

INVESTIGATION OF THE SILVER PARAMETER AND THE TRANSFER CURVE OF THE SALTED PAPER ALTERNATIVE PROCESS

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Abstract. Photographers usually choose a recipe for their artistic purposes from many experimented ones of the past 150 years. Unfortunately, these recipes describe only the dilution of the solutions, but do not give a guide how much shall be used for the optimal result for a unit size surface. Besides, each of the transfer processes have a cumulative mapping distortion of the image transfer steps. We have already found the optimal volume of the salt solution and we published the results in an article. The aim of this paper is to describe the salted paper technique and to seek the optimal volume of the silver solution for creating proper prints. This article will review the saltprint alternative process, the available large form negative types, the used machines and what we can expect from the result. By having the optimal salt and silver volume, we determined the transfer curve of this process. The final goal is to create a software, that is able to produce the inverse of the mapping error. By using this inverse function, the original picture can be predistorted in order to make the desired linear transfer of the image onto the paper. Later on, it will be essential to test the different paper types, the amount of UV light and the effect of arrowroot gelatin layer or toners on contrast.

Keywords: Image transfer, transfer curve, inverse function, linear transfer, salted paper, alternative processes, UV light

1 The Salted Paper Process

The saltprint process is one of the oldest known photo process (see [1], [url1] and [url2]). It was invented by Henry Fox Talbot in 1833. The main difference from Louis Daguerre's process is that it is a negative-positive process, on the contrary the daguerreotype is a direct positive process. This way, from the negative we can make positive copies of arbitrary number. The saltprint process has the advantage, that it is possible to make detailed pictures even from hard negatives of strong contrast. There are a lot of further alternative processes giving a good print result, e.g.: kallotype and cyanotype (see [2], [3], [4] and [url3]).

2 The Test Negative

We wanted to create a workflow for cheap salted paper image transfer, so we have chosen tracing paper as negative holder. The negative is printed by an HP CM1312 multi-purpose machine. A typographic negative on translucent foil will be the monitoring tool for the control of the experiment. The grayscale image having 256 shades of the black and white transition has a 2 pixels white border and a 2 pixels black border around, respectively from inside to outside (see Figure [1]). Figure [2] shows one of the salted paper process image. The

European standard A4 paper size was used as the basic unit. We have tested laserjet print on tracing paper and refractory transparent foil, inkjet print on translucent foil and negative foil made by digital press machine (see [5]). The original picture shall be vertically mirrored and inverted in order to get a good digital negative (see [6] and [7]).



Figure 1: Test negative of 256 gray shades



Figure 2: Saltprint of the test negative

3 The Scanner and the Scanning Error

We have used an Epson V700 flatbed scanner. For the comprehensive tests, the scans were obtained with 600dpi resolution at 48 bit color depth and all the special features were turned off for the best comparable results. The different type A4 sized negatives were scanned back, and we measured the difference from the ideal negative picture. This difference shall be taken into account at computations of the transfer error.

4 The UV Light Source

The light sources are fixed into an enclosing wood box having the following dimensions: 70cm length, 50cm width and 20cm depth. The flatbed is made of a 4mm glass table. The working area is 60cm times 40cm. The UV light is generated by 2 pieces of 18W power T8 F18W BLB 352-368nm Sylvania UVA Blacklight blue Tungsram neon tubes having diameter of 26mm and 590mm length (see [8]). The tubes are 15cm far away from the flatbed, and there is 8cm gap between them. The top of the machine has 5mm wide sponge for good

contact besides the two snap-on locks. 30 seconds of lighting time was applied for each sensitized paper, a Vipo Combi automatic power switch was used to ensure the consistent lighting time.

5 The Paper and the Coating Process

It is essential to choose an acid free paper, otherwise chemicals alter by time which decrease the quality of the prints. Etching and aquarelle papers suit this criteria. The cost effective 150g/m² Hahnemühle aquarelle paper was chosen for the tests. It is thick enough to absorb the solutions and cheap enough for daily use. For distributing the salt and the silver a glass rod having 1cm diameter and 30cm length was applied. (Using a paint brush is not a good idea, because of the uneven spread of the layers, and the buffer effect of the hairs which leads to reaction inside the brush.) Later on, we will investigate the effect of a gelatine layer made of arrow roots on the contrast. 6gm citric acid was used for 12gm AgNO₃/100cm³ solution to prevent fog.

6 Processing

The processing has three stages: developing, fixing and washing (see [url4]). Figure 3 and Figure 4 show an original digital picture and the salted print image.

6.1 Developing

The developing was applied under running tap water, letting the used water flow away. The processing time was 1 minute. This step removes the unnecessary chemicals, and the sepia tone starts to appear.

6.2 Fixing

We have tried to use a 10% solution of sodium thiosulfate (hypo) for fixing. Unfortunately, it provided a lot of dark patches. Instead of this fixing solution, the usage of black and white Tetenal Rapid Fixer solved the darkening problems. Here, the sepia tone is getting stronger, while the dark areas are fainting. The fixing time was 1 minute.

6.3 Washing

30 minutes washing under running tap water ensures the disposal of the fixing chemicals. This guarantees a long life for the prints.



Figure 3: Violin (original picture)

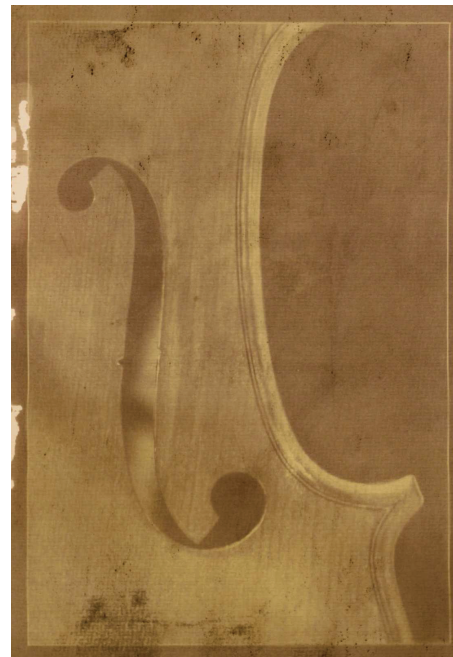


Figure 4: Violin (saltprint)

7 Results

Table 1 shows the scanning results determined by Adobe Photoshop CS4 using 11 by 11 Average filter (to compensate the error of the paper texture) at the lightest and darkest areas. It can be read out that the tonal range getting better until 6ml of 12% AgNO_3 solution reached per A4 paper size. After this point, the white tones are getting darker faster than the black tones. By the optimal salt amount, 54.69% of the full tonal range can be used.

Table 1: Measurement values

Salt solution (ml) (2gm/100cm ³)	12% AgNO_3 (ml) (12gm AgNO_3 /100cm ³)	Green min. value (0-255)	Green max. value (0-255)	Difference (0-255)
8	3	116	241	125
8	4	109	240	131
8	5	104	239	135
8	6	97	237	140
8	7	95	233	138

The amount of the silver solution was studied in details in this paper. We have determined, that 6ml of 12% AgNO_3 solution yields the best result.

8 The mapping error

The histogram of the processed 16 bit greyscale test negative has 2 high hills and 2 lower hills (see Figure 5). The histogram has 65.536 columns for the different shades.

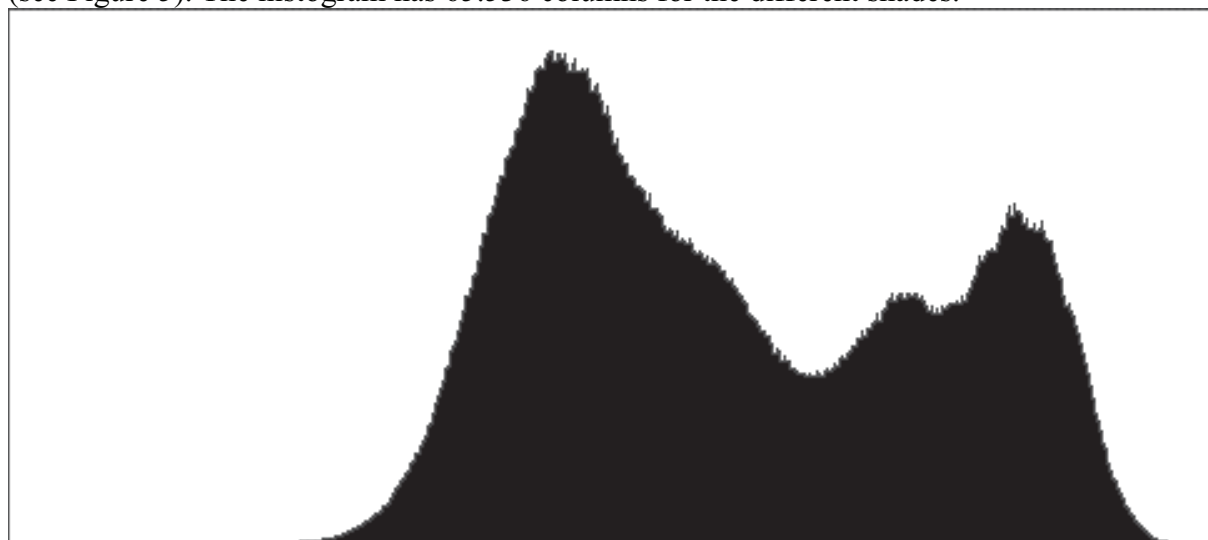


Figure 5: Histogram of the processed test negative

Based on this histogram, we determined the tone curve for predistorting the images for the saltprint process (see Figure 6). It is done by taking all the pixels of the scan of the processed image. After this, equal or nearly equal sized groups shall be formed. The new tone values are determined by checking the equalized groups. The new tone value for a given shade will be the index of the group that contains the original tone value, of course taking into consideration the targeted [97, 237] tonal range.

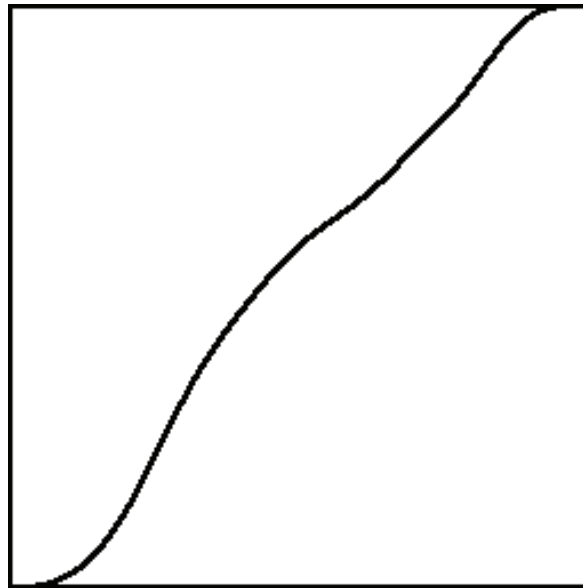


Figure 6: Tone curve for salted paper process

Let us notice the curves at the bottom and top ends for enhancing the shadows and highlights. The arc at the center of the tone curve ensures the correction of the middle tones. The modified grayscale test negative can be seen at the top part of Figure 7 (the original linear test negative is situated at the bottom part for comparison).



Figure 7: Predistorted (top) and original (bottom) grayscale test negative

After applying this tonal curve for a correctly edited image, it has to be mirrored horizontally. Furthermore, a simple negative effect shall be used on the picture before printing it on a tracing paper or transparent foil. The processed image using the determined tone curve will have a well balanced histogram, instead of having too much dark and light area.

9 Conclusions

The further investigation will cover the examination of fine-tuning the lighting time and the effect of a gelatine layer or different toners on the contrast (see [9] and [10]).

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BADANIA PARAMETRÓW SREBRA I KRZYWEJ TRANSFERU PAPIERU SOLNEGO FOTOGRAFII ALTERNATYWNEJ

Fotografowie już od 150 lat poszukują recept dla swoich artystycznych celów. Jednakże owe przepisy, podając zwykle tylko stężenie roztworów, nie podają jak dużo owego roztworu powinno być użyte w konkretnej sytuacji, by otrzymać optymalny efekt. Ponadto każdy proces przetwarzania obrazu kumuluje zniekształcenia. W artykule właśnie podajemy wyniki dotyczące optymalnego doboru objętości roztworu soli. Celem pracy jest opis techniki tworzenia zdjęć na papierze solnym w aspekcie implementacji komputerowej i znalezienie optymalnej pojemności roztworu srebra do stworzenia odpowiednich odbitek. W artykule sprawdza się proces alternatywny na papierze solnym poprzez analizę dostępnych form negatywów. Mając optymalną wielkość soli i srebra wyznaczamy krzywą transferu tego procesu. Ostatecznym celem jest stworzenie oprogramowania, które pozwala generować odwrotność błędu odwzorowania. Posługując się funkcją odwrotną oryginalny obraz może być przetworzony na przednie kształcony w celu znalezieniażądanego przekształcenia liniowego obrazu na papier. Wcześniej bardzo istotnym jest przetestować różne typy papierów, wartość światła ultrafioletowego i efekt wpływu warstwy żelatyny lub toneru na kontrast.