

PHOTO LAB MANAGEMENT

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Kodak Ektachrome Prof. 100x



Kodak Ektachrome Prof. 100 plus



Kodak Ektachrome Lumiere 100 Prof.



Fuji Velvia Prof.



Fuji Prof. 100



Kodak Ektachrome 64 Prof.

The Test Environment

This article features images that were produced under the tightest possible photographic controls. All emulsions were kept frozen prior to use and were re-frozen after exposure prior to processing. All films were processed simultaneously to ensure that each emulsion by itself demonstrated color interpretation and was not representing a color shift from the processing.

In each series, the light source, camera, lens, and procedures were consistent, to allow the film itself to be the only difference that is presented as a final result.

In order to have a test that would have validity, the experiment was run twice, with all steps being identical except that two different labs were used. All emulsions were purchased at the same time—off the shelf as any working photographer might

buy them. They were then all exposed at the same time with the same camera, lights, etc.

The film was then processed as simultaneously as the rack size on the machines would allow. Control strips were run in both labs, and the action limits of each E-6 process were within the control limits set by Q-Lab, a service of Kodak, as well as Jim Scyzgiel of the R•I•T Photofinishing and Lab Management program.

The images that are printed in the article subsequently represent the end work of the second run. They are consistent with the first experiment. In producing this work, I would like to thank Sentry Color Labs of Rochester, NY for their assistance as well as Jim Rice at RIT.



Agfachrome CT100i



Kodak Ektachrome Lumiere 100x Prof.



Kodak Ektachrome Prof. 100

“FILMS FUNCTION *the way they do because of the pre-determined characteristics that are built into the emulsion. These characteristics include: sensitivity (speed), grain, resolution, saturation, spectral sensitivity, color balance, neutrality, contrast, exposure latitude, and reciprocity.”*

Color Interpretation: A Function of Process & Film—Part I

Michael R. Peres

Editor's note: Michael Peres is an associate professor in the School of Photographic Arts & Sciences, Rochester Institute of Technology. Professor Peres has a masters degree in Instructional Design and is also a Registered Biological Photographer.

WHEN WAS THE last time you went into a professional photography store and examined all the new color transparency products on the shelf? In recent years, Kodak and Fuji have released many new films, such as Kodak's

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Color Interpretation

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Underwater Ektachrome and Fuji Velvia. There are currently many emulsions in the medium speed range (ISO 50/100). Which of these films is best suited for certain types of photography and why?

Predicting the Visual Results

I became interested in the inherent differences between emulsions while preparing a dental photography presentation for the Academy of Cosmetic Dentistry in 1988. As any photographer might, I needed information about the various films available, but the type of information I could put my hands on didn't help with predicting the visual results from the recording process.

Why is it important to know about an emulsion's inherent recording differences anyway? Many photographers and others who make pictures use emulsions indiscriminately. Often a photographer selects a film based on the recommendation of a friend, colleague or publication such as this one. The resulting photography may be entirely adequate, but not optimum for the recording task at hand.

When I began organizing this body of work, I was apprehensive about publishing new material on silver halide photography. The advances in electronic photography were so fast and the techniques so powerful in their applications that there seemed to be a tremendous number of people jumping into the digital world.

However, advances in silver photography are paralleling the advances in the electronic world. The results of this research continue to provide more color accuracy to the professional photographer and to photography in general. There continues to be better integration of films working together with papers in the silver halide "image chain"—the process of conceiving a picture, selecting a film and photographic strategy, photographing the subject and processing the film.

The response to my original work, published in Kodak's *Tech Bits*, Number 2, 1992, has been very supportive. Since that original work only one year ago, many new films have been re-

leased, such as the Kodak Lumiere family of Ektachrome Professional Films, including Underwater Ektachrome. Consequently, I have been curious about these new choices and I suspect more films will be on the horizon.

I find it fascinating to pick up a data sheet that discusses film products and read the copy that accompanies it. For example, information about Fujichrome 50 Professional Film might read, "A good general purpose professional color slide film." This is obviously an understatement, but is a common reflection of the lack of more detailed data needed by both photographers and labs today.

Personally, I need something more specific, and I suspect many of my contemporaries do as well. Knowing how a particular film performs and having the ability to previsualize the result from using that film, allows me to choose the most appropriate emulsion for a specific recording requirement.

When I am asked to photograph subtle changes that are occurring to the coloration in the fibrils of an iris, I want to be reasonably certain that the film will record the subject with high accuracy. It is no secret that some emulsions, specifically Kodachromes, are created with extended sensitivities.

Consequently, subjects photographed using Kodachrome 64 Professional Film will be recorded differently than if that same subject were shot with Ektachrome 64 Professional Film. Generally speaking, Kodachrome Films and Fujichrome Films will render subjects warmer, but the question of which film provides the most accurate representation of the subject offers some interesting issues for debate.

What constitutes "better"? Is "better" more saturation or greater fidelity? Is better warmer or cooler? It is important here to remember that photography is only a representation of reality and not reality by itself. In analyzing this question about which result is better, the answer might be, "It depends." It depends on what is required, desired or preferred in a given situation. Knowledge about the way a film works, and seeing the actual result will provide some insights as to

what will work better and why.

Color Interpretation

Achieving exact color can be difficult. In fact, it might be considered to be impossible by some because of the number of variables encountered from start to finish in the making of a color transparency. Considering the variables that influence the final results, one can understand why some experts are cynical. I am convinced that good color reproduction is possible with some hard work and reasonable awareness of the entire process and what factors can influence your results. Achieving good color quality is a fragile process.

In many cases, excellent color reproduction is almost crucial. For example, if color changes are occurring in skin as a result of a prescribed drug treatment plan, can these changes be monitored accurately with photography? What knowledge, information and techniques must the photographer use to achieve accurate photographic documentation over time?

Emulsion Characteristics

Before addressing the larger question of how to control, influence and select color transparency films, some fundamental characteristics of any photographic emulsion should be identified. Parts of these definitions may be referenced later in this article.

Films function the way they do because of the pre-determined characteristics that are built into the emulsion. These characteristics include:

- sensitivity (speed)
- grain
- resolution
- saturation
- spectral sensitivity
- color balance
- neutrality
- contrast
- exposure latitude
- reciprocity

Let's look at each of these characteristics briefly to see how they interrelate to films, and how they function. It is difficult to analyze each characteristic alone as each directly and/or indirectly affects other film functions. A film's component parts are all interrelated in one way or another.

A film's **sensitivity** can be defined by how much energy is required to cause a response in the silver halides. The fewer the lumens required to stimulate the emulsion's silver salts, the higher the ISO of that film. The ISO of a transparency film is defined as:

• $ISO = 1/Hm \times 10$

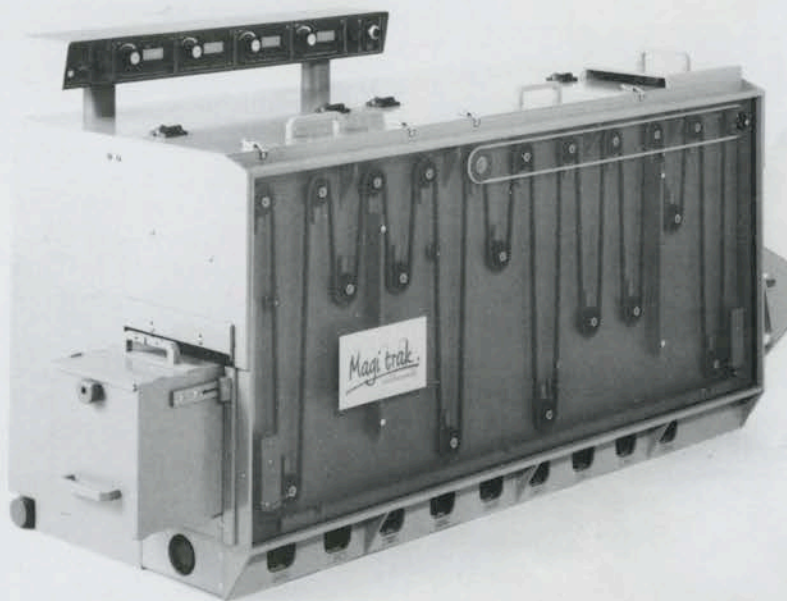
• $Hm = 2$ point average of 2.0 density above minimum density as well as 0.2

above minimum density (*Materials & Processes of Photography*, Stroebel 1985).

Prior to the introduction of Kodak's T grain emulsions technology, the sensitivity of an emulsion was modified by changing the amount of silver halide or the size of the silver halide used for that film; however, with tabular grain

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Color Interpretation

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films, sensitivity is increased by flattening the grains to increase the actual surface area.

It is also useful to point out here that very strong relationships exist between some of these characteristics. For example, increasing film speed requires larger crystals or more silver halide to be used and so it can be said that higher ISO materials will have a larger or more pronounced grain pattern.

Graininess describes the subjective impression of random unevenness observed using a grain focuser in enlargements or in other magnified images. Higher speed films typically display coarser grain, while lower speed films exhibit virtually undetectable grain. Color transparency films are classified by using a measurement or number referred to as *diffuse RMS granularity value*. Lower RMS numbers, such as 9 or 10, are very fine grain products, while numbers of 15 to

subjective. Criteria changes from viewer to viewer and are contingent on experience and expectations.

While **resolution** is defined as lines per millimeter reproduced on the film, it is effected by contrast. Consequently, a film (EPN 100) that resolves 100 lines/mm at 1000:1, may only resolve 50 lines/mm at 1.6:1. These figures represent a film with moderate or average resolution, while a film that resolves 125 lines/mm is said to have very high resolving power for slide films. Resolution is the product of inherent grain structure, film exposure, and photographic processing.

Color saturation refers to a film's ability to portray color with real richness or chroma. The finer the grain, the more compact the grain structure will be and consequently the higher the color saturation. Unlike the RMS granularity or ISO, saturation potentials of color films have no measure-

EVEN SUBTLE COLOR *temperature differences of light sources can affect the color of a photograph.*

17 or higher are coarser in grain structure. For example, EPN Ektachrome 100 Professional film has an RMS granularity measure of 11 and is considered a fine grain emulsion.

Directly related to the size and frequency of the grain is the film's ability to resolve detail. When speaking about picture elements, a common mistake is to portray a product as "very sharp." How sharp though?

I recently rediscovered some of my early photomicrography which originally I believed were really sharp. When I re-examined them, they were quite soft by my current standards. Sharpness is a relative term and very

ment system. Film descriptions usually contain only a reference to excellent color saturation, if that information is provided at all.

Color balance is a function of the film's overall sensitivity to a particular light source which has a given color temperature, e.g. daylight or tungsten. Color transparency films can be balanced for either 3200K (tungsten) or 5500K (daylight) and, for optimal results, should be exposed using light sources that match these aims closely. Even subtle color temperature differences of light sources can affect the color of a photograph. Tungsten halogen light sources are designed to de-

liver 3200K over their entire life. The color temperature of a tungsten lamp changes over the life of the lamp. These changes are manifested as color shifts in slides.

Similarly, electronic flashes and flash tubes vary widely in color output. This may be caused by the flash tube being coated or not coated with a filter to remove the UV radiation. Some diffusion materials may also influence the resulting color.

Spectral Sensitivity deals with the specific response of each film layer to a given range of wavelengths. The visible spectrum is comprised of wavelengths ranging from 400nm—700nm. A color film has three emulsions, each with a different sensitivity. Because each film exhibits a balance of sensitivities, different films will record different hues and achieve neutrality differently.

FujiChrome, Kodachrome and Ektachrome films have different spectral responses to subjects. If generalizations are permissible, Kodachromes and Fujichromes render the world warmer with more red saturation than some Ektachromes. Kodak 64 Professional film, EPR, also as a generalization would render subjects cooler than Kodachrome 64 Professional.

Contrast describes the basic tonal separation between highlight and shadow in a subject as recorded by the film. In color transparency films, little or no contrast control is possible with slide films other than through the use of different lighting strategies which change visual contrast of the image.

There is a slight difference in contrast when comparing the Ektachrome films to Kodachrome, the latter being slightly more contrasty. The reality of the situation is "contrast is reasonably fixed" in slide films.

Push processing of Ektachrome 64T Professional Film was advocated for increasing contrast in photomicrography. However, it has been my experience that the loss of color saturation and DMax may be a result of this and consequently offset the subtle gain in contrast.

Color negative films have a wide exposure latitude that allows many of the point-and-shoot cameras to function as well as they do. Usable exposures can be achieved over a five-stop spread (-2 normal, to +2 stops).

By comparison, color transparency films allow only a narrow range of exposures, typically +/- 1/2 stop from optimum, before critical detail is lost. The reason transparency films require such tight exposure control as compared to negative films lies in the inherent contrast of the film types. One can see from evaluating the characteristic curves that slide films have a much greater contrast than negative films.

For this reason, a small change in exposure on slide film produces a greater density change than the same exposure change on a negative film. This for some was a boon, while for others it was a curse. With any film, process controls determine the final density, contrast and color cast that a film will exhibit. Day-to-day and lab-to-lab fluctuations can radically change the final color.

Processing is one aspect of film choice that is often overlooked. This is no surprise to you; however, it still needs to be mentioned as a characteristic specific to a film.

Exposures on the film are a product of intensity of the image-forming light and the total time of exposure. This can be expressed by the equation:

$$\bullet \quad E = I \times T$$

• Exposure = Intensity x Time

From the relationship, one can see that an exposure of 1/60sec @ f/8 is equivalent to an exposure of 1/30 sec @ f/11. This relationship is known as the Law of Reciprocity.

There is, by virtue of this relationship, a range of time (controlled by shutter speed) and intensity (controlled by aperture) combinations that render the same exposure. In most situations the law holds; however, as exposures get very short (1/1000th sec or less) or very long (1 sec. or longer) the image produced may not have the predicted density. This is called the reciprocity law failure (RLF).

Reciprocity characteristics vary from film to film. Refer to the technical literature available for all professional transparency products to determine reciprocity information in very short or extended exposure situations. For example, EPT 160 at one second acts as though it were an ISO 100 product as contrasted to its 160 rating.

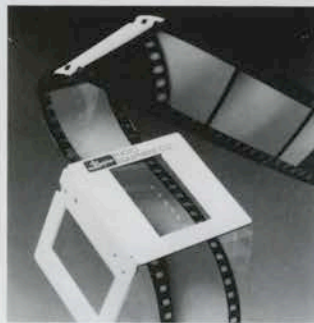
Next month, we will examine other factors which affect color transparency choices.

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