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A SELF-INSTRUCTIONAL, SELF-PACED COURSE  
IN ADVANCED TECHNICAL BLACK-AND-WHITE PHOTOGRAPHY TECHNIQUES

by

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B. S., California Polytechnic State University,  
San Luis Obispo, 1977

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A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

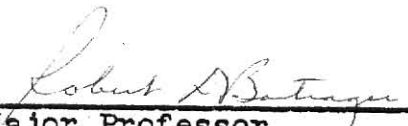
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Department of Journalism and Mass Communications

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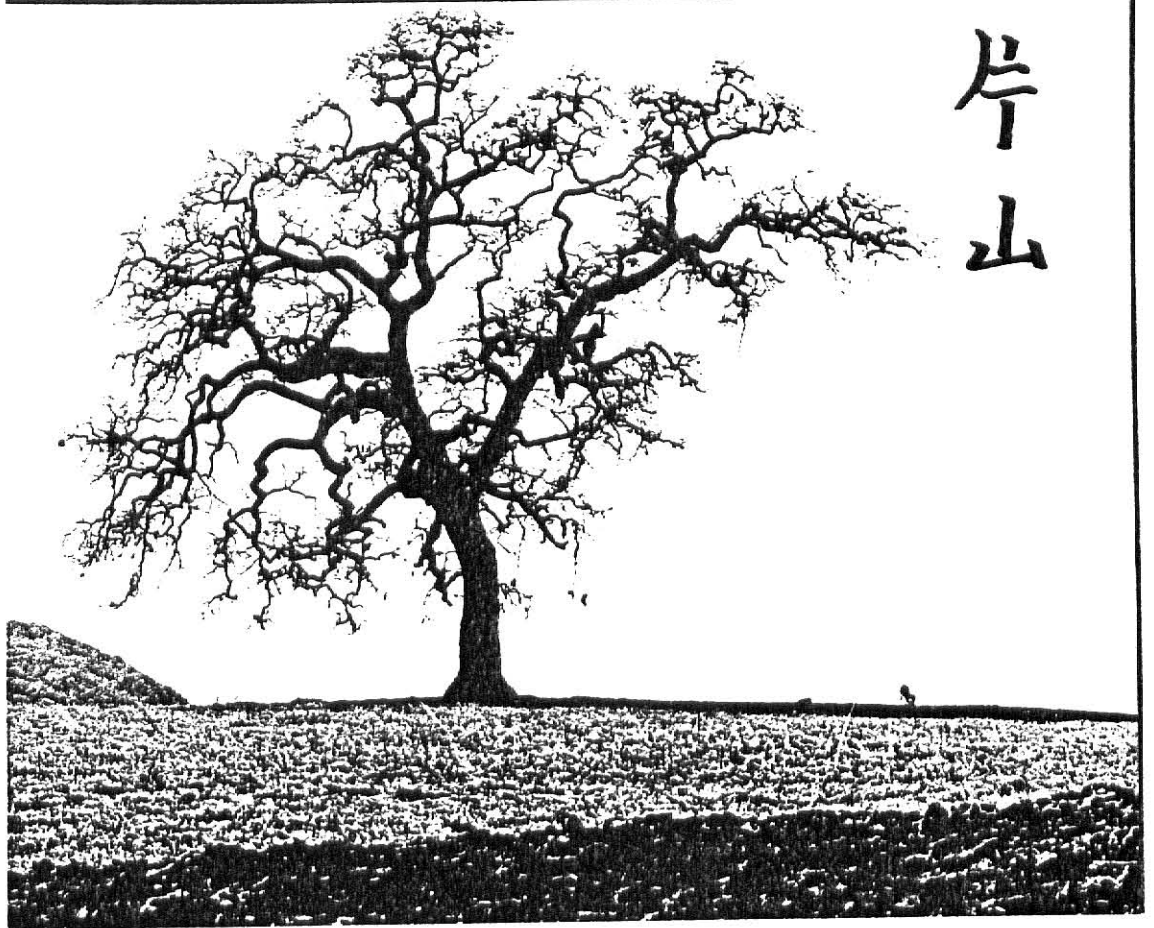
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## PREFACE

I am not a believer in objectivity. I don't feel objectivity can exist in any photographer's work. There comes a moment when you make the decision that you are going to make the picture. That in a sense almost eliminates objectivity. But I do try to come in with as open a mind and as fresh an approach as I possibly can.

William Albert Allard.<sup>1</sup>

Photography is a blend of art and science. This unique co-existence dictates that the "open mind" and "fresh approach" Allard writes about are not only aesthetic but also technical in nature.

It doesn't matter how artistic and creative one's 'eye' is if he lacks the mechanical proficiency and technical know how to reproduce what it sees on his film.<sup>2</sup>

As an undergraduate college student of photography, I began to realize that most photographers are not technically oriented. Their "eye" had been trained in the artistic and creative aspects of the medium but their minds often could not, or would not, comprehend basic technical knowledge.

This realization was reinforced when I was employed as a state photographer in California and as a graduate teaching assistant in photography at Kansas State University. Many of my students displayed a high level of creativity but were reluctant to add technical photographic knowledge to their skills.

Some of the students, as the course progressed, became interested in photography and wanted to continue learning about the craft. The university, however, did not offer any advanced black-and-white photography courses.

After doing some research, I discovered Kansas State University was not alone in offering a limited number of photography classes. Other students -- university, junior college and high school -- were left in the same predicament as my students, they had great interest in the subject and no where to go.

While it is true that there are many photography books on the market, they often do not instill the enthusias of involvement a classroom does.

For these reasons, and others, I decided to write a textbook on some of the technical concepts of black-and-white photography, along with a self-instructional and self-paced course, as part of my master's degree requirements.

This Report Option project is not in the usual format of a research report/project. It is primarily a textbook, with limited literature searches involved. Most of the textbook deals with techniques I have learned and used in the last 12 years as a photography student and as a professional photographer.

By design no photographs are included. I feel that photographic "examples" used in texts and technical manuals hinder the creative element. Most chapters include an additional reading section to guide a student who wishes to see examples or to further investigate a topic.

Mark Y. Katayama

## INTRODUCTION

### Course Objective

The objective of this course is to teach students who have a basic photographic background alternative methods in the technical aspects of black-and-white photography. By mastering these methods students can expand their creative "eye" by increasing the options available to them.

This course will teach the student the importance of consistency (controlling variables) and special darkroom techniques. These topics, once mastered, can enhance any photographer's ability to convey visual images into a photograph.

A good photographer is aware of the ways different films react to light and to different developers. He or she also has the ability to pre-visualize the final image and then produce it in the darkroom.

These elements are part of any photograph. The person who thinks about them and uses them to express ideas is a photographer. The person who does not leaves the final image to chance and risks producing photographs that do not communicate the "visual facts, metaphors and complex layers of meaning"<sup>3</sup> intended.

The photographer must be aware of these techniques, be proficient in their application and use them effectively. That is the objective of this course.

### The Self-Instructional, Self-Paced Learning System

A problem occurs in teaching advanced photography in schools whose staff or facilities cannot handle the students. Photography

is a craft and a technology that demands discipline, time, effort and material resources from students, instructors and educational facilities.

Many institutions have reluctantly come to realize that small-group instruction is not well suited to meeting the demand of such large numbers of (photography) students. As in other disciplines, photography teachers have begun to experiment with alternative models of teaching that delegate such repetitive functions as lectures, demonstrations, and laboratory supervision to other sources and individuals, allowing them to focus their own efforts on tutoring individuals and critiquing their photographs.<sup>4</sup>

One alternative teaching model is the self-instructional, self-paced, open laboratory system. The success of such a program is dependent upon the availability of appropriate instructional materials. A textbook used in this system must not only contain basic reference information but also serve "as a self-instructional tool capable of leading the independent learner through a sequence of learning activities in orderly, graduated, and relatively simple steps."<sup>5</sup>

The text must provide information and projects to achieve its objectives. It must provide a check of the students' progress, a means of directing them to additional information, and increase the students' knowledge and reinforce what has already been learned.<sup>6</sup>

This text has been designed with these points in mind. Each chapter contains basic information about the technique discussed along with step-by-step instructions on how to accomplish 10 projects. The course requires a student to complete seven projects, allowing an option of techniques attempted.

At the end of some of the chapters, a reading list has been

included to give the student additional sources of information about the topic.

Since the chapters are independent of one another, a student may choose the sequence of topics he/she prefers. This allows a student to not only study and work at his/her own pace, but also to pick those techniques he/she finds important at the time.

The chapters repeat information given in other chapters or refer the student to those chapters. This can serve as a review function, reinforcing information that has been learned.

The course has been organized so it can be completed in a two-week time frame. This time span would allow students to take the course during an intersession period, when the photography laboratories would generally not be used, or as a short-course. This does not preclude students from taking the course during the normal school period as long as laboratory time was available.

Although the course does not require direct supervision of the students, it will be necessary for an adviser to oversee the course. The adviser's primary functions would be to answer direct questions about a technique, evaluate projects the students turn in and administer the final examination.

The adviser would also be responsible for arranging two informal meetings when all the students taking the course would meet. These meetings would be scheduled at the end of the first week and just prior to the final examination, during an intersession or a short-course. During the regular school year, the meetings would be scheduled prior to the mid-term period

and before final examinations.

The adviser would hand back graded assignments during the meetings. Students would be expected to present their work in an informal manner at this time.

The purpose of the meetings would be to give the students a chance to exchange ideas, problems and possible solutions to those problems.

It is likely students will be at different stages of the course when the first meeting occurs. This would be beneficial since some students will have completed projects others have not. In this way students would learn from their peers.

The final meeting would give those students who did not complete all seven projects a chance to see what the completed techniques look like.

### Course Design

The course is in three parts. Chapters one through six cover basic photography principles; the proper methods of developing film with an emphasis on consistency; how to "read" contact sheets; and how to develop a test target to compare various techniques and procedures.

Chapters seven through 10 explain exposure indexes and black-and-white films and film developers. The section covers how film and developers work and how they can be used to expand the versatility of photography.

The final portion of the text covers the darkroom. Paper negatives, posterizations, tone-lines and making black-and-white slides are covered.



All advanced black-and-white techniques could not be covered in such a short course. The subjects included here will give the student an overview of the major techniques used by professional photographers and will expose the student to other techniques.

As an example, by designing and using a standard test target, students can compare and contrast other black-and-white films and developers with films and developers covered in the text. Properly designed, the test target could also be used to compare color films or transparencies.

When learning posterization, students must also learn how to make and evaluate direct-positive negatives (negatives that have a positive image). The student must then change basic exposures to three negatives to obtain a desired effect.

#### Additional References

The textbook is required for each student and the adviser. The adviser should also have the following books available: Introduction to Photography, A Self-Directing Approach by Marvin J. Rosen, The Negative, Exposure and Development by Ansel Adams and Darkroom Dynamics: A Guide to Creative Darkroom Techniques by Jim Stone.



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CHAPTER 1  
COURSE EXPECTATIONS

Objective: To give the student information on course prerequisites, cost and grading criteria.

## COURSE EXPECTATIONS

This course should be attempted only by students who have completed at least a basic photography course. It is assumed that students have a working knowledge of basic 35mm single lens reflex cameras, negative developing and printing techniques.

To some degree a review of developing and printing is included in the text, but no review or discussions of camera, camera exposures, or composition will be covered.

Students who feel a review of basic photography principles would be of benefit should read Introduction to Photography, A Self-Directing Approach by Marvin J. Rosen. The Beginner's Guide to the Single Lens Reflex Camera by the Nikon Educational Services is a good review text for basic camera operations and camera exposures.

### Equipment and Materials

The student will be required to provide a 35mm single lens reflex camera, film and paper. The total cost of the course to the student will be approximately \$50.

In order to keep grading as consistent as possible from project to project and student to student, Kodak's Panatomic-X and Tri-X films are required, unless otherwise stated.

For some of the creative darkroom techniques, it will be necessary to use 4" X 5" sheet film. If a student attempts one of these projects, a box of Kodalith sheet film must be purchased. The film is packaged in 25 sheets and its expense can be shared by two students.

Printing paper for the projects will be Kodak Polycontrast RC "F" MW, 8" X 10". Students will need a minimum of 25 sheets to complete the seven projects.

Projects will be displayed on 16" X 20" boards or on 8" X 10" boards, depending upon the assignment. Students are required to purchase the mounting boards.

All film and paper developers, stop baths and fixers will be provided by the photography department.

### Evaluation

The course grade will be determined by the seven projects, the final examination and participation in the two discussion groups.

Each project carries a weight of 100 points, for a total of 700 points. The final examination accounts for 100 points and the two meetings are worth a total of 200 points.

Grading will be determined on a straight percentage basis, i.e. 700-799 points will receive a grade of C; 800-899 points will receive a grade of B; and 900-1,000 points a grade of A.

### Grading Criteria

Since the course objective deals with technical photography, an emphasis will be placed on this aspect while grading the projects. The 100-point weight will be divided into three sections: technical technique, basic technical ability and the effectiveness of the technique.

Technical technique refers to how well the technique was done, purely from a technical standpoint, i.e. did the student

expose the contact sheet to eliminate only the base fog of the film; in a tone-line, are there any gray tones present, etc. This information will be contained in the step-by-step procedures of each technique. The technical technique section has a weight of 40 points.

The basic technical ability includes "sharpness" of the overall print, tonal quality and "cleanliness" of the print. This section has a weight of 20 points.

The criteria for the basic technical ability section will remain constant in all projects so the adviser will give only a numerical grade, without explanation.

The final category, the effectiveness of the technique, is totally subjective. The adviser must ask, "Does the photograph convey the feeling(s), the thought(s) and the spirit the photographer meant to express?" Grading will be determined on this basis, with a weight of 40 points.

Since the effectiveness of the technique is subjective, the adviser will note why points were subtracted or added and make suggestions for improvement.

### Projects

Projects will be due one day before the group meetings and will be handed back to the student after the group meetings.

An additional project will be allowed in the course. This project may be a redone assignment or an independent project researched by the student. It must be approved by the adviser and turned in one day prior to the last group meeting.

### Final Examination

The final examination will be a cumulative test of ten essay questions. It will test the student's knowledge of the new techniques and may review some basic photography principles.

### Group Meetings

Students will be required to attend two informal group meetings during the course. The meetings will give the students a chance to exchange ideas, share problems, make suggestions on how to improve techniques and display their photographs. It will also give the adviser a chance to assess the students' progress. After the initial meeting, the adviser has the prerogative to alter the program in any way to increase its effectiveness. Students will be encouraged to participate, by suggestions, in any changes the adviser may make.

Each student should be prepared to present his/her work at the time of the meetings. Students will be graded on their presentations and participation in the group discussions.

Extra credit will be given to any student who wishes to present additional information about a technique or procedure, with the prior approval of the adviser.

### Laboratory Use

The use of the laboratory and special equipment, such as tripods and filters, will be arranged by the adviser with each student. Students will also be issued lockers to store their photographic supplies.

Laboratory fees will not be charged, but the students will

be expected to clean-up after themselves. As the need arises, students will also be expected to work as laboratory assistants. This responsibility will probably be no more than one day during an intersession or short-course or two days during the semester.

### Project Listings

The following is a list of the 10 projects included in the textbook. Students must choose and complete seven projects.

PROJECT #	PROJECT	PAGE #
1.	Developing a test target.....	30
2.	Determining an exposure index.....	37
3.	Testing the effects of time in the development process.....	45
4.	Developer comparisons.....	56
5.	"Push" processing.....	58
6.	Paper negatives.....	64
7.	High-contrast negatives.....	69
8.	Tone-lines (worth two projects).....	75
9.	Posterizations (worth two projects).....	83
10.	Black-and-white slides.....	89

### Summary

Students are encouraged to read the entire text before attempting the projects. The initial sections will provide a review as well as important technical concepts that should help in the completion of the projects. Later sections include the projects.

## CHAPTER 2

### BASIC PHOTOGRAPHY PRINCIPLES/ TESTING CAMERA SHUTTER SPEEDS

Objective: To demonstrate the importance of consistency  
in the photographic process.



## BASIC PHOTOGRAPHY PRINCIPLES/ TESTING CAMERA SHUTTER SPEEDS

### Basic Photography Principles

After the initial excitement of taking, processing and printing the first roll of film, one might be amazed that it all works. The picture was conceived, the lighting measured, the negative exposed, then the film goes into the critically measured and temperature-correct developer for a specific amount of time, next into the fixer, dry the film, contact print the negatives, choose a frame, select a filter, determine the basic exposure, then dodge and burn certain areas, into the developer, to a stop bath, fix the print, wash it, dry it and like "magic" you have a photograph.

Each step represents a variable. If the same photographer were to take two pictures exactly the same on two rolls of film, then processed them at different times, chances are the results would be quite different, if he or she did not eliminate some of the variables.

The most obvious variables are the time the film is left in the developer, the developer's temperature and the agitation of the developer. They are important, but other variables also affect the outcome.

One such variable is the photographer's equipment. Most photographers give their cameras very little attention. Perhaps they have them cleaned and serviced once every five years or, more likely, when they break-down.

Like any mechanical device (even the electronic cameras

have moving parts), cameras wear out. The shutter, with its intricate parts, lubrications and exact tolerances tends to be most susceptible to wear.

Photographers usually ignore the problem since it occurs slowly and almost unnoticeably. It is also a problem that is difficult to test without sending the equipment to a service and repair shop, a process which can take as long as three months to accomplish.

There is a way, although not foolproof, to check shutter speeds on one's own. Before an explanation of the procedure is given, a few assumptions must be made. They are as follows:

1. The majority of the shutter speeds in the camera are accurate, i.e. only one or two speeds are questionable.
2. The lens apertures and lens elements are in working order. This can be checked by performing the test with more than one lens, then comparing the results.
3. The film is developed properly. (See "Negative Developing" on page 13 for more information on the subject.)

This test will not necessarily identify the specific problem within the shutter mechanism but it will be an indication of whether the camera needs attention by a repairperson.

#### Testing Camera Shutter Speeds

The test uses equivalent exposures to determine if the shutter is functioning properly. After a "basic exposure" is determined, equivalent exposures are calculated from it. In theory, when the film is exposed at these exposures, all the frames should be of equal densities. In practice, the densities

are close, but they are not exactly the same. This is due to various mechanical and procedural tolerances that are part of photography. (See "Exposure Indexes" on page 32 for more information.)

Materials needed for the test: The camera in question, a tripod, a roll of Panatomic-X (135-20), a photographic spot light (use a continuous light source rather than an electronic flash unit), a clean white wall and approximately a dozen 3" X 5" note cards.

Procedure:

1. Assume, for example sake, the camera in question has shutter speeds from one second to 1/1,000 of a second and a 50mm lens with a maximum aperture of f/1.4 and a minimum aperture of f/16.
2. Load the camera with film. Set the camera on the tripod.
3. Position the camera about five feet away from the wall and focus on the wall. With a 50mm lens, the angle of coverage should be approximately 6' X 5'. If other focal length lenses are used, adjust the camera distance to approximate this angle of coverage.
4. Position the light source so it covers the entire image seen in the camera. Some camera viewfinders do not show all the image that is recorded on the film, so do not "crop" the light coverage too closely.
5. Adjust the light so an exposure of the widest lens opening and fastest shutter speed the camera is capable of performing is achieved. In the example, this would be an exposure of 1/1,000 of a second at f/1.4. This adjustment is made by moving the light

source either closer (more light) or further back (less light) until the proper amount of light is attained.

6. Recheck the light coverage to make sure it covers the entire image the negative will "see."

7. On a note card record the equivalent exposures, from the basic exposure; the date the test is being performed; the test being performed; and note the camera being tested.

In the example, the equivalent exposures would be:

1/1,000 @ f/1.4

1/500 @ f/2

1/250 @ f/2.8

1/125 @ f/4

1/60 @ f/5.6

1/30 @ f/8

1/15 @ f/11 and

1/8 @ f/16.

The light source will be moved after these exposures have been made to test shutter speeds slower than 1/8 of a second. Note cards must be filled out for these exposures. The exposures would be:

1/4 @ f/1.4

1/2 @ f/2 and

1 second @ f/2.8.

A typical note card would contain the following information:

Exposure: 1/250 @ f/2.8

Date: 4/16/52

Camera: Nikon F2 #85744952

Test: Shutter Speed Test

8. Place the first card on the wall so that it is in the center of the frame with the data facing the camera.
9. Set the exposure, corresponding to the card, on the camera and expose the frame.
10. Repeat the procedure until all the exposure combinations are used.
11. Reposition the light source to achieve a basic exposure which allows for the testing of the slower shutter speeds.

In the example, the basic exposure would be  $1/4$  of a second at  $f/1.4$ .

12. Place the appropriate note card (from Step #7) in the center of the frame and expose the film.
13. Repeat the procedure until all the exposure combinations are used.
14. Remove the film from the camera and process the film normally. (See "Negative Developing" on page 13 for more information.)

#### Evaluation:

1. After the film has dried, cut the film in strips containing six frames each. Do not reverse the order of strips when making a contact print of the negatives.
2. Contact print the strips. (See "Determining Proper Contact Sheet Exposures" on page 20 for more information.)
3. Process the contact print.
4. Allow the print to dry before examination.
5. Examine each frame in relationship to other frames. If the camera shutter speeds are working properly, all frames will be identical.

NOTE: Those frames exposed before the light source was moved will look considerably different than exposures made afterwards. These frames should be examined separately.

As mentioned previously, because all cameras are built with certain tolerances, slight exposure variations may be seen. Look for those frames that are distinctly different from the rest.

6. If only slight variations are found, the camera is operating properly. If significant differences are seen, repeat the test using a different lens.

When evaluating the second test, if the variations appear at the same shutter speeds, the camera is the culprit. If slight variations are seen, the lens is probably to blame, assuming the tests were conducted properly.

7. The results of this test will help in explaining the problem to the repairperson. Include the contact sheet with the camera when the repairs are being done.

8. Do not throw the contact print away. The test may be repeated at any time a problem with the camera is suspected and its results compared to this test.

#### Additional Reading

There are other means of testing camera shutter speeds. One of the best the author has seen appeared in the February and March, 1980 issues of Popular Photography by Michele A. Frank. She outlines in the February issue, pages 18 and 212, how to use a television set to test shutter speeds from 1/125 of a second to 1/2,000 of a second.<sup>7</sup>

In the March issue, pages 12 and 78, Frank uses a record

turntable to test speeds of  $1/60$  of a second and slower.<sup>8</sup>

CHAPTER 3  
NEGATIVE DEVELOPING

Objective: To outline acceptable and unacceptable procedures  
for developing 35mm film.



## NEGATIVE DEVELOPING

There are at least 20 individual steps that go into processing 35mm negatives. If any one of those steps is incorrectly done or done differently from roll to roll, the final product will be altered, sometimes slightly, sometimes dramatically.

A photographer can control all of these variables when processing film, but it requires being concise and methodical.

A major difference between a "snapshooter" and a professional photographer is not only his/her "eye" but also the professional's ability to pre-visualize the final image. This can be done only if the photographer knows what the film developer will do and can expect those results every time a roll is developed.

Suggestions and hints about film processing follow:

1. Use the same measuring devices for developers. The author's standard developer is D-76, diluted 1:1. The same graduate is always used to measure the developer which is marked to show the level of the stock developer needed and the amount of water required.

This is helpful when handling highly concentrated developers such as Rodinal, which can be mixed at a ratio of one part Rodinal to 100 parts water. The mixture may not be exact, when dealing with such high dilutions, but the mixture can always be the same if the same graduates are used, thus making the results predictable.

2. Be aware of "wet time" whenever processing film. "Wet time" is the time the film is in the developing solution. Generally speaking, wet time should not be less than three minutes and not

longer than 20 minutes.

Film that is developed for less than three minutes tends to display irregular developing characteristics. Film that is developed for longer than 20 minutes may develop excessive chemical "fog" (the development of unexposed silver halides, creating an overall mask that reduces the contrast of the negative). This fog is most prevalent when film is "push" processed to attain a higher film speed.

3. Use a minimum of two thermometers when checking the temperature of a developer. The temperature readings from them should be within plus or minus 1 F. If they vary more than that, a third thermometer should be used to see which of the thermometers is off.

A mercury-filled thermometer is helpful as a check for the faster reacting dial thermometers.

NOTE: This is also a good check when buying thermometers. Open a few of the boxes they come in and see what temperatures they indicate. If you find one that is not consistent with the others, don't buy it. Choose only those units that indicate "the majority opinion."

4. The time it takes to pour in the developer and the time it takes to drain it may seem irrelevant, but it is not. Some developing tanks allow a fast pour time and a relatively slow drain time and vice versa. The differential can be as long as 30 seconds -- 30 seconds that the film is not being developed or is being overdeveloped.

Record the time it takes to pour in the developer and the time it takes to pour it out. It need be done only once and the

times can be used as a basis to adjust the actual developing time.

This is especially useful when color negatives or slides are processed since their developing tolerances are much more stringent than that of black-and-white films.

5. One of the most critical variables in the developing process is the agitation of the developer around the film surface. Too much or too aggressive an agitation sequence will result in overdeveloped negatives. Too little agitation will result in underdeveloped negatives. Erratic agitation will yield inconsistent development of the negatives.

The photographer should choose an agitation sequence and stick with it. The manufacturer's recommended procedure is a good one to start with.

It is strongly recommended that the "figure eight" method of agitation not be used. In this method, the developing tank is moved in a figure eight configuration for a given amount of time. The tank is then inverted and returned to its original position to rest until the agitation sequence is repeated.

This technique allows the developer on the outside areas of the film to be exchanged more rapidly than it is on the inside areas. This results in a film strip that is underdeveloped on one side and overdeveloped on the other.

A recommended sequence is to invert the developing tank three times in a slow and orderly fashion. When the tank is put down, rotate it one-third of a turn and allow it to rest until the procedure is repeated. The rotation of the tank allows fresh developer to be distributed equally around the film and, with

practice, the three inversions can be accomplished in five seconds, the standard time of subsequent agitations.

6. The use of a stop bath between the developer and the fixer is an acceptable practice. It can, however, increase grain in the negatives. When developers act on film, a high alkaline level is present. Because stop bath is an acid based solution, it shocks the developing process to a halt. This shock the film is subjected to may be too great for certain films to withstand.

Because the stop bath works so quickly, it may also cause small "pinholes" to form on the film surface, these holes are most prevalent when the stop bath is used on sheet films, but also occur on 35mm films.

An alternative to the stop bath is a quick water rinse before the fixer is added. After the developer has been drained from the tank, fill the tank with water. The water should be at a temperature plus or minus 5 F of the developer. Rap the bottom of the tank gently to remove any air-bells on the film, then dump the water. Follow the normal fixing procedure after this step.

Since the water bath will slow the developing action to a minimum, no adjustments in the developing time will be needed.

7. During the fixing stage, follow the agitation sequences described in Step #5 of this chapter. Over-agitation of the fixer will cause a loss of overall contrast in the negatives. Under-agitation may cause vertical streaks to be formed on the film.

Most film data sheets will give a minimum and maximum fixing time for a given film. With fresh fixer, always use the minimum

time. As the fixer's strength diminishes with usage and time, it may be necessary to extend the time to the maximum recommended by the manufacturer.

Remember, fixing time is roughly calculated as twice the time needed to clear the film. If the film has not cleared in the recommended time, do not extend the fixing time. Replace the fixer.

Film that has not been adequately fixed will have a milky-white appearance to it. Often the film can be re-fixed, with fresh fixer at the recommended time, and saved.

8. Avoid using any type of hypo-clearing agent on the film. It is the opinion of the author that these agents increase the grain of the film and cause unusual grain clusters. A standard water wash is recommended.

9. Always use fresh "wetting" agents after the final wash. Wetting agents that are reused are often responsible for dust that cannot be brushed away. The dust, or other foreign elements, may be carried by the wetting agents and dry directly into the film. This problem can be reduced by using freshly mixed solutions or a working solution and then dumping it.

#### Additional Reading

For more detailed discussions on the developing process, two publications are recommended. Processing and Process Monitoring of Kodak Black-and-White Films is an excellent overview of processing, monitoring and problem solving of various developing procedures.

Perhaps the most complete and concise book on exposure and

development is Ansel Adams' The Negative, Exposure and Development. Although the book stresses Adams' zone system of exposure, the concepts of film characteristic curves, reciprocity, gray scales, etc. are invaluable to any 35mm photographer.

## CHAPTER 4

### DETERMINING PROPER CONTACT SHEET EXPOSURES/ READING A CONTACT SHEET

Objective: To utilize the contact print to its fullest advantage.

## DETERMINING PROPER CONTACT SHEET EXPOSURES/ READING A CONTACT SHEET

A contact sheet is more than an organized display of frames on photographic paper. It can be a teacher, an editor and an invaluable guide in the technical processes of photography.

Many photographers produce a contact sheet merely to see what frames look reasonable to print. They expose the print paper in a manner that allows the majority of frames to be viewed clearly.

Makes sense, right? Not really. Consider the fact that such an exposure does not give a true indication of the camera exposures.

The photographer may be consistently over or underexposing negatives in the camera and then compensating for it by altering the exposure of the contact sheet.

By altering the exposure of the contact sheet, the photographer cannot make comparisons about the final print exposures, contrasts and negative sharpness from one contact sheet to another.

This can slow the print-making process and limit the effectiveness of the final image.

Correctly exposing and processing a contact sheet will eliminate still more variables from the process.

All photographic films must have some type of base to hold the emulsion layers in place. The base may appear transparent, but they all restrict some light from reaching the photographic paper. This is known as the film's base density.

When film is developed, it also receives an additional density



known as chemical or development "fog." The "fog" is caused by the development of unexposed silver halides and reduces the overall contrast of the negatives.<sup>9</sup>

Both elements prevent the unexposed areas of a negative from appearing black in the print.

By eliminating base density and chemical fog, through proper exposure of the paper, one can make a more accurate assessment of the exposures made in the camera. A correctly exposed frame will appear "normal" with black areas being black and white areas having the correct densities.

#### Determining Proper Contact Sheet Exposures

Materials needed: A processed roll of film, printing paper, a contact printer, an enlarger, a timer and chemicals to process prints.

#### Procedure:

1. Select the negative strips to be contact printed. They should be from the same roll of film.
2. Save approximately four inches of the clear portion of the film found either at the beginning of the roll or at the end.
3. Set up the darkroom to make contact prints. Begin with the enlarger head at its highest elevation and the lens stopped-down to its smallest aperture (maximum enlargement with the least amount of light).
4. Cut a piece of printing paper approximately 1 1/2" X 4".
5. Set the timer to give an exposure of five seconds.
6. Place the unexposed film and photographic paper in the contact printer, the paper on the bottom, emulsion side up and

the negative, emulsion side down, on top of the paper.

7. Expose the entire sheet for five seconds. If a variable contrast paper is used, use a #2 (normal) contrast print filter.
8. With a piece of cardboard heavy enough to prevent light from filtering through, cover 1/4" of the negative.
9. Expose the remaining 3 3/4" of the negative for five seconds.
10. Continue this procedure, covering up 1/4" each time, until the final 1/4" of paper has received 60 seconds of exposure. Twelve separate five-second exposures are needed to accomplish this.
11. Remove the paper from the contact printer and process the strip as a normal print. Be sure to process the paper exactly as any other print, with proper agitation in the developer and fixed for the proper amount of time.

The last 1/2" or so of the test strip should be completely black. If it is not, repeat the procedure with the lens aperture opened-up (more light) at least one f/stop.

If the entire test strip is dark, a mistake has probably been made. Check to make sure the enlarger head is at its highest point and the lens is stopped-down all the way.

Also, the paper may have been exposed to light at some other point. Repeat the procedure.

#### Evaluation:

1. Allow the test strip to dry completely before examining it.
2. Find the exposure that gives the first true black on the strip. This exposure has eliminated the overall density of the film and is the basic exposure for the contact sheet for this roll of film.

NOTE: In theory, if the same type of film is used and developed

in the same type of developer, all its contact sheets should require the same exposure, if the same enlarger is used. This is not always true, however, because of the changing temperature, dilution and depletion of the print developer. Therefore, each contact sheet exposure should be determined separately, unless they processed at the same time.

Procedure continued:

12. Using the basic exposure time for the contact sheet, determined in Step #2 of the evaluation section, contact print the negatives.
13. Process the paper normally and allow it to dry completely.

Reading a Contact Sheet

If, overall, the contact sheet frames are too dark, or too light, the film has not received the correct amount of exposure or development.

Many factors can contribute to this. Most likely it is caused by the combination of the film's ASA, the tolerance levels of the equipment and the development procedures used. For a more complete analysis of the subject, see the "Exposure Indexes/ Determining an Exposure Index" chapter beginning on page 32.

When a correctly exposed and processed contact sheet is made, it can tell the photographer a number of things.

The most obvious is that it enables the photographer to view positive images, making the selection of possible frames to be printed easier to examine. It allows a comparison between similar frames to be judged and potential cropping of the frames to be made.

Beyond this, a contact sheet can aid in the printing process. Since the sheet was printed with a #2 contrast print filter, those frames that contain good contrast levels on the contact sheet will, most likely, require no filter changes when the final print is made. Frames which appear to lack contrast or contain too much contrast can be corrected in the initial stages of printing.

When the first enlargement is made from a contact sheet, the exposure time and f/stop used should be recorded. From this information, the exposures of other frames on the same contact sheet can be estimated.

If another frame on the sheet is printed at the same magnification as the original print and if they appear to have the same contrast, tones and densities, the second print's exposure will be similar to the first print.

Frames darker or lighter on the contact sheet than the first enlargement will need less or more exposure, respectively, assuming the magnification level has not been changed.

These estimates can be made before the photographer goes back into the darkroom. It saves time and paper.

Finally, the contact sheet can be the photographer's best teacher and worst critic. The following are excerpts from a Popular Photography article entitled "Contact" written by Albert Gruen.

Since photography is a selective medium, each photographer composes his world with what he chooses to see, or not to see, and a contact sheet is the revelatory sum of his parts. It opens out frame by frame the person and style of the photographer -- the peculiar individuality of the way he sees and how he searches...

The serious evaluation of pictures is made from the contact sheet -- a cerebral and esthetic process. There, on the contact sheet, the whole episode of a roll of film is laid out -- the photographer's achievements, the embarrassments, and the run-of-the-mill.<sup>10</sup>

Gruen also writes about how to interpret a contact sheet for the first time. The contact sheet should be approached at arm's length and casually. This allows the photographer to look at the entire sheet without being "confused with detail," according to Gruen.

"The sheet becomes a group of competing abstractions and the most vital compositions attract attention first... Take advantage of first impressions, but then go over the contact sheet carefully..."<sup>11</sup> Gruen wrote.

Upon closer examination, he recommends the use of a magnifying glass. The photographer should look for potential cropping possibilities and mark them accordingly as a guide for printing.

While looking at individual frames, Gruen suggests the photographer disassociate him/herself from the original shooting session and look at the frames "with a virginal eye." "Often important elements or small surprises surface, things that the photographer didn't comprehend at the moment he tripped the shutter, and that are to be found waiting on the contact sheet,"<sup>12</sup> he wrote.

Gruen concludes the article with an explanation of how important the "contact-reading ability" is to the photographer.

The masterful reading of contact sheets is an exercise in objective taste and requires its own kind of talent. There are photographers who can take superb pictures without a matching contact-reading ability. And that is a shameful waste, because with patience, a point of

view, and a knowledge of available printing techniques, the best picture could be exploited and not left to oblivion in their tiny frames.<sup>13</sup>

CHAPTER 5  
DEVELOPING A TEST TARGET

Objective: To assemble, for photographic testing purposes,  
a series of objects to be used as a test target.

## DEVELOPING A TEST TARGET

When photographers hear the words "test target" they have visions of little register marks and lines closely placed in groups around a giant bullseye. These test charts are most useful for testing lenses, film plane alignments and various other esoteric photographic principles, but do little for "the common person."

The test target to be discussed here is not so complicated or esoteric. Most photographers use some type of target more often than they realize.

The most common test target is a person. A photographer who wishes to test a new lens or developer will ask someone to model. This seems like a logical choice: a person has skin tones, to test for subtle contrast changes; a person has eyes and eye lashes, to test for sharpness; and a person has facial contours, to test for details in shadow areas.

But a person is not always available, at least not the same person. Different people have different complexions, different facial characteristics, different shades and thicknesses of eye lashes, etc. People also tend to get bored during a five-hour session and walk away.

Enter the non-human, non-living test target. The problem with replacing a human being with an inanimate object is that most photographers take pictures of humans and there's no substitute for the original.

It is possible to represent most tones from the whitest white to the blackest black, however. Kodak makes a gray scale



which has most of the tones that film is capable of reproducing, but the scale is often difficult to "read" and sometimes tells the photographer nothing about actual picture taking.

It is also possible to use a doll or other types of models to represent the human face. Care must be taken here to find a face that is not too small.

The test target must include a constant tone, if a gray scale is not being used. The standard mid-range tone is an 18 percent gray. Inclusion of a "gray card" is also useful when an incident light meter reading is used to determine exposures.

Finally, the target should include a means of comparing "sharpness" in the negative. Clean, sharp, high-contrast lettering works quite well for this purpose. The lettering should be placed on the same vertical plane as the face or other model. The lettering's purpose is two-fold; first it can be used to judge the sharpness of the image on the film and second, it will be the critical area of focus, when the actual tests are conducted.<sup>14</sup>

In review, a well-designed test target should include good, clear, well defined areas of tones, i.e. an area of rich black, an area of pure white, middle gray areas and an 18 percent gray. The target should contain some type of model, preferably a life-sized face, but any three dimensional figure can be used. It is important for the model to have dimension because it will allow depth-of-field tests to be performed. And last, but not least, the target should include some type of lettering to judge sharpness and act as a consistent area of

focus in the target.

Once the test target has been designed, keep it consistent. If changes are needed later, attempt to keep as many elements as possible the same. In this way, tests that are made now can be compared favorably with tests that will be made in the future.

The author's test target includes a patchwork quilt that contains a number of gray tones, an 18 percent gray card and a Mickey-the-Mouse bank. The two-foot bank is the key element. Mickey's ears are a solid black, his hands are white and the Mickey Mouse emblem has clear lettering.

#### Lighting the Test Target

Many photographers conduct comparison tests under sunlight conditions since this lighting is extremely contrasty and taxes any film's or developer's potential.

With a photographic spot light and a large white board, the sun's light can be simulated to illuminate the test target.

Generally, the difference between the highlight areas and the shadow areas in open daylight is five exposure stops. As an example, if a light meter reading of 1/500 of a second at f/16 is determined in the highlight areas, the shadow area's exposure would most likely be 1/500 of a second at f/2.8.

This lighting can be simulated by placing a spot light facing the test target model and varying its distance until the correct exposure is achieved. In the example, an exposure of 1/500 @ f/16 in the highlight areas would be needed.

The light falling on the shadow areas must then be measured.

If less than five exposure stops are present, change the light source replacing it with a more intense light, i.e. a point light source. If the shadow area exposure is greater than five stops, use the white card to reflect more light into the shadows until the desired exposure is achieved. In the example, an exposure of  $1/500$  @  $f/2.8$  would be needed.

This lighting technique can be used to achieve a wide variety of lighting conditions and expands the versatility of the test target.

PROJECT 1  
DEVELOPING A TEST TARGET

Requirements

1. Design a test target.
2. Record all scenes on Panatomic-X rated at ASA 32 and developed in D-76, diluted 1:1.
3. Light the test target to simulate the following lighting conditions:
  - A. Sunlight. Five exposure stops difference between the highlight and shadow areas.
  - B. Extreme contrast lighting. More than 5 exposure stops difference between the highlight and shadow areas.
  - C. Low contrast lighting. Three exposure stops difference, or less, between the highlight and shadow areas.

At each lighting condition, set up the light source at four different angles: at a  $45^{\circ}$  angle from the lens axis and the test target; front lighting; back lighting; and side lighting.

Be sure to include a note card in each of the 12 frames, recording pertinent data, i.e. the camera being used, the date of the test, the exposure used and the test being conducted.

4. While the test target is illuminated to simulate sunlight, expose two additional frames at each angle. One exposure should be made at the largest lens aperture possible (limited depth-of-field) and the second exposure at the smallest lens aperture possible (maximum depth-of-field).

Be sure to include a note card for each frame.

NOTE: This step will produce eight additional exposures, for a total of 20 exposures on the roll.

5. Contact print the roll.
6. Make an 8" X 10" print of the frame representing sunlight at a 45° angle and exposed to give maximum depth-of-field.
7. Dry mount the print on a 16" X 20" board and include the contact sheet on the back.

#### Evaluation

Students will be evaluated on how well the test target was designed; how well the lighting and exposure instructions were followed (including the information recorded on the note cards); whether the contact sheet was made correctly; and how well, technically, the 8" X 10" print was made.

#### Presentation

The student will be expected to discuss any problems encountered in the project and analyze the effectiveness of the test target and its possible improvements.

## CHAPTER 6

### EXPOSURE INDEXES/ DETERMINING AN EXPOSURE INDEX

Objective: To give the student a background on how  
photographic films are rated in light sensitivity.

## EXPOSURE INDEXES/ DETERMINING AN EXPOSURE INDEX

### Exposure Indexes

Camera manufacturers allow most of their camera bodies a shutter speed tolerance of plus or minus one-third of an exposure stop. Lens manufacturers allow most of their lenses an aperture tolerance of plus or minus one-third of an f/stop.

The manufacturers of film developers give recommended developing times and temperatures for various films. These are merely recommendations and often they are misleading.

Film manufacturers utilize a rating scale devised by the International Standards Organization (ISO) to rate their films' sensitivity to light.

Essentially, the standard combines the existing American rating (ASA) and the German system (DIN). The ISO rating for Plus-X, for example, is ISO 125/22° -- the first number being the ASA rating and the degree sign indicating the DIN logarithmic value.<sup>15</sup>

Individually, these tolerances or recommendations are not significant in the final product. Collectively, they can mean a difference of over one exposure stop from the indicated value.

For this reason, most photographers use the film's ASA rating as a starting point in determining their own film value.

Exposure Index (EI) is a term used to describe "a number indicating the relative effective light sensitivity of a given film, as determined by any methods other than those proposed by the ANSI (American National Standards Institute) or similar

organizations."<sup>16</sup>

The key words in the definition are "as determined by any methods other than those proposed by the ANSI." So, an exposure index is any value of light sensitivity a photographer assigns to a given film, if it is determined differently than by the scientific standard.

Therefore, if Tri-X is assigned a value of EI 400, the photographer has deviated from the recommended procedures determined by the manufacturer to attain this film rating.

To initially determine an EI for a given film, the photographer must eliminate certain variables. In this case it will be assumed the developer's time and temperature chart are correct.

The variables that will be eliminated are the tolerance levels of the camera, lens and exposure meter.

#### Determining an Exposure Index

Materials needed: Camera, exposure meter, tripod, one roll of Tri-X (135-20), one roll of Panatomic-X (135-20), a test target, a continuously illuminated light source, note cards and the appropriate equipment to make and develop a contact print.

#### Procedure:

1. Set up a test target.
2. Set up the light source to indicate a basic exposure of 1/125 of a second at f/8.
3. Load the film in the camera.
4. Secure the camera to the tripod and frame the camera to the



test target.

5. Fill out a note card with the following information: camera being used, lens used, light meter reading in the highlight and shadow areas, developer to be used and the film being tested.

Place the card within the camera frame.

6. Fill out additional note cards with the exposure data information, as follows:

1/125 @ f/4

1/125 @ f/4-5.6

1/125 @ f/5.6

1/125 @ f/5.6-8

1/125 @ f/8 BASIC EXPOSURE

1/125 @ f/8-11

1/125 @ f/11

1/125 @ f/11-16 and

1/125 @ f/16

Notice that since the lens' f/stop will be the first area tested, the shutter speed remains constant while the aperture is changed in one-half stop increments.

Also, since a film's assigned ASA is "in the ballpark," a bracketing of two stops under and overexposed from the basic exposure is adequate in determining an EI for the film.

7. Fill out a second set of note cards that will indicate changes in the shutter speeds. They should read as follows: First, to test the slower speeds,

1/8 @ f/16

1/15 @ f/16

1/30 @ f/16 BASIC EXPOSURE

1/60 @ f/16 and

1/125 @ f/16.

Then, to test the faster speeds,

1/125 @ f/4

1/250 @ f/4

1/500 @ f/4 BASIC EXPOSURE

1/1,000 @ f/4 and

1/2,000 @ f/4 (if the camera is so equipped, if not, this step can be omitted).

Notice that the test is actually comparing only two shutter speeds, 1/30 and 1/500 of a second. These speeds are indicative of the slower end of the shutter mechanism and its faster end.

8. Expose the 19 frames in the order given, placing the appropriate note card in each frame.

9. Repeat the procedure with the second roll of film.

Remember to move the light source to obtain the correct basic exposure for the film of 1/125 of a second at f/8. The note card in Step #5 should also be changed to indicate the change of film.

10. Process both rolls of film separately.

11. Make a contact print, following the procedures in "Determining Proper Contact Sheet Exposures" on page 20.

#### Evaluation:

1. Carefully examine each frame in the three groups (f/stop changes, slow shutter speeds and fast shutter speeds) and choose the one frame from each that appears to be correctly exposed.
2. Assume the Tri-X contact sheet is being evaluated. If the best exposures all appeared in the BASIC EXPOSURE frames,

the film would have a light sensitivity rating of ASA 400, not an EI of 400 since nothing in the recommended procedure was changed.

3. Assume the best exposure was 1/125 at f/5.6-8 in the f/stop group. This would give the film an EI of 300 (the film required one-half of an exposure stop more light than the film's recommended rating).

Assume the best exposure in the slower shutter speed group was at 1/30 at f/16 and 1/250 at f/4 for the faster speed group. This would give the film a rating of ASA 400 and an EI of 200, respectively.

By averaging these figures, an exposure index of 300 is calculated. This figure is within one-half of an exposure stop determined in the three test groups and is acceptable. If the difference is greater than one exposure stop, further examination of the equipment, developer and/or development procedure is needed.

PROJECT 2  
DETERMINING AN EXPOSURE INDEX

Requirements

1. Follow the steps outlined in "Determining an Exposure Index."
2. Make two 8" X 10" prints, one from the Tri-X roll and one from the Panatomic-X roll.

For each film, use the frame determined to be the correct exposure from the f/stop change section of the test.

3. Dry mount the two prints, side-by-side, on a 16" X 20" board and include the contact sheets from both rolls on the back.

Evaluation

The basis for evaluation will be entirely technical. Was the light source correctly implemented; were the note cards correctly filled out; are the exposures correct; did the student choose the right "correct" exposures; was the contact sheet properly made, etc.

Presentation

The student will be expected to discuss any problems encountered in the project. The student and adviser will analyze both prints in terms of contrast, grain, acutance ("sharpness") and effective film speeds.

## CHAPTER 7

### TESTING THE EFFECTS OF TIME IN THE DEVELOPMENT PROCESS

Objective: To show the student how the contrast and speed of film can be affected by development.

## TESTING THE EFFECTS OF TIME IN THE DEVELOPMENT PROCESS

The "Determining an Exposure Index" test eliminated the variables of manufacturers' tolerances in the photographic process. The procedure can also be used to test the effects of different development times and temperatures.

After the exposure index is established, additional tests can be conducted with this objective in mind. Even if the exposure index test is not performed, the following test can be conducted using the film's recommended ASA.

In the test, four rolls of film (of the same type) are exposed in exactly the same manner. The photographer illuminates a test target to achieve a basic exposure of  $f/5.6$  at any shutter speed greater than  $1/60$  of a second. The film is then overexposed and underexposed by three stops, in increments of one-half of a stop. This is a total of 13 exposures, when the basic exposure is counted.

Since all four rolls are exposed in this way, developing is the only variable left to examine. When film is underdeveloped, exposure must be increased to compensate for it. When film is overdeveloped, exposure must be reduced.

This test will tell the photographer exactly how much exposure compensation is needed to adjust for development time of 50, 75, 125 and 150 percent of normal development. It will also allow a study of how development affects the densities, acutance and grain of films.

Materials needed: A camera, a lens with a minimum aperture of

at least  $f/16$  and a maximum aperture of  $f/2$ , an exposure meter, tripod, four rolls of Tri-X (135-20), a test target, a continuously illuminated light source, note cards, two developing tanks (each with a capacity to hold four 35mm reels), seven 35mm developing reels and appropriate equipment and chemicals to develop film and make a contact print.

NOTE: A 12" section of a metal clothes hanger, with a hook on one end, is a useful tool for removing developing reels from a developing tank. (See Step #12.)

Procedure:

1. On the exposure meter, set the exposure index number obtained from "Determining an Exposure Index" or use the film's ASA rating.
2. Set up a test target and illuminate it as required. The light source should enable the photographer to use an  $f$ /stop of  $f/5.6$  at a shutter speed faster than  $1/60$  of a second.
3. Load the camera with film, place the camera on the tripod and frame the test target in the viewfinder.
4. Fill out a note card with the following information: the camera and lens being used, the light meter reading for the highlight and shadow areas, the developer being used and the film being tested.
5. Place the card within the camera's coverage.
6. Additional cards must be filled out to indicate how much development each roll received and the exposure each frame received.

This can be done as prescribed in Step #6 under "Determining

an Exposure Index," on page 34, with exposures from f/2 through f/16 in half-stop increments. In which case 13 separate cards must be made.

An acceptable short-cut would be to fill out four cards with the following information:

f/2 through f/16 in half-stop increments.

(shutter speed used) @ f/5.6 BASIC EXPOSURE.

By including this information, each of the 13 exposures can be identified. If the first frame was exposed at f/2 and the last frame at f/16, with each frame representing a one-half stop increment, then the sixth frame would have an exposure of f/4-5.6.

This information may not seem critical at this time, but it will be in the future as a reminder of how the test was conducted.

A typical note card would look like this:

f/2 through f/16 in half-stop increments.

1/125 @ f/5.6 BASIC EXPOSURE.

125 percent of normal development.

7. Expose the four rolls of film with the appropriate sets of cards (from Steps #4 and #6) within the camera's frame.

Example: The four rolls of film will all receive the same exposures of:

f/2

f/2-2.8

f/2.8

f/2.8-4

f/4



f/4-5.6  
f/5.6  
f/5.6-8  
f/8  
f/8-11  
f/11  
f/11-16 and  
f/16.

The note cards will indicate how much development the roll has received.

8. Rewind the film, take it out of the camera and mark it with the appropriate percent of developing the roll will receive.
9. The order the reels are placed into the tank is critical to the test. Make sure it is correct.

Load the four exposed rolls of film onto the developing reels and place them into the four-reel tank in this order: the first reel into the tank will be the negatives to be processed at 150 percent of normal; the second reel will be the negatives to be processed at 125 percent of normal; the third reel, 75 percent of normal; and the top reel in the tank will be the negatives to be processed at 50 percent of normal. Replace the lid on the tank and set it aside.

10. Fill the second four-reel tank with 32 ounces of fixer. Do not put the lid on the tank, but have it handy.
11. Have the three empty developing reels available, next to the developing tank.
12. Develop the film, keeping the temperature constant while altering the time the rolls are left in the developer.

In order to accomplish this, it will be necessary to remove individual reels from the developing tank at specific times.

Follow these procedures:

- A. Thirty seconds prior to the time the first roll's development time is completed, turn-off the lights.
- B. Remove the top of the developing tank and take the top reel out, with a piece of a clothes hanger bent into a hook, or use a similar device.
- C. Place the reel into the tank filled with the fixer and replace the lid.
- D. Place an empty reel in the developing tank and replace the lid on the tank. The empty reel prevents the other rolls of film from receiving too much agitation, when the tank is inverted.
- E. Turn on the lights.

F. Repeat the procedure until all the rolls are developed. When the second roll is removed, two developing reels must be removed since the top reel is an empty one. The empty reels must also be removed before the third and fourth rolls are taken out.

Remember to agitate the tank with the developer as well as the tank containing the fixer. While it is true that the first and second rolls of film will receive an extended fixing time it should not adversely affect the results.

Example: If Tri-X is being tested, its recommended time and processing temperature are 10 minutes at 68 F.

Fifty percent of 10 minutes is five minutes.

Seventy-five percent is seven minutes and 30 seconds.

One hundred and twenty-five percent is 12 minutes and

30 seconds.

One hundred and fifty percent is 15 minutes.

13. After development, fix the last roll of film at its minimum fixing time with the other rolls still in the fixing tank.

Process the rolls of film normally after the fixing bath.

14. When the four rolls of film are dry, make a contact sheet of each roll following the procedures described in "Determining Proper Contact Sheet Exposures" on page 20.

#### Evaluation:

1. Check each frame of the negative strip that was developed for 50 percent of the normal developing time. Choose the frame that has received the best amount of development.

Assume the following: The basic exposure of  $f/5.6$  was derived using Tri-X film rated at ASA 400 and the frame which showed the best development was at  $f/2.8$ .

The difference between  $f/5.6$  and  $f/2.8$  is two exposure stops. It required four times more light to compensate for a decrease in development time of 50 percent. Therefore, the EI for Tri-X developed for five minutes (rather than the normal 10 minutes) is 100.

2. Repeat this procedure for the three remaining rolls, figuring the EIs for each of them.

#### Summary

Notice, as the development time is decreased, the film requires more light and its overall contrast is reduced. Conversely, when the development time is increased, the film

requires less light and its overall contrast is increased.

Controlling contrast and changing a film's speed are important concepts. Simply stated, "To reduce contrast, overexpose the negative and underdevelop it. To increase contrast, underexpose the negative and overdevelop it."

By determining how development time affects film a photographer can "personalize" his or her ability to change the negative image. If the lighting conditions are too severe (overly contrasty) or too "flat" (low-contrast), the photographer can change the film's rating and process the film for desired results.

PROJECT 3  
TESTING THE EFFECTS OF TIME  
IN THE DEVELOPMENT PROCESS

Requirements

1. Follow the steps outlined in "Testing the Effects of Time in the Development Process."
2. Make four 5" X 7" prints, one from each roll of film. The frames to be printed will be determined in Steps #1 and #2 of the "Evaluation" section.
3. Dry mount the four photographs in a progression from least development to most development on a 16" X 20" board, including the four contact prints on the back. If the note cards were marked "f/2 through f/16 in half-stop increments," or its equivalent, mark the frame on the contact print that was used to make the print.

Evaluation

The basis for evaluation will be entirely technical. Was the test target illuminated correctly; was the correct EI or ASA used; are the note cards correctly filled out; were the development, contact sheets and EI determinations done correctly?

Presentation

The student will be expected to discuss problems encountered in the project and to analyze the four prints. The analysis should be specific, including a comparison of each print's tonal quality, grain structures, acutance and overall characteristics.

CHAPTER 8

EXPLANATION OF FILMS AND DEVELOPERS

Objective: To explain how films and developers work and how they are composed.

## EXPLANATION OF FILMS AND DEVELOPERS

There are hundreds of 35mm films and developers on the market today. Manufacturers spend millions of dollars on research and development of these products and probably just as much trying to promote them.

Broken down into their basic components, however, all films are similar in nature and all developers contain the same basic ingredients.

### Film

Silver halides give film the ability to reproduce light and dark images. All the other components are secondary to the function of the silver halides.

Simply stated, silver halides are light sensitive crystals which exist in three sizes. The larger the halide, the more sensitive it is to light. And the larger the halide, the more apparent grain is produced and the lower the overall contrast.

Conversely, the smaller silver halides are less sensitive to light, produce less apparent grain and are higher in overall contrast.

Films like Panatomic-X are composed of the smallest silver halides. This gives the film its characteristic low sensitivity to light (ASA 32), fine grain patterns and relatively high contrast. Such films are sometimes described as having thin emulsion layers.

Films like Plus-X are composed of the smaller crystals, but include far more "mid-sized" halides. This gives the film

a light sensitivity between Panatomic-X and Tri-X, at a rating of ASA 125. These films display more grain than the slower films and less contrast.

The faster films such as Tri-X (ASA 400) contain all three sizes of silver halides, with a greater concentration of the larger sizes. This gives the film far more sensitivity to light, but more grain and a lower overall contrast.

### Film Developers

The purpose of film developers is to convert the exposed silver halide crystals to a black metallic silver. Most developers contain four basic ingredients: a developing agent, an accelerator or activator, some type of preservative and a restrainer.

Mixed with water, these chemicals penetrate the emulsion layer, which swells the gelatin and gives the developing agent a chance to work on the exposed silver halides.

Most film developing agents are special organic compounds and are formulated with more than one developing chemical. For instance, D-76 contains two developing agents, metol and hydroquinone. Metol (p-methylaminophenol sulfate) is a fast-acting agent that produces an image of neutral tones and low contrast. Its activity is accelerated under mild alkalines and produces little development "fog." Metol works on the shadow areas of the negative.

Hydroquinone (p-dihydroxybenzene) is a high-contrast developing agent that also works well under alkaline conditions. The agent will cause a considerable amount of development "fog"



unless restrained. The activity of hydroquinone affects the highlight areas of the negative.

When a developing agent is dissolved in water, it will oxidize when it is exposed to the air. The oxidation turns the solution brown and weakens the developer's activity. A preservative, usually sodium sulfite, is used not only to retard the oxidation but also to combine chemically with the oxidized products and help to keep the solution clear.

In large quantities, sodium sulfite acts as a silver solvent that reduces the size of the silver halide crystals, providing a finer grain pattern.

Another vital component in the developer is the accelerator or activator. Developers work very slowly in water or other neutral solutions, but, as mentioned previously, are very active in alkaline solutions. Borax, sodium carbonate and sodium hydroxide are often used to accelerate the developing action.

Left to itself, a developing agent will work on exposed as well as unexposed silver halides. A restrainer, usually potassium bromide, is added to slow this action. The restrainer diminishes chemical or development "fog."

The activity of the developer is determined by its formula, its concentration and its degree of exhaustion. The formula gives film its specific characteristics in terms of grain development, speed and tonal quality. The developer's concentration controls contrast.<sup>17</sup>

To more fully understand the developer's effect on film, a study of five types of developers is included. The developers are D-76, Microdol-X, Rodinal, Acufine and Diafine.

### D-76

Kodak D-76 is a general-purpose developer that handles a wide range of subject conditions very well. It is considered the "standard" developer by many professional photographers.

It should be noted that because D-76 is a general-purpose developer it is not capable of utilizing all the negative's potential. Other specialized developers function by maximizing one aspect of the negative's potential and reducing the effectiveness of others. When subjects are more specialized, i.e. low-light conditions, overly contrasty scenes, etc., a developer that maximizes that particular dimension should be used.

D-76 is a mild, silver solvent developer, changing the grain structure slightly by "eating away" the sharp edges of individual grain clusters. This results in minimal acutance loss ("sharpness") but better apparent graininess of the image.

The developer may be used either in stock form and replenished after use or diluted 1:1 and dumped after use. In stock form the developer leans toward a high-contrast developer. In dilution, the developer displays normal tones.

### Microdol-X

Microdol-X is an active silver solvent. It is characterized by almost non-existent grain and very low acutance and contrast. The developer can be used in stock form and replenished after use or diluted 1:3 and dumped after use.

Be careful when using the developer in dilution. Because of its inherent nature, the developer produces negatives of low contrast and can also prevent a film from attaining

its ASA rating.

Microdol-X uses a large amount of sodium sulfite to dissolve silver. This presents another problem. A high level of this chemical causes the developer to work very slowly, therefore, increasing "wet time." The developer works so slowly in dilution that Kodak recommends a temperature of 75 F at a relatively long development time (13 minutes for Tri-X) for the developer to work efficiently.

### Rodinal

Rodinal has the opposite effect on silver to Microdol-X. It contains virtually no silver solvents and is, therefore, characterized by very crisp, sharply defined grain patterns. The developer produces negatives with high acutance and is used only as a one-shot developer.

The developer is used in high dilutions (1:50 with Tri-X and 1:100 with Panatomic-X, at their rated ASAs). This high dilution causes a compensating development effect. That is, the developer acts upon areas with less exposure (shadows) longer than in areas with greater exposure (highlights). Negatives developed in a compensating developer are characterized by extended gray tones, good shadow details and unblocked highlight areas. This quality is most useful when subjects of high-contrast are photographed.<sup>18</sup>

Rodinal, like D-76, is considered a general-purpose developer, but that is where the similarity ends. Each developer has its own characteristics. D-76's strength lies in producing negatives with low apparent grain, while Rodinal's forte is in

producing negatives of high acutance and extended contrasts.

### Acufine

Acufine is a developer designed to increase the speed of film. It does this by substituting metol with a developing agent called phenidone (1-phenyl-3-pyrazolidone) in the developer's formula.

The developer is used only in stock form and the developer must be replenished by adding additional chemicals after a certain number of rolls have been processed.

By using Acufine with Panatomic-X its speed is increased by approximately two exposure stops (EI 100) and an increase of approximately one and one-half exposure stops with Tri-X (EI 1,000) is achieved.

Film processed with this developer is characterized by relatively high contrasts and medium to coarse grain.

### Diafine

Diafine is the most unusual of the developers under discussion. It is a divided, or two-step developer, designed to increase film speed (EI 160 with Panatomic-X and EI 1,600 with Tri-X).

The first solution contains the developing agents, restrainer and preservatives. The second solution is the activator. The film is placed into the first solution where the emulsion is allowed to soak-up the developer. Little of the actual development takes place during this step.

The film is transferred directly into the second solution where the developing occurs. Development continues to take

place until the developing agents absorbed by the emulsion are exhausted. For this reason, development in the more densely exposed areas of the film is done quickly and since the developing agents are not replenished, the highlight areas tend not to "block-up." Development in the shadow areas occurs slowly, allowing these areas to form more details. This creates a compensating development effect.

With this type of system, time and temperature variations have much less effect on the final image. Since the activating solution never touches the developer, the shelf-life of these developers is generally greater than that of single solution developers.<sup>19</sup>

The data sheet enclosed with Diafine specifies that the developer be at a temperature between 65 and 80 F and the film be soaked in each solution for more than three minutes.

Tests conducted by the author indicates the optimum conditions for processing film in Diafine are six minutes in each solution, at a temperature of 75 F.

Film processed in Diafine is contrasty but has adequate details in the shadow areas for such a high exposure index. Apparent grain approaches being coarse, but again, it is adequate when such high film speeds are necessary.

By knowing what a developer's possibilities and limitations are a photographer can cope with different lighting conditions and subject requirements.

When Panatomic-X and Tri-X are used with one or a combination of general developers (D-76 and/or Rodinal, for instance) and Acufine and Diafine, the two films can be exposed at six different

ASAs or EIs. With Panatomic-X they are as follows:

ASA 32 (standard),

EI 100 (Acufine) and

EI 160 (Diafine).

With Tri-X:

ASA 400 (standard),

EI 1,000 (Acufine) and

EI 1,600 (Diafine).

### "Pushing" Film

"Pushing" film, the intentional underexposing and overdeveloping for available light photography, is perhaps one of the most misunderstood photographic techniques. The speed of a film is inherent in its emulsion and is determined in the context of a standard performance level for that emulsion.

Developers with active developing agents (Acufine, Diafine, etc.) and extended development times of general-purpose developers allow the maximum utilization of the film's inherent speed but they do not increase it significantly.

When film is underexposed, shadow details are diminished and highlight densities are decreased greatly. The normal development of such a negative would result in a low-contrast image.<sup>20</sup>

If the underexposure is carried too far, no developer can make an image appear. Generally, film that has been underexposed by more than two stops will not receive enough exposure in the shadow areas and no detail will exist in these areas.<sup>21</sup>

While extending the development time increases shadow details, it also causes a higher density to be formed in the highlight areas. This produces a negative of higher-than-normal contrasts, lower acutance and increased graininess.

When the underexposure is within one exposure stop of the film's speed, a well-developed negative can be obtained by extending the developing time in a general-purpose developer. A good starting point is to extend the standard development time by 50 percent. (See "Testing the Effects of Time in the Development Process" on page 38 for more details.)

The use of a general-purpose developer that a photographer is accustomed to provides the advantage of knowing the developer's specific performance. Negatives developed for this extended time will be similar to those obtained in normal development.<sup>22</sup>

When the underexposure is two stops or greater than the film's normal speed, special-purpose developers are required. These developers not only contain developing agents that are more active than those of general-purpose developers; they are also compensating developers. This helps to reduce densities in the highlight areas while extending the development of the shadow areas.

Notice that whenever extra speed is achieved, some degree of quality is lost with respect to tones, acutance and grain. The use of fast lenses, tripods, artificial lighting and slower shutter speeds should be examined before "pushing" film is considered.

### Additional Reading

There are many informative and useful books and articles about films and developers. Here is a partial listing:

Kodak Films -- Color and Black-and-White is a Kodak publication (Code Number AF-1) that describes how to choose, expose and process films.

The Negative, Exposure and Development is one of the most complete studies on the subject. The book is written by Ansel Adams.

"Pushing Gently" appeared in the April 1980 issue of PhotoGraphic (page 18). In it, Joe Novak explains some of the subtle ways to increase a film's speed.

"Rodinal is Back" is an article in Camera 35, January 1980, by Dan O'Neill, about the "comeback" of the general-purpose developer. The article appears on pages 46, 47 and 76.

"Tri-X at 1,600 in Daylight?" is an interesting article by Penny Ann Dolin which appeared in the February 1980 issue of Popular Photography (pages 88-91). Dolin describes her technique of exposing Tri-X at an EI 1,600 for outdoor photography.



PROJECT 4  
DEVELOPER COMPARISONS

Requirements

1. Test, either by test target or in actual shooting conditions, Microdol-X and Rodinal developers using Panatomic-X (135-20) film.

NOTE: One roll of the film will be sufficient for this test.

The roll may simply be exposed normally, then in the darkroom, cut in half. Process one-half in Microdol-X and the other in Rodinal.

If the test is conducted in actual shooting conditions, take great care in shooting similar subjects from similar distances. Since a comparison is to be made between the two developers, any change in these areas will make the results harder to analyze.

It is recommended that a model be used in this situation and the distance between the camera and subject remain constant.

2. Develop the rolls using the manufacturers' recommended procedures.
3. Contact print the negatives.
4. Enlarge one negative from each roll on an 8" X 10" sheet of print paper.

The enlargements are to be made with the enlarger head as high as it will go (maximum enlarging size). Crop them to include similar subject areas from both negatives, i.e. the face of the subject.

5. Dry mount the two prints, side-by-side, on a 16" X 20"

board and include the contact sheet on the back.

### Evaluation

The evaluation for this project will be determined by the type of subject chosen for the comparison; the development and the printing procedures used; and the technical quality of the two prints displayed.

### Presentation

The student will be expected to present a critical comparison between the two prints. This will include subjective judgments as to how each developer would perform in different shooting conditions and which developer the student prefers and why.

PROJECT 5  
"PUSH" PROCESSING

Requirements

1. Test, either by test target or in actual shooting conditions, Acufine and Diafine negative developers, using Tri-X (135-20) film.

NOTE: Two rolls of Tri-X must be shot for this test. One roll, to be developed in Acufine, should be exposed at an EI 1,000 and the other roll, to be developed in Diafine, should be exposed at an EI 1,600.

If the test is to be conducted in actual shooting conditions, take great care in shooting similar subjects from similar distances.

It is recommended that a model be used in this test and the distance between the camera and the subject remain constant.

Remember, these developers increase the speed of the film and should be used only when conditions warrant their use, i.e. when a faster shutter speeds are needed, more depth-of-field is required, or when lighting conditions dictate their use.

2. Develop the rolls in the appropriate developers.
3. Contact print the negatives.
4. Enlarge one negative from each roll on an 8" X 10" sheet of printing paper.

The enlargements are to be made with the enlarger head as high as it will go (maximum enlarging size). Crop them to include similar subject areas from both negatives, i.e. the face of the subject.

5. Dry mount the two prints on a 16" X 20" board with the contact sheets attached to the back.

#### Evaluation

The evaluation will be determined by the type of subject chosen for the comparison; the development and the printing procedures used; and the technical quality of the two prints.

#### Presentation

The student will present a critical analysis of the two developers, emphasizing the differences in tonal quality, grain, acutance, effective film speeds and overall quality loss in comparison to a general-purpose developer.

CHAPTER 9  
PAPER NEGATIVES

Objective: To examine the use of photographic paper as a medium for negative and positive images.

## PAPER NEGATIVES

A photographer's perspective on the universe is not always reality. Producing continuous toned images is fine for recording events, but often the photographer needs an interpretation of images to convey a message.

Images can be changed in a number of ways. Shape and outline can be distorted, tones can be altered, the image may be reversed, and any combination made.

Here are four techniques for changing the image's effect and a method for making black-and-white slides.

One of the easiest ways to alter the photographic image in the darkroom is by reversing its tones. That is, producing a negative image of the print. This technique is also useful if a fast, if not limited, print is made from a color slide.

Materials needed: A negative of virtually any format the enlarger will accept, resin-coated photographic paper, a contact printer and equipment and chemistry to make an 8" X 10" print.

### Procedure:

1. Make a good, continuous tone print from the negative. Crop the photograph. Use the appropriate contrast filter and dodge and burn-in where appropriate. The project is dependent upon producing the best possible print at this stage.
2. Process the print normally and allow it to dry completely before going to the next step.
3. Set up the equipment to make a contact print. Open the lens to its largest aperture (most amount of light).

4. Place an unexposed sheet of photographic paper, emulsion side up, in the contact printer.

5. Place the continuous tone photograph on top of the unexposed sheet, emulsion (photograph) side down.

NOTE: The paper used may have manufacturer's printing on the back.

This will not alter the outcome of the image.

6. Make a test strip, exposing the two sheets of paper for a minimum of five seconds and a maximum of two minutes, at five-second intervals.

7. Process the now exposed and undeveloped photographic sheet normally and allow it to dry completely before evaluation.

8. If the test strip's last three inches or so do not contain good, solid black areas, it must be remade by extending the exposure time. Begin the second test strip with a minimum exposure of one and one-half minutes.

9. Evaluate the negative image as though it were a standard test strip. Look for the exposure that provides the first clean black area while maintaining reasonably good white areas. In many instances, the white areas will receive some exposure and appear slightly gray. This is acceptable because the darker area's exposure is more critical. Select an exposure time.

10. Repeat Steps #4 and #5. Expose the print at the time calculated in Step #8.

11. Process the print and dry it.

#### Summary

The result is a negative image of a continuous tone print. This procedure can be used for any type of negative, from one

exposed normally to a high-contrast one.

If a high-contrast effect is desired, use a #4 contrast print filter and polycontrast paper. A #5 graded paper, for both the initial print and the final image, will give an image of extreme contrast.

#### Additional Techniques

The following are some of the techniques which can be performed on the paper negative or the original print.

1. Elimination of dark areas on the negative by "whiting-out" its corresponding areas on the original print. Use a red felt marker, a printer's opaquing pen or solution, or rubylith. The photographic paper is not sensitive to the yellow-red spectrum so these areas will appear white on the print.
2. Elimination of light areas on the negative by scratching the emulsion surface of the original print. These areas will appear gray or black on the print depending upon how much of the emulsion is left. Use a razor or exacto-type blade for this technique.

It is recommended that this procedure be done while the print is being fixed. Fixer hardens the silver image and if allowed to completely do its job, the procedure is more difficult but not impossible.

3. Intentionally processing the paper negative or the original print to create streaks or textures. This may be done by painting developer on the paper to develop certain areas more than others.<sup>23</sup>
4. The paper negative process may be taken to its third generation to produce a positive image. That is, the paper



negative may be contact printed onto print paper to produce a positive image. The three previous techniques may also be incorporated when this positive image is produced.

This image will be considerably different from the original image, but its change may be more creative.

5. By placing a color transparency in the enlarger instead of a negative and using the same procedures of making a paper negative, a positive print can be made.

This procedure should not be used in place of an inter-negative because the quality lost is significant, but it can be used when a creative effect is desired.

Because normal black-and-white photographic paper is not sensitive to certain colors, the use of Kodak's Panalure paper (which is designed to make B/W prints from color negatives) may be substituted for the polycontrast paper in Step #1. The final print may be made with "normal" paper.

6. The paper negative may also take the place of a standard negative in the enlarger. By contact printing a film negative onto photographic paper, then making a contact print of that positive image, a paper negative that can be placed in the enlarger is made. This paper negative can now be enlarged just as any other negative (with a greatly extended exposure time) to give extremely unusual results.

#### Additional Reading

For more information and examples of the technique, see Darkroom Dynamics: A Guide to Creative Darkroom Techniques by Jim Stone.

PROJECT 6  
PAPER NEGATIVES

Requirements

1. Follow the procedures under "Making a Paper Negative."
2. Produce one 8" X 10" print, either a negative or positive image from the procedure.
3. Dry mount the print on a 16" X 20" board.

Evaluation

The technical procedures followed to make an image will be only a part of the evaluation for the project. Other considerations will be the effectiveness of the image, the appropriateness of the technique to the subject and its creativeness.

Presentation

Students will be asked to "defend" their techniques, i.e. why the technique was used with the subject chosen and why other techniques were used, or not used.

During the presentation, students should bring the original negatives, photographs and different photographic "generations" used to produce the final print.

CHAPTER 10  
HIGH-CONTRAST NEGATIVES

Objective: To show the effects of using Kodalith 4" X 5" sheet film.

## HIGH-CONTRAST NEGATIVES

The next three creative techniques require the use of a special high-contrast film, Kodalith. Because two of the techniques require exact registration (the perfect alignment of two or more negatives), 4" X 5" sheet film is needed to complete the projects.

Kodalith is an orthochromatic film (not sensitive to the red spectrum) which can be handled under a red safelight (series 1A). This safelight may also be used with polycontrast print paper, so, once it is set-up in the darkroom, it need not be changed when prints are to be made.

The film has an effective speed similar to that of print paper and can be processed in straight Dektol (paper developer) for one minute. All film processing can be done in trays and treated like print paper. The use of a stop bath is not recommended, however, as the film has a tendency to develop pinholes in the acid.

Kodalith has the ability to record some gray tones but its strength is its ability to produce solid areas of blacks and whites.<sup>24</sup>

The first project, will be to expose a sheet of Kodalith, process it and make a contact print of the direct-positive.

The term "direct-positive" refers to any negative with a positive image, i.e. the dark areas of the negative are the shadow areas and the clear areas are the highlights.

### Exposing Kodalith to Make a Direct-Positive Negative

Materials needed: A continuous tone negative of any format the enlarger will accept, at least two sheets of 4" X 5" Kodalith film, a red safelight (series 1A), a printing easel, an enlarger, a contact printer, print paper and chemicals to process the film and the print paper.

#### Procedure:

1. Prepare the chemicals as if prints were to be processed, with the exception of the developer and stop bath. The developer (Dektol) should be prepared in stock solution. Replace the stop bath with a water bath.
2. Place the negative in the enlarger. Crop and frame it in the usual manner for making a 4" X 5" print.
3. Stop the lens aperture down to whatever f/stop is normally used.
4. Make sure the darkroom is illuminated by only a red safelight.
5. Place a sheet of Kodalith in the easel, emulsion side up, and do a test strip, using five-second intervals, for 60 seconds.
6. Process the film in the following manner:
  - A. Place the film in the tray of Dektol, emulsion side up. Continuously agitate the film for one minute.
  - B. Transfer the film to the water bath. Continuously agitate it for 30 seconds.
  - C. Fix the film for 10 minutes in standard fixer or for five minutes in a rapid fixer.
  - D. Wash the film for 20 minutes.
  - E. Place the film in a freshly prepared "wetting" agent for

30 seconds.

F. Gently wipe the excess "wetting" agent from the film and dry it normally.

7. Examine the film. If the last inch or so is not completely black, the film has not received enough exposure. Make another test strip, opening-up the enlarger lens one f/stop.

8. If the test strip is satisfactory, choose the exposure time that produces the first good black areas as the basic exposure for the final negative.

9. Notice how the exposure times change the film's densities quickly. Exposure times are more critical here than with printing paper.

Notice also how only the minimal amount of exposure produces areas of gray. As the exposures are increased, only clear areas and dense areas exist on the film.

10. Expose the second sheet of Kodalith at the exposure determined in Step #8.

11. Process the negative and make a contact print from the resulting direct-positive image.

### Summary

Examine the final contact print carefully. The print should include areas of pure blacks and whites with no gray areas. Assuming the contact print was made correctly, if gray areas exist, the basic exposure was too short; if the print is too light, the basic exposure was too long.

The gray areas might be eliminated by using a #4 contrast print filter in the enlarger when making the contact print.

As with paper negatives, the direct-positive image can be taken one step further to produce a negative by contact printing it onto another sheet of Kodalith. This negative can then be used to make a positive print.

#### Additional Reading

For more information and examples of the technique, see Creative Darkroom Techniques, a Kodak publication (Code Number AG-18).

## PROJECT 7 HIGH-CONTRAST NEGATIVES

### Requirements

1. Follow the steps in "Exposing Kodalith to Make a Direct-Positive Negative."
2. Produce one 4" X 5" contact print, either a negative or positive image, from the procedure.
3. Dry mount the print on an 8" X 10" board.

### Evaluation

The technical procedures followed to make an image will be only a part of the evaluation for the project. Other considerations will include the effectiveness of the image, its appropriateness to the subject matter and its creativity.

### Presentation

Students will be expected to "defend" the techniques used to make the final image, i.e. why the technique was used with the subject chosen and why other techniques were used or not used. Students should also have the original negatives, photographs and/or different photographic "generations" used to produce the final image available at this time.



## CHAPTER 11

### TONE-LINES

Objective: To describe the technique of making a continuous tone negative appear like a pen and ink drawing.

## TONE-LINES

A tone-line is a technique which requires two high-contrast negatives, one a negative and the other a direct-positive, having the same densities and contrasts.

The two negatives are "sandwiched" together and an unexposed negative is placed underneath them in a contact printer.

The contact printer is placed on a record turntable, a lazy-susan, or some other rotating device and exposed to a light source at a distance of five feet and at an angle of  $45^{\circ}$  from the contact printer for approximately 30 seconds.

This produces a direct-positive negative containing lines which look as if they were drawn by a pen and ink technique. This negative is then contact printed with another sheet of Kodalith to form a negative which can be contacted printed or enlarged to produce a photograph.

Simple, right? In actuality, it is a relatively simple technique that produces a dynamic final print.

To create a tone-line, the "sandwiched" negatives are placed with their base sides (as opposed to their emulsions) together. This causes the image layers (emulsions) to be separated by the two thicknesses of the film base. The space allows light to shine through, if the light source is placed at an angle from the film's horizontal plane.<sup>25</sup>

This is the reason for the light source being placed at a  $45^{\circ}$  angle to the contact printer. The rotating device lets the film receive uniform exposure from all sides.

### Creating a Tone-Line Image

Materials needed: A continuous tone negative of any format the enlarger can handle, a minimum of six sheets of 4" X 5" Kodalith film, a print easel, a contact printer, some masking tape, a record turntable (or other rotating device), a 15-watt light source, a red safelight (series 1A), printing paper, an enlarger and equipment and chemicals to process the Kodalith and to make a contact print.

NOTE: Because of the different generations of processing and handling, each step of this procedure must be done carefully. Keep all photographic materials as clean as possible and tap or gently wipe all photographic film and paper to eliminate dust particles.

#### Procedure:

1. Prepare the chemicals to process Kodalith film. (See "Exposing Kodalith to Make a Direct-Positive Negative" on page 66 for more information.)
2. Choose a negative that contains strong lines in the subject. The negative should have good contrasts that accentuate these lines. While this characteristic in the negative is not essential to producing a tone-line, it will show off the technique.
3. Place the negative in the enlarger. Crop and frame the negative as in any 4" X 5" print.
4. Stop the lens aperture down to the f/stop normally used to expose print paper.
5. Make sure a red safelight is being used before removing the

Kodalith from the box.

6. Place a sheet of film, emulsion side up, in the print easel and perform a test strip from five seconds to 30 seconds, in five-second increments.

7. Process the film.

8. When a basic exposure has been determined from Step #7, expose a fresh sheet of Kodalith at that exposure and process the film.

This is a critical step. The direct-positive negative produced at this stage must be correct. If the negative does not have clean densities (good clear areas and opaque darker areas), remake it as many times as needed to achieve the correct results.

9. After a good direct-positive image is produced, it will be used to make another negative. To do this, set up the enlarger to make a contact print. Place an unexposed sheet of Kodalith, emulsion side up, in the contact printer. Put the direct-positive negative, emulsion side down, over the unexposed sheet of film. Close the contact printer.

Make a test strip, from five seconds to 30 seconds, in five-second increments. Process the film and determine which exposure will best match the densities and contrasts of the direct-positive image.

This is another critical step. A correct exposure of the negative will produce a uniformly dark image when the two negatives are "sandwiched" together and properly registered. Continue to make negatives from the direct-positive negative until this is achieved.

10. Once the two negatives are made, they must be placed together so the bases of the two are in contact with each other (both emulsions will be on the outside of the "sandwich"). They must also be in perfect registration with one another. When this is done, tape the two negatives together to prevent them from moving.
11. Set up the record turntable, in the darkroom. Position the 15-watt light source approximately five feet away from the center of the turntable and at a  $45^{\circ}$  angle to the turntable's horizontal. Place the contact printer in the center of the turntable.
12. Turn off all the lights except the red safelight.
13. Place an unexposed sheet of Kodalith, emulsion side up, in the contact printer. Put the "sandwiched" negatives directly over the unexposed sheet. Close the contact printer.
14. Turn on the turntable and set its speed at  $33 \frac{1}{3}$ . Allow it to reach a consistent speed, then turn on the light source for approximately 30 seconds.
15. After the exposure time is complete, turn off the light and the turntable. Remove the undeveloped negative and process it.
16. The negative should be clear with thin, well-defined black lines on it. If the lines are not black or if they are not well defined remake the negative.

The failure to achieve a good solid black indicates the 15-watt light source was not on long enough. If the lines are not well-defined, the film is overexposed.

If no image appears, make sure the "sandwiched" negatives

are placed with their bases together and the light source is at a  $45^{\circ}$  angle to the contact printer. If these elements are correct, extend the length of exposure of the 15-watt light source.

Do not be overly concerned if some grey areas appear on the negative, as any of these areas should be eliminated in the next step.

17. Make a test strip then, contact print the negative on another sheet of Kodalith film.

18. The negative can now be printed in the normal fashion or contact printed on photographic paper to yield a positive image.

#### Additional Reading

For more information on this technique and examples of high-contrast negatives, see the book Photography by Phil Davis.

PROJECT 8  
TONE-LINES

NOTE: This project is the equivalent of two 100-point projects. Students who attempt the project should be aware that it requires a great deal of time and effort to complete.

Requirements

1. Follow the steps under "Creating a Tone-Line Image."
2. Produce a positive 4" X 5" print from the technique.
3. Dry mount the print on an 8" X 10" board.

Evaluation

The project will be evaluated largely on its technical merits, i.e. how well was the technique performed. Other minor considerations will be the effectiveness of the technique, the appropriateness of the subject matter for the technique and the creative use of the technique.

Presentation

Students will be expected to display the various photographic "generations" needed to produce the final image and discuss them. Suggestions by the student dealing with short-cuts, problems, their possible solutions and improvements on the procedure are encouraged.

CHAPTER 12  
POSTERIZATIONS

Objective: To describe the technique of making a three-tone posterized print.



## POSTERIZATIONS

Kodalith film has the capacity to separate tones from continuous tone negatives into individual areas of contrasts. These tonal separations can be printed individually as described in "Exposing Kodalith to Make a Direct-Positive Negative" on page 66, or in combination to give a posterized effect.

Posterization is any print which displays distinct areas of tones. A posterization containing two tonal separations would contain distinct areas of black and distinct areas of white, with no gray areas, essentially appearing like a high-contrast print. When a posterized print contains four or more tone separations, it begins to look like a continuous tone print and the posterized effect is minimized or lost.

A three-tone posterization is recommended to maximize the technique's effectiveness. The success of the technique depends on the exposures given to the three negatives. One negative should be almost entirely black, separating the white and black areas on the print; a second negative should contain equal amounts of black and clear areas, separating the dark gray areas; and a third negative should be almost clear with some black accents, producing the gray areas on the print.

The negatives are printed separately on photographic paper to produce the desired effect. If the negatives were printed as a "sandwich," each negative would cancel the effect of the other and the final image would be a uniform gray tone.

Unlike a tone-line, the posterization effect is infinitely

variable. Through different exposures of the three negatives, a photographer can control the impact of the technique and further "personalize" the image.<sup>24</sup>

### Making a Three-Tone Posterized Print

Materials needed: A continuous tone negative of any format the enlarger can handle, 4" X 5" Kodalith film, a boarderless easel, a red safelight (series 1A), print paper, a contact printer, a registration guide (See Step #10), an enlarger and equipment and chemicals to process the Kodalith and to make a print.

NOTE: Because of the different generations of processing and handling, each step of this process must be done carefully. Keep all photographic materials as clean as possible. Tap all photographic negative materials on a table to remove dust particles and handle the negatives by the edges.

### Procedure:

1. Prepare the chemicals to process Kodalith film.
2. Select a negative with good overall contrasts and tones. Place the negative in the enlarger and crop and frame as in any 4" X 5" print on the printing easel.
3. Stop the lens aperture down to the f/stop normally used to make a print.
4. Make sure a red safelight is used before removing the film from the box.
5. Place a sheet of Kodalith, emulsion side up, on the easel and conduct a test strip with a minimum exposure of five seconds

and a maximum exposure of 30 seconds, at five-second increments.

6. Process the sheet of film. (See "Exposing Kodalith to Make a Direct-Positive Negative" on page 66 for more information.)

At the same time this sheet is being processed, develop an unexposed sheet of Kodalith for use in a later step.

7. After the film is dry, examine the exposures.

Look for the exposure that gives the negative its first good black density. Record this time.

8. Expose another sheet of film using the exposure time determined in the previous step.

Process the negative and allow it to dry completely.

9. While the negative is drying, set up the enlarger as if a contact sheet were to be made.

10. Make a registration guide for use in the contact printer.

This is done by cutting a heavy cardboard sheet into the shape of an "L." Make sure it forms a 90° angle at its base. The "L" should be at least five inches at both lengths.

Tape the registration guide inside the contact printer. If the contact printer has a foam backing, do not tape the guide on it as the tape may ruin it. Instead, cut a thin cardboard template to fit over the foam and tape the guide to the template.

11. Place a sheet of Kodalith, emulsion side up, in the contact printer and align it with the registration guide. Put the unexposed and developed negative from Step #6 on the sheet and close the printer.

12. Conduct a test strip as described in Step #5. Process the negative and allow it to dry completely.

13. Two negatives should now exist.

The first negative, obtained from Step #8, is the base negative that will be used to expose the three tonal separations.

The second test strip negative, obtained from Step #12, will be used to determine the time exposures of the three negatives to be made.

NOTE: The unexposed and developed negative was included in Step #11 because, although it had no exposure density, it does contain base and development fog, thus, some density.

14. Examine the test strip negative from Step #12. Three exposures are needed from this test.

The first exposure should give a negative of low density, appearing as a light gray area on the test strip.

The second exposure should yield a negative with equal amounts of black and clear areas. This will be the time where the first good black will appear.

The final exposure (and the longest) should produce a negative almost entirely black with only a minimal amount of clear areas.

Record the three exposure times.

15. Three negatives must now be made. Use the direct-positive negative from Step #8 as the base negative and expose the negatives at the times determined in Step #14.

Example: To obtain the first negative (light gray), assume you have an exposure time of five seconds as determined in Step #14. Put a sheet of Kodalith film, emulsion side up, into the contact printer and align it with the registration guide. Place the base negative (from Step #8), emulsion side down, on the unexposed

sheet of film. Close the contact printer and expose the negative for five seconds. Repeat this procedure for the second and third negatives.

16. Develop the negatives and let them dry.

17. While the negatives are drying:

A. Prepare the chemicals to process photographic paper.

B. Make sure the enlarger head is still positioned to make contact sheets.

C. Cut a piece of print paper into four equal section (4" X 5") and put them back into their light tight container.

D. Have the unexposed and developed negative from Step #7 available.

18. Conduct a test strip similar to Steps #11 and #12, but substitute print paper for the Kodalith film.

The test will be used to determine the final exposure for each negative when the print is made.

19. Process the test print and let it dry before examining it.

20. Three exposure times will be obtained from this test similar to those from Step #14.

The first exposure should give a light gray tone.

The second exposure will yield good black areas and white areas.

The third exposure is determined by the portion of the test print that retains little white areas and deep, solid black areas.

Record these three exposure times.

21. Assume, for example, the three times are five, 15 and 30 seconds, respectively. The negatives from Step #15 will be contact printed separately on print paper at these times.

The negative containing only light gray tones will receive the least amount of exposure, the negative with equal areas of black and clear images will receive the middle exposure and the almost-entirely-black negative will receive the longest exposure.

22. With the enlarger and contact printer still set up for contact printing, place a 4" X 5" piece of print paper, emulsion side up, in the contact printer and register it in the guide. Put the light gray negative, emulsion side down, on the paper. Close the contact printer and expose the paper for the time determined in Step #20 (the example time of five seconds).

Set the negative aside.

23. Without moving the print paper, place the negative containing equal amounts of black and clear areas, emulsion side down, on the paper, in exactly the same location as the first negative. Be precise.

Expose the paper for the amount of time indicated in Step #20 MINUS the first exposure time (the example time of 15 seconds MINUS the original 5 seconds, equals 10 seconds).

Set the negative aside.

24. With the paper still in the easel, put the last negative, emulsion side down, in place. Expose the paper for the time indicated in Step #20 MINUS the time for the first and second exposures (the example time of 30 seconds MINUS the first exposure of five seconds and the second exposure of 10 seconds, equals an exposure of 15 seconds).

Set the negative aside.

25. Develop the print normally.

The print should be a posterized image with distinct areas of black, dark gray, light gray and white.

Additional Reading

For more information on posterization and examples of the technique, see Photography by Phil Davis.

## PROJECT 9 POSTERIZATIONS

NOTE: This project is the equivalent of two 100-point projects. Students who attempt the project should be aware that it requires a great deal of time and effort to complete.

### Requirements

1. Follow the steps under "Making a Three-Tone Posterized Print."
2. A 4" X 5" positive print will be produced from these steps.
3. Dry mount the print on an 8" X 10" board.

### Evaluation

The project will be evaluated largely on its technical merits, i.e. how well was the technique performed. Other minor considerations will be the effectiveness of the technique, the appropriateness of the subject matter for the technique and the creative use of the technique.

### Presentation

Students will be expected to display and discuss the various photographic "generations" needed to produce the final image. Discussion by the student dealing with the problems encountered, their possible solutions, short-cuts and improvements on the procedure is encouraged.



CHAPTER 13  
BLACK-AND-WHITE SLIDES

Objective: To introduce black-and-white slide materials  
and processing.

## BLACK-AND-WHITE SLIDES

Most photographers view black-and-white photography as a more creative medium than color photography. These same photographers shoot only color slides, perhaps not even being aware that a black-and-white transparency film is already in their camera bag.

Kodak recommends the use of Panatomic-X with its Direct Positive Film Developing Outfit to produce black-and-white slides. The film can be used like any color transparency material but is easier to process than Kodak Ektachrome films.

Like color transparencies, the film has a narrow exposure latitude and must be exposed with care. It is advisable to bracket exposures, when first using the film in this manner. Bracketing should be done in one-half stop increments.

Panatomic-X has a normal ASA rating of 32. When it is used as a transparency material its speed changes. Kodak recommends a speed of 80 in daylight and 64 if the film is used under tungsten illumination.

Because the medium is black-and-white and the format is slides, composition is a critical element in the final image. Cropping, center-of-interest and tonal variations affect black-and-white more than color.

Often a color slide can stand on its color alone, i.e. a sunset. This is not possible with the black-and-white slide. It must rely on the intricate patterns of clouds, the placement of the horizon and the subtle shades of light to be successful.

Shooting this film can benefit any photographer's "eye,"

creativity and discipline.

Another use of black-and-white slides is to copy black-and-white prints. These prints are usually copied on Kodachrome or other types of color transparency materials and have a tendency to display a cyan or blue color cast. By using Panatomic-X and the direct positive film developer, the color cast can be eliminated.

The inherent sharpness of Panatomic-X aids its capability to reproduce photographs and its increased film speed makes it easier to use in day-to-day shooting situations.

#### Making Black-and-White Slides

Materials needed: A camera, one roll of Panatomic-X (135-36), a Kodak quart-sized Direct Positive Film Developing Outfit, film fixer (the outfit does not include fixer), equipment to develop 35mm film, 36 slide mounts for 35mm film and a tacking iron.

NOTE: Panatomic-X, developed in the Direct Positive Film Developing Outfit, has two recommended exposure indexes, 80 in daylight and 64 in tungsten lighting. Unlike most films, these EIs can be used on the same roll of film since the processing time is the same for both. Therefore, one roll of film can be used in both daylight and under tungsten illumination.

#### Procedure:

1. Load the film into the camera and expose the film as you would any transparency material. Bracket all difficult or

unusual lighting conditions in one-half stop increments.

2. Remove the film from the camera, load the film into a developing reel and place the reel into the developing tank.

If a 16 ounce tank is used, place an empty reel in the tank.

3. Before processing the roll, read the following information from Kodak:

WARNING: Because the bleach corrodes most metals, do not leave it in contact with metal equipment any longer than necessary. Store in polyethylene, earthenware, porcelain, rubber, glass, or enamelware with surfaces free from cracks or chips.

SAFELIGHT: Carry out all operations in total darkness until bleaching has been completed. A greenish-yellow filter (OA) with a 15-watt bulb may be used to examine the film thereafter.

PROCESSING TEMPERATURES: The recommended temperature of all the solutions is 68 F.

AGITATION SEQUENCES: Agitate continuously during the first 30 seconds in each solution and for five seconds every minute thereafter.

REDEVELOPER PREPARATION: Prepare the Redeveloper solution immediately before use because it will keep only one to two hours.<sup>27</sup>

4. Prepare the Redeveloper by mixing "Part A" with 16 ounces of water at 68 F. While mixing, add "Part B" and "Part C" to the solution. Stir until the chemicals are completely dissolved.

5. Justify all solutions to 68 F.

6. Pour the First Developer into the developing tank and tap the tank against the sink to release any air-bells present on the film surface (this should be done when any solution is initially poured in the developing tank). Follow the proper agitation sequences and develop the film for eight minutes.
7. Pour the developer back into its receptacle when the eight minutes are up.
8. Wash the film in running water for two minutes.
9. Pour the Bleach into the tank, rap the tank, follow the agitation sequences and pour the chemical back into its bottle after one minute.
10. Pour the Clearing Bath into the tank for two minutes, then pour it back into its bottle.
11. Redevelop the film for eight minutes.

If two rolls of 36-exposure film are processed at the same time or one after the other in the same Redeveloper, allow nine minutes redevelopment for the second roll to compensate for the reduction of the Redeveloper's activity.

12. Wash the film for one minute.
13. Fix the film for five minutes.
14. Wash the film for 20 minutes in running water sufficient to replace the water in the tank once every five minutes.
15. Treat the film in a "wetting" agent for 30 seconds.
16. Dry the film normally.
17. After the film is dried, cut each frame from the roll.

Mount the individual frames in 35mm slide mounts. Plastic slide mounts are the easiest to load and last longer than paper mounts, but they are more expensive.

Paper slide mounts generally need to be sealed with some type of heat source (a tacking iron works well for this) and requires more time to mount than plastic ones.

### Summary

The following is a summary of the developing steps needed to process Panatomic-X into transparencies using Kodak Direct Positive Film Developing Outfit:

STEP	SOLUTION	TIME @ 68 F
1.	First Developer.....	8 min.
2.	Water Rinse.....	2 min.
3.	Bleach Bath.....	1 min.
4.	Clearing Bath.....	2 min.
5.	Redeveloper.....	8 min.*
6.	Water Rinse.....	1 min.
7.	Fixing Bath.....	5 min.
8.	Wash.....	20 min.
9.	"Wetting" Agent.....	30 sec.

AGITATION: Thirty seconds, initially; five seconds every minute, thereafter.

\*If two rolls of 36-exposures are processed simultaneously, or one right after another in the same Redeveloper, increase its time to nine minutes.

### Additional Reading

For more information about using Panatomic-X as a black-and-white transparency material, see "Black-and-White Transparencies with Kodak Panatomic-X Film" (Code Number s-23), a Kodak data sheet.

PROJECT 10  
BLACK-AND-WHITE SLIDES

Requirements

1. Expose a 36-exposure roll of Panatomic-X according to the instructions under "Making Black-and-White Slides."

Shoot the film in a variety of lighting conditions and with different types of subjects, bracket exposures whenever necessary.

2. Include at least one copy of a continuous tone black-and-white print. Bracket the exposure plus and minus one-half of a stop in addition to the basic exposure.
3. Follow the procedures under "Making Black-and-White Slides" to develop and mount the slides.

Evaluation

The evaluation will be made on how well the slides were processed, the subject matter recorded and how well the copy slides were done.

Presentation

The student will show his or her slides and discuss the differences between shooting black-and-white transparencies and shooting color. The student will also be expected to analyze each exposure, composition and tonal qualities of the slides.

CHAPTER 14  
FINAL EXAMINATION

NOTE: Only the adviser will have access to the final examination until it is given.



FINAL EXAMINATION  
FOR  
A SELF-INSTRUCTIONAL, SELF-PACED COURSE  
IN ADVANCED TECHNICAL BLACK AND WHITE PHOTOGRAPHY TECHNIQUES

Name\_\_\_\_\_

Date\_\_\_\_\_

Answer all questions on a separate sheet of paper. Be as brief and concise as possible.

1. Identify three advantages of using black-and-white transparencies rather than color transparencies.
2. What are the four basic ingredients composing most black-and-white film developers? What are their functions?
3. Describe how slow, medium and fast speed black-and-white films achieve their different light sensitivities. Compare and contrast each film's characteristics in terms of contrast, acutance and grain.
4. Compare and contrast the characteristics of negatives processed for 50, 75, 125 and 150 percent of normal, assuming the correct exposure compensations were made in each case. Also describe what the correct exposure compensations are.
5. What specific physical elements affect a negative's densities that can be eliminated by determining an exposure index for the film?
6. What is a black-and-white posterization? Describe the effects of a two-tone posterization, a three-tone posterization and a four-tone posterization.
7. What is Kodalith? Describe its characteristics, how it is processed and what it is used for.

8. Describe the elements needed to construct a good, usable test target. What is the test target's greatest asset?
9. A contact sheet made from 35mm negatives is useful because it provides a positive image of the individual frames. Identify five other advantages a contact sheet can provide a photographer.
10. Briefly describe the major steps in producing a tone-line image.

## FINAL EXAMINATION ANSWERS

1.
  - (1) Black-and-white is a more creative medium than color;
  - (2) A photographer probably carries Panatomic-X as a standard film, which is more convenient than carrying a specialized color film;
  - (3) It is easier to process than Ektachrome films;
  - (4) No color cast occurs when copying black-and-white prints;
  - (5) It's considerably cheaper.
2.
  - (1) Developing agent.  
It works on the exposed silver halides, converting them to silver and, if left unchecked, may also develop unexposed silver halides.
  - (2) Preservative.  
It retards the oxidation of the developing agents, chemically mixes with existing oxidized products to help keep the solution clear and, in large quantities, can act as a silver solvent.
  - (3) Accelerator or activator.  
It increases the alkaline level of the developing solution, thereby, accelerating the development action.
  - (4) Restrainer.  
It retards or restrains the developing agent(s) from working on unexposed silver halides.
3. Slow speed films contain only small particles of silver halides. Since the smaller the silver halide particles are, the less sensitive they are to light, the film has the least sensitivity to light of the three types of films under discussion. These

films display relatively high contrasts, very high acutance and fine grain. An example of a slow speed film is Panatomic-X (ASA 32).

Medium speed films contain a combination of small and medium sized silver halide particles, with a preponderance of medium sized halides. These films display moderate film speeds, moderate contrasts, average acutance and fine to moderate grain. An example of a medium speed film is Plus-X (ASA 125).

Fast speed films contain three sizes of silver halides, the majority being large, so the film is extremely sensitive to light. These films display relatively low acutance, moderate grain and low contrasts. An example of a fast speed film is Tri-X (ASA 400).

4. Negatives processed for 50 percent of normal need approximately two stops overexposure to compensate for the short development time. The negatives display relatively low contrast levels but acutance and grain are affected only to a limited degree.

Negatives processed for 75 percent of normal need approximately one stop overexposure to compensate for the shorter development time. The negatives have a slightly lower overall contrast than do negatives processed normally. The acutance and grain of the film are relatively unaffected.

Negatives processed for 125 percent of normal need approximately one-half of a stop underexposure to compensate for the longer development time. The contrast levels of these negatives are higher than normal, with a slightly lower acutance and more grain.

Negatives processed for 150 percent of normal need

approximately one stop underexposure to compensate for the longer development time. The contrast of these negatives are considerably higher than normally developed negatives. The negatives display an extremely low acutance with coarse grain.

5. The specific physical elements are as follows: the manufacturer's tolerances in the camera's shutter speeds and apertures; developer strength and effectiveness; development procedures (including agitation, dilution, pouring sequences, etc.); and the film's ASA rating.

6. A posterization is any print whose tones have been separated into two or more divisions.

A two-tone posterization could appear as a high-contrast print if the tonal separations were the black and white areas of the image. In any case, a two-tone posterization would include two separate tonal separations.

A three-tone posterization is the most effective of the three types. Its tonal separations are usually light gray, dark gray and black. The effect of the posterization is that of large areas containing the same contrast, with only three contrast levels in the print.

A four-tone posterization approaches a continuous tone print and often does not look like a creative technique.

7. Kodalith is a high-contrast, orthochromatic (not sensitive to red) film that can be processed in Dektol developer.

It has high acutance and reproduces only a limited amount of gray tones. Its strength is in reproducing images of very high contrasts.

The film can be processed in straight Dektol for one minute

under a red safelight (series 1A).

Kodalith is used to make high-contrast negatives and is also used in the making of tone-line and posterized images.

8. A well designed test target should include good, clear, well defined areas of tones; an 18 percent gray; some type of model, preferably a life-sized face, but any three dimensional figure is adequate; and some way of judging sharpness.

Its greatest asset is, if it is not changed significantly, the test target can be used to test any photographic element anytime.

9. (1) Whether exposures in the camera are correct;
- (2) Allows for comparisons between similar subjects;
- (3) Aids in potential cropping;
- (4) Helps in determining what contrast filter to use for a specific frame; and
- (5) Helps in determining general exposure times for specific frames.

10. A tone-line requires two high-contrast Kodalith negatives, one, a negative and the other, a direct-positive, having the same densities and contrasts.

The two negatives are "sandwiched" together and a third unexposed negative is placed underneath them, in a contact printer.

The contact printer is placed on a record turntable, or other rotating device, and exposed to a 15-watt light source placed at a 45° angle and five feet away from the contact printer. The film is exposed for approximately 30 seconds.

A direct-positive image is produced from this procedure.

It is contact printed on an unexposed sheet of Kodalith film to form a negative image which can be contact printed or enlarged to produce a photograph.

## FOOTNOTES



## FOOTNOTES

<sup>1</sup>Scholastic's Concerned Photographer Program, Images of Man 2, (New York: School Division, Scholastic Magazines, Inc., 1973), p. 64.

<sup>2</sup>Mike Stensvold, "Art or Science?," PhotoGraphic, (April 1980), p. 16.

<sup>3</sup>Robert Routh, "Justifying Photography Education," PhotoGraphic, (April 1980), p. 88.

<sup>4</sup>Marvin J. Rosen, Instructor's Manual: Introduction to Photography, A Self-Directing Approach, (Boston: Houghton Mifflin Company, 1976), p. 1.

<sup>5</sup>Ibid., pp. 1-2.

<sup>6</sup>Ibid., p. 2.

<sup>7</sup>Michele A. Frank, "The Gadeteria," Popular Photography, (February 1980), p. 18.

<sup>8</sup>Michele A. Frank, "The Gadeteria," Popular Photography, (March 1980), p. 12.

<sup>9</sup>Eastman Kodak Company, Processing Chemicals and Formulas for Black-and-White Photography, (New York: Eastman Kodak Company, 1973), p. 5.

<sup>10</sup>Albert Gruen, "Contact," Popular Photography, (March 1980), pp. 105, 108.

<sup>11</sup>Ibid., p. 105.

<sup>12</sup>Ibid., p. 106.

<sup>13</sup>Ibid., p. 108.

<sup>14</sup>Adrian Vance, "How to Test Your Lens System," PhotoGraphic, (January 1982), p. 29.

<sup>15</sup>Phil Davis, Photography, (Dubuque, Iowa: Wm. C. Brown Company Publishers, 1982), p. 378.

<sup>16</sup>Ibid., p. 374.

<sup>17</sup>Eastman Kodak Company, Processing and Process Monitoring of Kodak Black-and-White Films, (New York: Eastman Kodak Company, 1982), p. 2.

<sup>18</sup>Ansel Adams, The Negative, Exposure and Development, (New York: Little, Brown and Company, 1948), pp. 107-8.

<sup>19</sup>ZONE V inc., Photo Chemicals Kit for Black & White Developers, (Mass.: ZONE V inc., 1974), p. 12.

<sup>20</sup>Joe Novak, "Pushing Gently," PhotoGraphic, (April 1980), p. 18.

<sup>21</sup>ZONE V inc., Photo Chemicals Kit for Black & White Developers, p. 10.

<sup>22</sup>Novak, "Pushing Gently," p. 18.

<sup>23</sup>Michael Scott, "Photographic Painting, Dip Your Brush in Developer," PhotoGraphic, (December 1979), p. 34.

<sup>24</sup>Ralph M. Hattersley, "Six Ways to Control Contrast," Popular Photography, (June 1980), pp. 105, 132.

<sup>25</sup>Michael Langford, The Darkroom Handbook, (London: Dorling Kindersley, 1981), pp. 200-203.

<sup>26</sup>Davis, Photography, pp. 286-9.

<sup>27</sup>Eastman Kodak Company, "How to use the Kodak direct positive film developing outfit," (New York: Eastman Kodak Company, 1974), pp. 1-4.

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A SELF-INSTRUCTIONAL, SELF-PACED COURSE  
IN ADVANCED TECHNICAL BLACK-AND-WHITE PHOTOGRAPHY TECHNIQUES

by

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AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

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KANSAS STATE UNIVERSITY  
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The purpose of this Report Option project was to design an advanced photography class for students who have completed a minimum of a basic photography class. The class can be completed in a two-week time span at the student's own pace. The completion time frame would make this course conducive to an intersession class or a short-course.

The self-instructional, self-paced method of instruction is also useful for high schools, junior colleges and universities with a limited faculty or photographic facilities. It enables students to learn advanced photography without the direct supervision of a faculty member.

Although direct supervision is not necessary, an adviser is needed to answer direct questions about techniques, evaluate projects, oversee two class meetings and administer the final examination.

The final grade is determined by a combination of seven projects, two class meetings and the final examination.

The following photographic principles are covered in the project:

Basic photography principles.

Testing the shutter speeds in a 35mm single lens reflex camera.

The proper methods of developing 35mm negatives.

The proper methods of interpreting contact sheets.

How to determine the proper exposure for a contact sheet.

How to construct and use a standard test target for photographic tests.

How to determine exposure indexes for various types of films.

Testing the effects of time in the development process.

How to make paper negatives for a creative effect.

How to use high-contrast negative materials.

How to produce a tone-line image.

How to produce a three-tone posterization print and

How to expose and develop black-and-white slide materials.

Students may choose the seven projects needed to meet the requirements of the class from 10 projects included in the text.

The ten projects are as follows:

1. Developing a Test Target.
2. Determining an Exposure Index.
3. Testing the Effects of Time in the Development Process.
4. Developer Comparisons.
5. "Push" Processing with Acufine and Diafine Developers.
6. Paper Negatives.
7. High-Contrast Negatives.
8. Tone-Lines.
9. Posterizations.
10. Black-and-White Slides.