

## The Lighting Ratio Mystery - Solved

This article belongs completely to Ed Shapiro, a professional photographer, who contributed a lot to the art. It is based on the content of a topic of forum. I have to thank Ed for covering this topic. I could not find any place where Ed gathered and published his knowledge, so I decided to extend the audience of the forum where he posted this topic. So here it goes...

### The Lighting Ratio Mystery - Solved

There have been a number of posts recently questioning and arguing the subject of lighting ratios. On each post there have been good and valid arguments but mostly based on theory, the use of exposure meters and mathematics. As most photographers know, the lighting ratio determines the difference between the highlights and shadows in a photograph and this theory is especially applicable to portraiture. Knowing how to control the lighting ratio is enormously essential to fine portraiture because it affects the final image both from a technical and aesthetic standpoint.

#### ***Technical Considerations***

The brightness range of a subject is the series of tones from the darkest shadows to the brightest highlights (in terms of densities) that the human eye can see in a normal level of light. When we produce a properly exposed and developed negative or transparency we can see almost as much of that tonal range when viewing the negative or transparency by transmitted light. When however, we produce a print, which is viewed by reflected light, the tonal range capabilities of the printing paper can not record as wide a range of tones as seen by the eye before photography or while viewing the negative or transparency. When we are photographing a landscape or an architectural subject, we must consider the tonal range of the subject by making exposure meter readings thereby determining the tonal range of the subject. In black and white photography we can use the zone system to expand or compress the tonal range of the subject on the negative so as to compensate enough for that negative to print on a normal grade of printing paper. The zone system is based on manipulations in exposure and film development and during the printing stage. In transparency work we can not exercise that much control. We can push or pull process film to increase or decrease contrast and speed but the results are not as predictable because color shifts can occur. The same applies to color negative materials. There is a choice of color films, some having more or less intrinsic contrast and there are various printing papers, at our disposal that can alter contrast slightly. If we need to photograph a particular scene that has poor potential in terms of contrast, we might have to return to the scene at another time when the lighting conditions have changed.

In the portrait or commercial studio, we have a different approach because we are in control of the lighting. We are also in control of the intrinsic contrast of any particular subject because we can change the color of the background and in the case of black and white work, utilize filters to help separate colors for good panchromatic rendition. Most importantly, we get to control the direction, quality and quantity, of the light and of course adjust the ratio to our requirements.

Before we leave the technical part- just a few more things; If the lighting ratio is such that it exceeds the tonal range of the film, way beyond the film's latitude, poor quality will result. Prints will appear "too contrast" and will lose detail in the highlights, the shadows, or both. Blocked up highlights have no skin texture and make the subject appear pale. Vacant shadows cause harsh results lacking the gradations of tone that lend three-dimensionality to the subject- this looks like cut and pasted images. In color films, lack of density in the shadows can also cause color-crossover due to reciprocity law failure, that is, unpleasant murky colors in the blacks. Lighting ratios that are too flat, having little or no differential between the highlights and the shadows, can yield images with insufficient contrast that lack modeling, depth and visual impact.

## ***Aesthetic Considerations***

The lighting ratio is one of the most important elements in setting the mood of a photographic composition. In portraiture we set the "key" of the SUBJECT, for the most part, with adjustments to the lighting ratio.

### ***Low Key***

A LOW KEY portrait usually renders the subject with rich and deep shadows, well graduated middle tones, diffuse highlights and some well placed specular highlights. Printed down to produce detailed highlights, all the other tones should fall into place with ample detail. For the sake of argument, let's say that a lighting ratio of 1:4 or 1:5 will work well in low key portraiture. Well executed low key portraiture look like the painterly work of the old masters like Vermeer and Rembrandt- but here is the proverbial fly in the ointment; A subject lighted in the aforementioned manner does not necessarily a low key portrait make. If the background and the subject's clothing are not in the darker and richer tones the results will nor be a true low key study. A subject lighted in a 4:1 ratio, photographed on a white background is out of key. Any clothing that is brightly colored or patterned is out of Key. The idea of a true low key image is that the background and clothing are dark, part of the face is in shadow causing the strategically lighted and subdued mid-tones, diffuse highlights and the carefully placed specular highlights will define the motif of the image. Since the viewers eyes will always take the path of least resistance, anything in the composition that is brighter in color or tone than the part of the face that the photographer has selected as the main motif of the image, is a distraction. Any props or accessories added to the portrait must be subordinate to the main subject. If you had a properly lighted image of a little boy- the "statement" made by that portrait would be simple and concise; "A little boy". If the boy was holding a bright red and yell toy fire engine, the statement might be "A bright red and yellow toy fire engine held by a little boy." Fastidious purest photographers even select their subjects for various "keys". They would opine that a blond blue eyed fair kid has no business in a low key sitting. The best subjects for low key sittings are medium to dark skinned subjects. So the rule of thumb for low key work is dark background, dark clothing, darker subjects, higher ratios and since the lighting is set to emphasize the subjects face, the face will become the relatively brightest part of the image and therefore the main subject. Because of the precision of lighting control, that is inherent in low key work, it is well better suited for corrective techniques like reducing apparent weight in a subject or "reshaping" the face.. The reason for mentioning all this is to explain the ratio alone does not unilaterally define the key of a portrait or commercial photograph. One should also note that kicker and background light usage is also an important part of low key photography.

### ***High Key***

Most experienced portraitists will use a lower ratio (1:1, 1:1.5 or 1:2) in high key work because dark shadows are not compatible with the airy feeling of a truly high key image. Once we fully understand the theory behind low key work, understanding high key imagery will be easy. Here we have a lighter subject dressed in light or white clothing on a very light or white background. The face of the subject is the darkest element of the composition and therefore becomes the most outstanding tone in the photograph. High key photography utilizes the higher end of the tonal scale and anything that is dark or black will be out of key and cause a cause distraction. I personally like a delicate kicker light in my high key images to add another "layer" of highlight to catch the eye - but this needs to be carefully done to avoid too much blending of the subject into the light background . As you must realize by now is that the lighting ratio alone does not set the mood all by itself and that other consideration are important in coming up with a good all over composition.

### ***Medium Key***

This is a handy method of lighting which I use as a compromise technique when confronted with certain problems. There is where the old recommended 1:3 ratio is recommended. I like to use this method in family or corporate portraiture on location where going to high or low key mode might seem too extreme or out of key. When including environmental backgrounds, furnishings and industrial surroundings, using medium key can "hide" some problems such as not perfectly coordinated clothing or backgrounds. Sometimes I will lean toward the lower key mode when trying to subdue distracting backgrounds but still want them to remain somewhat visible. I don't want dark shadows appearing on floors and walls so locating and positioning of the subjects is critical. Other factors such as lighting

the background or shutter dragging, factor in as well. I also find that medium key work is good for people in very bright cultural costume because that kind of attire can go out of key in strictly high or low key settings. Commercial catalog work is often done in medium key because it is easy to reproduce in the photo-mechanical process and does not require too much pre-press manipulation to hold all the details in the final printed illustrations.

## **Ratio**

I hope that I have not frustrated too many folks on the boards when I constantly encourage people to use mathematically based tables, charts and lighting diagrams ONLY as a starting point in determining settings and ratios. With practice, consistent results and testing, lighting procedures and techniques will become second nature to you- lighting ratio issues are no exception to my theory. You will know exactly and instinctively where to place your lights, in order to obtain what ever effects you wish to create.

Since ratio is in itself a mathematical term lets use the math and physics as a starting point. In a very simple portrait lighting scenario with the subject full face to the camera you start by placing your fill light behind or near your camera in the proper position, providing base exposure and fairly flat lighting. Now you should make a light meter reading - you will find that the face is lit evenly on both sides, ergo one unit of light on both sides of the face. Next, in order to start giving your image form and texture, you bring in your main light at the same power setting and distance from an off camera position, thereby forming some shadow on one side of the face. Unless you split the light so that one side of the face is in complete shadow, there is going to be some overlapping of the main and fill lights. Other than that unlikely (split lighting) situation, with your main light at 30 to 45 degrees it is time to take the next reading. Now you will find that the highlighted side of the face will probably read about 1 or 2 f/stops higher than the side with the shadows, so you can now say that there is a 1:3 or 1:4 ratios respectively. If you move the main or fill light closer or further away from the subjects, increase or decrease the power settings or add diffusers to the lights, changes will occur in the lighting ratio. As far as the exposure meter readings and the mathematical formula are concerned things should be simple. It should go like this:

1:2 - Normal medium key effect.

1:3 - slightly more dramatic with richer shadows,

1:4 - very dramatic shadows and

1:5- pushing the envelope with color negative work - may work in black and white with soft development.

By means of this method, using an exposure meter and a bit of testing should work, to a degree, in establishing predictable lighting ratios, but surprisingly enough, it oftentimes does not work as predictably as we would like it to and sometimes yielding very disappointing results. I will explain - but first a small history lesson.

Old guys like me, often talk about "the good old days" and many people here think that this is all false nostalgia. To some extent, that is true and of course age does not necessarily bring wisdom. The advantage, some of us old geezers have, is that since we know where we have been, we also know where we are going- we have the history. This is a good example:

The year 1959. Although electronic flash had been around for a while, many studios preferred to stick with their old tungsten lights, especially for fine black and white portraiture. The portable strobes were used for weddings but the old incandescent photofloods were still the preferred tools in many studios. The argument against studio strobes was that they were very costly, had comparatively dim modeling lights and were sometimes unpredictable and in some cases considered dangerous because of the lethal voltages packed into those old power supplies. Most importantly, accomplished portraitists and commercial photographers wanted to see exactly what they were getting on the ground glass. Those big floods were pretty well "what you see is what you get" tools. The lighting patterns and ratios were right there for you to see and with the aid of a directors glass, we could visually determine the exact ratio before exposing a sheet of film. The darkroom chemistry and procedures were all set up to jibe with the lighting setup in the camera room - happy days!

Meanwhile back at the Kodak plant in Rochester, newer color negative emulsions were being invented and, on the home front, the popular demand for professional color portraits was on the rise. Progressive studios started to switch over to electronic flash because of its' compatible daylight balance with most popular color roll films and

the availability of long roll cameras for school and senior photography. The action stopping ability when photographing young children was another nice feature. So it wasn't very long 'till the old hot lights were carried off the basement and the big white truck from American Speedlight Corporation pulled up in front of the studio door with lots of cartons and crates containing the brand new flash system. With our boss bossing and all the staff excitedly unpacking, my job was assembling. It seems that I was the only kid in the place that knew how to turn a screwdriver and read the instructions without having a nervous breakdown. I remember those chrome plated stand sections and the ball bearing casters as if it were yesterday. I inserted the flash tubes and modeling lamps and attached the satin finish 16" parabolic reflectors. The power supplies encircled the stand columns and there were massive coiled cords and monster size electronic connectors. I handed one of the AC cords to my boss asking him to do the honors - he declined saying "you are better at these things". I think he was afraid it was gonna blow up and his youngest apprentice (me) was the most dispensable. It took two of us to assemble the boom for the hair light - very heavy. We switched on the units, the ready lights began rapidly blinking as if they were anxious as I was to get started. I attached an open flash extension cord with a push button switch and again handed it to the boss - again he handed it back to me - then I was sure he was afraid of it. I pushed the button and the camera room lit up like lightening in the night sky. Some people cowered because they were not used to the "pop" but soon everyone was laughing and celebrating the new shiny acquisition. That was the last peaceful day I had for the next three weeks.

I came to work extra early on Monday morning to help test out the new lights. I placed them exactly where their predecessors had dwelled for the last 25 years (long before I was born) and carefully aimed the phototubes (slaves) and made sure everything was triggering. I set the power dials to 100 watt/seconds, lined up all the barndoors and snoots, and placed the bullet shaped background light. I attached the synch cord to the old studio camera with its' converted Packard pneumatic shutter fitted with a newly installed synch contact. The boss's daughter volunteered to be the test subject and we were ready to rock 'n roll. The boss squeezed the ball to open the shutter for focusing - he said the shutter wouldn't open and asked if I had disconnected the tubing when I had hooked up the synch cord. I looked at the lens and discovered that the lens was indeed open. I looked at the ground glass - it was almost pitch dark. I thought I had forgotten to open the aperture for focusing but it was wide open. Seems that the 100 watt modeling lamps could not get much of an image on the 50 year old dirty ground glass - not like the 1000 watt flood lamps that was in the old hot lights. An urgent call to our dealer brought us a spanking new Kodak 5x7 ground glass and field lens. The field lens was a plastic sheet attached to the front of the ground glass that would amplify and spread the light in to the dark corners of the focusing screen - it was significantly brighter but still not as good as the old 1000 watt bulb. The modeling lights would dim and brighten so as to track with the flash output but a 50 or 25 watt/seconds they would dim beyond visibility. What a bummer - you could no longer see the ratio on the subjects face or on the ground glass. Here we were - the boss was in apoplexy - we had thousands of dollars worth of lighting gear that we could not visually control - like shooting blind with portable flash units - sans modeling lamps. Another urgent call to American Speedlight (Ascor) helped solve the problem but we made some interesting and surprising discoveries.

Ascor had its' headquarters in Queens, not too far from our Brooklyn location. We would buy through our regular dealer and Ascor would drop ship directly to us because of the bulk of the equipment. Thankfully, technical problems, exchanges and service were also handled by the factory. If there were billing differences, the dealer would invoice us accordingly. That phone call brought us a more deluxe set of heads with 3 modeling lamps instead of one and the exchange was made. Now we could see again. Problem solved? - not in our lives! We started to make tests and everything was flat and gray. NO RATIO! - NO MODELING DEAD FLAT! To get any indication of modeling we moved the fill light as far at the walls permitted with very little improvement. We bounced it of the ceiling and things began to look better on the film but we could no longer SEE the effect of the fill light on the face of the subject - it looked like a 1:10 ratio to the eye and was just beginning to show a bit of contrast on the face, in the negative. I suggested that we do a shot using only the modeling lights with the units placed like the old hot lights and everybody laughed - they said that the modeling lights were too dim and that a time exposure would be needed and they teased "well, if we're gonna use the modeling lights why waste money on strobes- might as well send these things back to Ascor and put back the old lights". My theory was that the flashtubes and the modeling were somehow not aligned. We did the "modeling lights only time exposure" and it looked normal (just like the old hot light) in the negatives and prints - what we saw is what we got! This is all good and well but we wanted to use our strobes to shoot color. Yet another call to Ascor brought us an electronics engineer, slide rule and a large wooden box containing a Thomas electronic flash meter in hand. This thing (the flash meter) had to weigh in at 30 lbs and looked more like a Geiger counter, with its' large hand held probe and impressive analog galvanometer. It, in fact was THE first flash meter, produced in England by Thomas Instruments. Measurements were made but again no conclusive remedy was apparent. The engineer recommended that we get in touch with a master photographer by

the name of Peter Niccastro, who I believe worked out of New Jersey at that time. It seems that Peter was getting tremendous results with the same equipment we had and was singing the praises of these lights at seminars and master classes.

We contacted Peter, who figured out most of our problem from what we told him over the telephone and the nice folks at Ascor decided to arrange to have Peter visit us at their expense. Peter was an extremely nice person who had more knowledge of lighting than anybody I have ever met to this day. It took him all of 3 minutes to diagnose the problem. It was UNSEEN SECONDARY LIGHT. It seems, for whatever physical reason, light generated from a gas filled electronic flashtube is different from light generated for a tungsten source, not only in color temperature but in the ability to bounce off surrounding surfaces and reflect back on to the subject. This unseen light was already filling in to some degree and then, added to the fill light, would over fill the shadows and cause flat results. This is where the ratio formula fell apart. Peter told us of a colleague who had a very small camera room with white walls - he had to install some black window shades, on the walls, when doing low key photography and rolled up the shades for high key work. Even in large camera rooms there is always a bit of unseen secondary light.

The funny thing is that we were all out shooting weddings and Bar Mitzvahs and some of the photographers were producing beautiful and dramatic candid portraits with on strobe on an extension cord - no fill. It seems, in retrospect, that the light bouncing off wedding dresses and prayer shawls were enough to fill the shadows when soft developers were used with the appropriate black and white films. The funny part is that we never related this to studio work.

There were also other issues that figured into achieving the desired lighting ratios. When using parabolic reflectors most experienced photographers feather their lights - that is the use the edge of the beam of light as opposed to the center or hot spot of the beam. When the lights are feathered off in that manner, an increase in exposure is necessary - it could be about 1 stop. For that reason, all tests should be done with the lights in the feathered position when using parabolic lights in the aforementioned manner.

When using soft focus prime lenses or filters, the effective ratio is altered as well. Since these optics tend to spread the highlights into the shadows thereby reducing contrast, higher ratios are oftentimes needed to maintain the contrast. There is a saying; soft lens - hard light, meaning that parabolic or even feathered spotlights are very effective with soft focus optics. With very soft lighting in combination with soft focus optics, too much contrast is lost and the entire image turns to mush.

More ratio pitfalls - When adding more light to your setup such as kickers (accent lights) hair and background lights, the ratio between those lights and the previously established main and fill in light relationship is yet another problem that can cause headaches unless certain theories are known to the photographer. The angle of incidence theory is the important one here; the angle of incidence = the angle of reflectance. In practice, that boils down to the fact that lights which are brought in at angles exceeding 90 degrees from the camera subject axes, at the same distance and power will appear brighter on the subject. This can be a good thing when you want to introduce a secondary layer of specular highlights to emphasize certain facial characteristics or provide a rim light to a beautiful profile. This added brightness can also be troublesome if it burns out detail in the defuse highlights or ends up exceeding the range of the film. Some times these other lights need to be reduced in power or moved further away from the subject to be effective yet not distracting. A meter reading of these lights will not reveal the problem, that's why careful testing is required. How to get all of this under control? Please see next section.

## ***The Method***

Firstly, decide on what kind of fill light you would like to use. You can install 3 or four lamp heads aimed at the ceiling at 15 or so feet from the background- these lights should be feathered forward so that their beam ends slightly before (but not on) the background. My ceiling bounce units total 2400 watt/seconds from a Speedotron power pack - this yields a base exposure of  $f/11$  at full power or  $f/8$  at 1/2 power. You may want to use a large soft box or an umbrella unit as a fill - high and in back of the camera. Some parabolic users simply utilize a simple parabolic unit near the camera and very mobile to create what is called form fill. Form fill techniques are far more complex and I will save them for another article. Once you have set up your fixed fill light the testing should begin. Start with only the fill light turned on.

You will need an average subject dressed in a black shirt or sweater with detail in it. Make a series of these, using your favorite portrait film, and bracket, in 1/2 stops from f/4 to f/22. Have your subject hold up a legible card showing the f/stop at which each frame was exposed. Keep the shutter speed at 1/125th of a second or higher so that the modeling lamps do not influence the exposure. Process the film only (no prints) and examine the negatives on a light box. Start with the weakest negative, which will probably be completely underexposed and work your way up until you see the shadow detail just beginning to appear in the black sweater or shirt. The next frame after that will be the base exposure test one. For the sake of this article, let's say it is f/8.

For the next test set the camera at f/8 and leave it there. Now bring in you main light. Prepare a piece of string or twine with knots tied at 1 foot intervals from 2 to 6 feet and tie the string to the edge of your reflector for parabolics, the front of your soft box or the light stand supporting a mono light with an umbrella. With parabolics, feather the light before shooting. Make a series of exposures with the main light at each "knot" measuring from the unit to the subject's nose. Process and print this film and ask your lab to print each negative so that there is good highlight detail in the face - no blow out. The resulting prints will exhibit a series of RATIOS from flat to delicate to more pronounced shadows to dramatic shadows to too contrast results. Eliminate the knots (distances) which yielded flat or overly contrast results and the remaining knots or distances will be your useful range of effects in YOUR shooting space. You can use the string for a while but in no time you will know the distances by instinct. By doing this test you have factored in the unseen secondary light and other factors pertaining to your camera room.

### ***Fine Tuning Your System***

If your results are all to flat, increase your exposure by one f/stop. If your results are consistently contrast, reduce your exposure by one f/stop. Remember with this system your f/stop never changes unless you change the output of the fill light or fill light system. If the output of the fill light is changed the main light's output has to be changed proportionately - I do that when I want to use my soft focus lenses at full aperture - I bring the whole system down to f/4.

### ***Fine Tuning Even More And Adding More Lights***

When adding more lights you can start testing at the predetermined power and distance and than compensate for high angles of incidence by reducing the distance or the power output. When it is impracticable to use the entire "knot system" because of space restrictions or the unit itself is getting into camera range, you will have to adjust the power output instead. The distance system should work in most cases but there are exceptions; when you want to bring in the main light very close to achieve a softer effect or when you need to move everything back to accommodate groups and full length poses. You may need to step the power up or down to maintain the same ratios you have established by the previously mentioned tests. This is where an incident light exposure meter with a flat disc receptor comes in handy. You can measure the output of the main light or any other light alone (with the fill light turned off) and record the f/stop when using the string or distance method. If you have to move that unit back and forth, out of bounds, so to speak, you can adjust the power until the index f/stop returns. You can set the meter for the film you are using the f/stop in terms of exposure is arbitrary because the camera is set at the base exposure level and is constant. The main light might read at f /22 for the ratio you wish to establish or reestablish - the meter reading is only an index. Once your string method is established, The exact output from each lighter should be individually be metered and noted- this way the relationships can be repeated if the system is used on location or other lights such as spots are substituted for the main light. When working on location - the unseen secondary light levels will probably differ from you studio setup. I usually make some Polaroids to reestablish the ratios. Background lights are important tools especially in low key portraiture. There is often a misconception that low key portraits entail jet black backgrounds - that is far from the actual fact. GOOD low key portraits need a delicate color mass in the background to help with tonal separation. The color mass adds depth to the background preventing the image from having a cut and paste look. The background light must be carefully adjusted, with all the other lights in play, to obtain the subtleties as described. Hair lights also need to be adjusted to render correctly, hair of different colors and shades. Blond hair may require very little or no hair light and dark hair might need somewhat more. Remember, even dark hair can be over lighted because of the angle of incidence at which your boom light is positioned. I leave my hair light in the same position and adjust the power for the color and shade of the subject's hair.

## ***Lab Considerations***

The method described here is applicable to black and white and color negative films. Transparency films require that we expose for the highlights and fill the shadows. After the lights are set up, exposure meter readings will usually work out providing the ratio is not too high. It is advisable to make Polaroid tests to verify your readings because Polaroid films have similar latitude to transparency materials and if the instant film looks good you will not be far off in the final transparency - I always bracket to obtain the optimum exposure.

When working in portraiture, I strongly advise setting up a standardized system of achieving the desired effects without exposure meters, mathematical calculations and endless Polaroid testing, because that all distracts from working with the subject. Expression and emotions are fleeting moments that need to be captured with great speed and efficiency and you do not want to be fiddling with meters and Polaroids and camera settings when the peak of expression occurs.

## ***Special Notice To Digital Workers***

Please do not think that some of this information is not for you. My testing of some of the latest cameras in my studio has proved to me that the control of lighting ratio is all important in digital photography. It seems to me that highlight blow outs are very prevalent among new digital users and unless one wants to spend days at a time correcting and compressing all their images on PhotoShop, tight control over ratios and angle of incidence is needed. Overly corrected digital images never look as good as properly exposed ones when the prints are made.

When working on commercial still life and products I meter and test the heck out of each setup. When working with large format and transparency films, bellows extension factors, multiple flash pops and filter packs, there are too many variations to kill your shot - so before taking down the set, I wanna see finished film - that's OK because still life doesn't move around, loose patience or have bad expressions - that's why they call it STILL life.

I hope this settles some of the ratio arguments and helps some of you who were having problems with starting up a studio space. For the new guys on the boards, this is one of my infamous very long posts.

I would like to dedicate this one in memory of Mr. Peter Niccastro M. photog. Cr. who passed away some years ago. In his lifetime he created many wonderful images and shared his knowledge with many wonderful photographers. Peter headed a company called Photography Learning Systems. If anyone out there has or can locate any of the books or AV programs that he wrote or designed, they would indeed possess a treasure.

*Ed Shapiro*