Journal of Criminal Law and Criminology

Volume 58 | Issue 3 Article 14

1968

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THE JOURNAL OF CRIMINAL LAW, CRIMINOLOGY AND POLICE SCIENCE
Vol. 58, No. 3

Printed in U.S.A.

SYSTEMATIC APPLICATION OF SPECIALIZED PHOTOGRAPHIC TECHNIQUES

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As photographic detection methods increase in complexity and scope, the need for standardized techniques becomes a necessity. Rather than "reguess-timate" the exposures for infrared and ultraviolet photography again and again, the application of a single predetermined exposure chart for each method will permit the usual drudgery to be replaced with easy, relaxed skill.

Charts 1, 2, 4 and 5 are designed for use by the experienced laboratory photographer and document examiner respectively, whereas chart 3 is intended for the identification officer who is only occasionally involved in photography. Documents and garments are the materials that lend themselves best to this standardized approach.

The construction and use of charts 1, 2, 3 and 4 is only possible if the following 3 conditions are met:

A. The light output and light to subject distance must be constant.

B. An individual chart is necessary for each film-developer combination.

C. Processing time, temperature and agitation (charts 1 + 2) have to be kept strictly under control.

REFLECTED INFRARED CHART

Chart 1 is meant to be used with documents on a calibrated copy camera. It pairs image size on the negative with the corresponding exposure figures for 2 different development times.

In case the available copy camera is not factory-calibrated one can do this quite satisfactory oneself. Place a rule on the copyboard and rack the copyboard back and forth till this rule matches another rule of the same size on the ground glass for a 100% image size. Note the positions for copyboard and lens on a white tape running alongside the camera bed. Continue the procedure for the other seven percentages set out in chart 1.

To establish the correct exposure with your equipment make a test exposure at 100% till you obtain the perfect negative (Kodak recommends a 1.2–1.4 density for white cardboard to print with a minimum of tone). Place that exposure opposite the 100% figure on your chart. Then just fill in the other exposure figures ½ stop apart for the other percentages. Then exposure is related to the percentage figures only.

Chart 1

REFLECTED INFRARED

Percentage Values of the Original Subject (1:1 = 100%)	Developed for 4 minutes	Developed for 7 minutes
13%	1 sec.-f27	1 sec.-f32
38%	1 sec.-f22	1 sec.-f27
63%	2 sec.-f27	2 sec.-f32
100%	2 sec.-f22	2 sec.-f27
134%	2 sec.-f19	2 sec.-f22
180%	4 sec.-f22	4 sec.-f27
234%	4 sec.-f19	4 sec.-f22
300%	4 sec.-f16	4 sec.-f19

Kodak I.R. sheet film; D-19 at 70°F. 87 filter.

Chart 2

I. R. LUMINESCENCE

Lens to Film Distance	Exposure
8 in.	f9-3 min.
9.7 in.	f9-4.5 min.
11.5 in.	f9-6 min.
14 in.	f9-9 min.
16 in.	f9-12 min.

I-N plates; D-19 for 5 min; 70°F. 87 filter.

Chart 3

ECONOMICAL ULTRAVIOLET SET-UP

Light Source	Single Light Source to Subject Distance	Method	Filter On Lens	Film	Exposure For A Single Light Source	Process-ing	Bellows Factor
 Purple X Bulb G.E.	24"	U.V. Flu.	2A	TRI-X	f8-90 sec.	DK-50 68° F 5 min.	Add
		Ref. U.V.	18A		f8-9 sec.		Add
 Black Light G.E.	16"	U.V. Flu.	2A	TRI-X	f8-60 sec.	DK-50 68° F 5 min.	Add
		Ref. U.V.	18A		f11-3 sec.		Add

The exposure figures given are for the average subject such as Kodak Blotting Paper. Occasionally a subject may require an increase or decrease of exposure by 2 stops. But with these average figures one will always get an image even though a second exposure may give one a better negative.

Chart 1 was made for a f9–90 process lens. The light source we employ are the very stable quartz iodine tubes.

Additional charts along the same lines can of course be made for any film-developer combination, black and white or color, that will be used on the same camera. Should one decide to use a filter that has a 1.5 factor, meaning ½ stop with any one of these, just run a finger 1 step down to the next figure.

I. R. LUMINESCENCE CHART

Infrared luminescence photography of documents is usually done with a view camera or a roll film camera. With the previously mentioned conditions A, B, and C under control, the only variable left is then the camera to subject distance, or its equivalent, the lens to film distance. Chart 2 relates this distance to the wanted exposure.

To obtain these exposure figures make a series of test exposures with the lens set at infinity. Chart 2 was made for an 8″ lens. Use 2 or 3 white paper samples with a half dozen ballpoint pens, some of which luminesce and others that do not. A usable negative will show some separation between the non-luminescing inks and the average paper background. Fill in your test exposures in the chart opposite the lens to film distance used. Also fill in the

Chart 4

U. V. Fluorescence—Medium Standard

	2A	2A +25	2A +47	2A +58	Deviations	Bellows Extension Factor
6527-B 3000 A	f8 6 sec.	f8 6 min.	f8 25 sec.	f8 100 sec.	D.S. = +4x B.S. = −16x	Add!

Tri-X; DK-50; Develop for 5 min. at 68°F.

rest of the exposure figures by adding 50% of the previous time. Whereas previously we used to slave all morning masking off stray light from the light sources, cutting up 5½″ × 26′ roll film and "guess-timating" exposures, now we can show a good negative in 25 minutes.

Our 2 light sources, illuminate an 11″ x 14″ area, and are fixed to the floor. We are using 2 Leitz Pradovit projectors with 500 W. bulbs mounted permanently in completely light tight boxes. Their f2.5 lenses are 28″ away from the center of the subject.

Economical Ultraviolet Set-Up

Chart 3 can be used, as is, right away. It gives all the facts required, to make a successful ultraviolet photograph of a variety of subjects in a step by step fashion.

The 2 light sources are available for well below $10. each. The 'Black Light' will give a greater image contrast than the Purple X bulb. Both light sources operate in the 350–390 mμ band. The 'Purple X' bulb used in a 12″ reflector will have to be kept further away from an 8 x 10 subject than the fluorescent tube in an enamel reflector for a reasonably even illumination. In case that the subject should only measure 2 or 3 inches one can of course reduce the light to subject distance. A 12″ distance for the Purple X bulb will reduce the exposure by 2 stops or ¼ times according to the inverse square law. The intensity of the 'Black Light' is directly proportional to distance.

The exposure figures given apply only when the lens is focussed at infinity. At other distances the bellows factor will have to be added.

DK-50 can be replaced with D-76 stock solution and the new processing time will be 7 minutes.

Ultraviolet Fluorescence Filter Chart

Two of the major difficulties in ultraviolet fluorescence photography are:

1. Determining filter factors for camera filters in conjunction with several lamp filters.
2. Estimating and compensating for the large variation in fluorescence encountered with various subjects.

Chart 4 attempts to take care of these 2 problems in the following manner:

1. Camera filters are plotted against light filters. For each filter combination one test exposure will solve this problem once and for all. A good negative will have a density of 1.2–1.4 with Kodak Blotting paper serving as subject.
2. We have found that the best results are obtained when 3 standards are being used. By comparing the fluorescence of the questioned subject with one of the known standards one can always calculate the exposure accurately.

These standards are Kodak Blotting Paper as Medium Standard and brown wrapping paper and lined office paper as Dark Standard (D.S.) and Bright Standards (B.S.) respectively.

How to obtain the correct exposure for a subject with chart 4:

1. Locate filters on chart and note the basic exposure.
2. Compare visually area of brightest fluorescence in subject with standards under U.V. lights.
3. Add or subtract from basic exposure time as located in 1. an appropriate amount of time to compensate for the deviation of the subject matter.

The camera filter factors with lamp filter 6527-B are 4× for the Wratten 47; 18× for the Wratten 58 and 60× for the Wratten 25. Our light sources are 2 Hanovia Quartz Mercury Arc Lamps. Light filter to subject distance is 18″.

Method Chart

With document cases certain approaches are more likely to give better results then others. This chart summarizes the most common problems and

Chart 5

METHOD CHART

SUBJECTS	REFLECTED U. V.	U. V. FLUORESCENCE	INVISIBLE U. V. FLUORESCENCE	REFLECTED I. R.	I. R. LUMINESCENCE	HIGH CONTRAST	VARIOUS OTHERS
1 CHARRED DOCUMENTS							
Lead Pencil	1			2			2 Directional Bounced Light
Ball Point Pens	T			T			T Directional Bounced Light
Fluid Ink	T			1			T Directional Bounced Light
Typewriting	T			1			T Directional Bounced Light
Undetermined	T			1			T Directional Bounced Light
2 ADDITIONS							
Ball Point Pens - All Colors	T			T	1		T Enlargment; T Filters
Fluid Ink - Black				T	1		
Fluid Ink - Blue	T	2	1	T	2		T Filters
Fluid Ink - Red		T			1		T Filters
Fluid Ink - Green		1			1		T Filters
Typewriting					T		1 Enlarged Superimposed Transparencies
3 PHYSICAL ERASURES							
Ball Point Pens					1	T	T Oblique Light
Fluid Ink	T	T	T		1	T	
Lead Pencil	T High Contrast	T	T	T High Contrast		1	T Oblique Light
Typewriting	T High Contrast	T	T	T High Contrast	T	T	T Oblique Light
4 CHEMICAL ERASURES							
Ball Point Pens - All Colors	T High Contrast	T	T		T	T	1 Oblique Light
Fluid Ink - Black	T	T			1	T	T Oblique Light
Fluid Ink - Blue	2	1	1		2	T	T Oblique Light
Fluid Ink - Green	T	T	T		1	T	T Oblique Light
Fluid Ink - Red	T	T	T		T	T	T Oblique Light
5 FADED WRITINGS	T High Contrast	T	T	T High Contrast	T	T	T Oblique Light
6 CROSSED OUT WRITING		T	T	1	T		T Masking; T Filters
7 WHITE AND CREAM COLORED PAPERS	2	1	1				T X-Ray

their solutions encountered by the writer. It points out the direction which a purposeful investigation should take for a rewarding and speedy solution.

The meaning of the abbreviations in chart 5 are as follows: 1 for 1st choice; 2 for 2nd choice; T for worth trying. In case of a toss-up between two methods the same number or letter was used more than once.

The obvious deficiency in some areas of photographic detection methods will encourage further research for public use and ones own satisfaction.

SUMMARY

This article introduced various photographic charts, which can be adopted to local conditions to enable photographers to make greater use of their available time. Included are standardized procedures for infrared and ultraviolet photography and a summary of applicable techniques.

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2. Kodak Quality Control System.