypists, the potential dangers of exposing yourself to the toxic vapors of bromine and mercury have led them to choose the Becquerel method. Following the general precepts outlined by Gerard Meegan in his landmark article in the Daguerreian Society Annual 1991,[7] I prepared a series of plates fumed over iodine to the second yellow color.

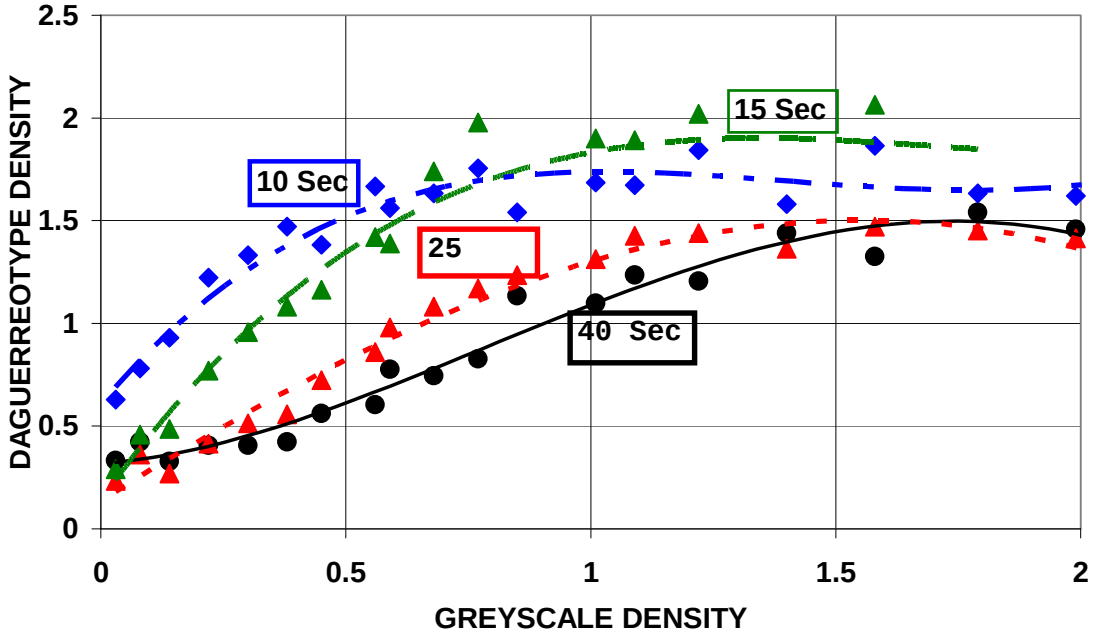
First I had to find out how much exposure my new Becquerel plates needed to record an image. Using my spit-back Speed Graphic camera, I gave Plate Ten a series of 4 separate exposures to the image of my Grayscale in bright sunlight (EV 15.5). Immediately after the exposures, I covered my plate holder with a 2 layers of rubylith and exposed the plate for 3 hours to the light of a 500 watt halogen work light at a distance of 16 inches. The plate was then fixed but not gilded.

PLATE X



My exposure test Plate Ten appeared to indicate that I would have to give Becquerel plates an exposure of 25 to 40 seconds at f/5.6 to produce a satisfactory grayscale images.

FIGURE 6
DENSITY OF BECQUEREL DAGUERREOTYPES
VS EXPOSURE AND GREYSCALE DENSITY



Later, a measurement of image densities (see Figure 6) confirmed that the 40 second exposure produced the best contrast ratio. This result is roughly in agreement with the exposure times of 8 to 10 seconds at f/2.8 reported by Meegan[8] .

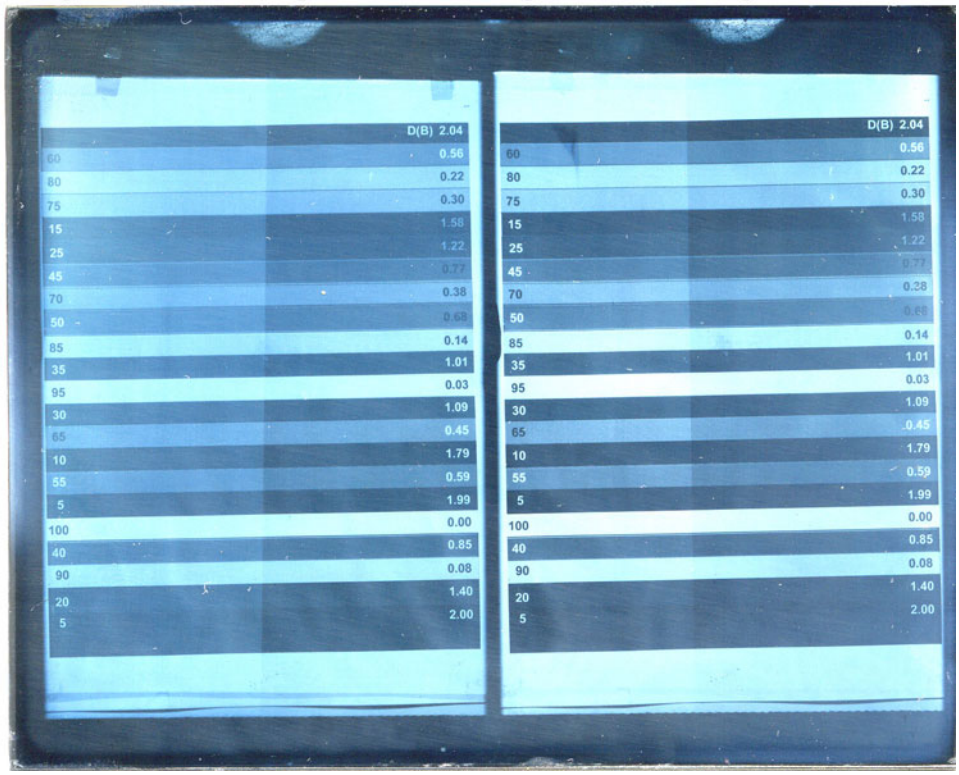
HYPER SENSITIZING BECQUEREL DAGUERREOTYPES

My preliminary exposure results told me that my Becquerel plates required at least 4 stops more exposure than my multiply sensitized mercury plates. Since the Becquerel plates required 16 times more light to record an image, I assumed that I would have to expose them to 16 times more light or up to 100 foot candle seconds, to hyper-sensitize them. Using my split-back 4x5 camera and the dark-slide of the camera's plate holder as mask, I pre-flashed quarter portions of my second Becquerel plate with 25, 50, 75 or 100 fcs of sunlight. Actual in camera pre-flash exposures used were 1, 2, 3 or 4 seconds at f/5.6 to an EV 16.5 target. After pre-flashing, the left and right halves of the plate were given image exposures of 10 and 15 seconds respectively to the grayscale (EV 15.5).

PLATE XI

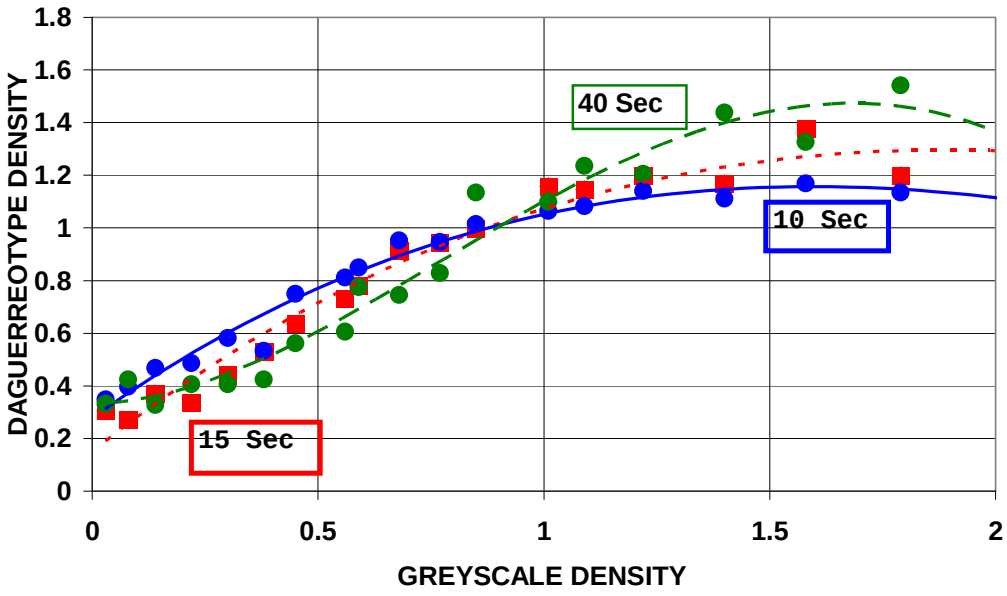
Exposure 15 seconds @ f/5.6 Exposure 10 seconds @ f/5.6

Light Flash 100 fcs Light Flash 75 fcs Light Flash 50 fcs Light Flash 25 fcs



Upon first examination the grayscale images in Plate Eleven appear to be much brighter than those in the right side of Plate Ten which were also given exposures of 10 and 15 seconds.

FIGURE 7
DENSITY OF BECQUEREL DAGUERREOTYPES
VS EXPOSURE AND GREYSCALE DENSITY

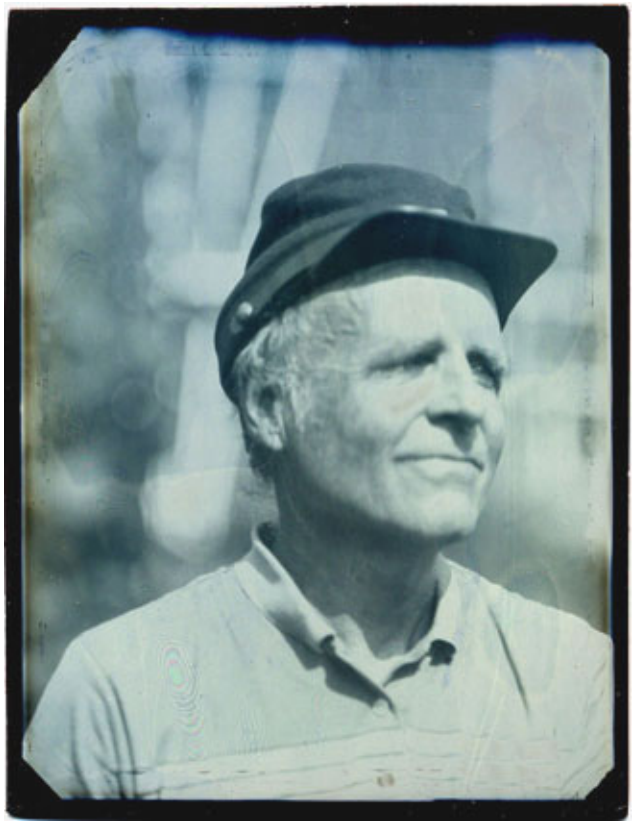


My subsequent image density measurements (Fig 7) also indicated that those portions of Plate Eleven which had been given a 50 to 75 fcs pre-flash recorded good grayscale images after exposures of only 10 to 15 seconds. Image contrast appeared to be comparable to that obtained on the un-flashed Plate Ten after a 40 second exposure.

HIGHER SPEED BECQUEREL DAGUERREOTYPE IMAGES

Plate Twelve was prepared to examine the effect of pre-development light exposure on Becquerel Daguerreotype images. As before, the plate was fumed to the second yellow color.

The plate was first given a pre-exposure to white sunlight of 75 fcs. Then within 10 minutes after this pre-exposure, at approximately 9 AM the plate was given an image exposure of 25 seconds @f/5 in direct sunlight. EV was 14. Effective speed of the plate was approximately ISO 0.0067 or approximately 1/10th the speed of a mercury Daguerreotype plate.



John Hurlock
PLATE Twelve, *Becquerel self-Portrait*
Quarter Plate Daguerreotype taken July 2, 2004.

A portrait of the author. The image has uncharacteristically good shadow detail for a Becquerel

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ABOUT THE AUTHOR

JOHN HURLOCK has been a member of the Daguerreian Society since 1996. He is a retired chemical engineer and has been making Daguerreotypes off-and-on since 1958. His last article “Frozen in Time”, which was co-authored with Eric Richart, appeared in the Daguerreian Annual in 2001.

NOTES

1. B Lowery, “Secrets of the White Chamber” The Daguerreian Annual (2002-2003) Lake Charles, LA) By the Daguerreian Society (2003) pp 332-341.
2. J. Hurlock, “Warming Up to Cold Mercury” The Daguerreian Annual 1998 (Lake Charles, LA) By the Daguerreian Society (1998) pp. 230-240.
3. E-mail; correspondence with Irving Pobboravsky, May 21, 2004
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APPENDIX A

EXPERIMENTAL PROCEDURE - MERCURY PROCESS

Step 1 Polished 4x5 inch silver plates were fumed for 15 seconds over iodine to a warm straw color, then 4 seconds over bromine to an incipient rose color, then back over the iodine for 5 more seconds to a rose color, and lastly for 2 more seconds in the dark over the iodine at approximately 20 C.

Step 2 Using the dark slide of the camera plate holder as a mask, and the camera shutter for timing, portions of each plate were given a brief in-camera pre-exposure or flash ranging from 1/5th second up to 4 seconds at f/22 to a sheet of white inkjet printing paper illuminated in direct midday sunlight (EV 17.5).

Step 3 Then portions of the plate were given an exposure to the image of a random grayscale illuminated in direct midday sunlight. A 4x5 Crown Graphic Press Camera equipped with a 135 mm f/4.7 Schneider Kreuznach Xenar lens in a Compur shutter was used. When two image exposures per plate were desired, the camera was equipped with a sliding split back. This eliminated any possibility of coating or developing variability between the pared images

Step 4 Exposed plates were developed for 2 hours over room temperature mercury [(2)] under a vacuum of 50 torr. After developing, each plate was then fixed and dried.

Step 5 All daguerreotypes were scanned together with a calibrated grayscale using an HP® Scan jet 5370C scanner. Relative image densities of each grayscale step on the daguerreotypes were estimated using the eyedropper tool in the info palette of Adobe® 4.01. The L values were matched with the corresponding L value on the grayscale scan to obtain the density. Image densities were then plotted versus the density of the original grayscale using Excel®.

APPENDIX B

EXPERIMENTAL PROCEDURE – BECQUEREL PROCESS

Step 1 Polished 4x5 inch silver plates were fumed for 90 seconds over iodine to the second yellow color and then again for 15 more seconds in the dark over the iodine at approximately 20 C.

Step 2 Using the dark slide of the camera plate holder as a mask, and the camera shutter for timing, portions of each plate were given a pre-exposure or flash ranging from 1 to 8 seconds at f/5.6 to a sheet of white inkjet printing paper illuminated in direct midday sunlight (EV 17.5).

Step 3 Then portions of the plate were given an exposure to the image of a random grayscale illuminated in direct midday sunlight. A Crown Graphic Press Camera equipped with a 135 mm f/4.7 Schneider Kreuznach Xenar lens in a Compur shutter was used. When two images per plate were desired, the camera was equipped with a sliding split-back attachment. This eliminated any possibility of coating or developing variability between the pared images

Step 4 Exposed plates were covered with two layers of Ruby Lith and developed for 3 hours [8] under a 500 watt halogen work light. After developing, plates were fixed and dried.

Step 5 All daguerreotypes were scanned together with a calibrated grayscale using an HP® Scan jet 5370C scanner. Relative image densities of each grayscale step on the daguerreotypes were estimated using the eyedropper tool in the info palette of Adobe® 4.01. The L values were matched with the corresponding L value on the grayscale scan to obtain the density. Image densities were then plotted versus the density of the original grayscale using Excel®.