RMUG iPhone Photography Update

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Photography has undergone major changes in the last 25 years. In the 20th century photographs were taken with film cameras. The major film medium was 35mm and the leading company in the world was Kodak. Kodak was also the early leader in digital photography but suppressed digital development for fear of harming the film market.

Around the later 1990's camera manufactures such as Nikon and Cannon started developing digital cameras. This coincided with the trend toward everyone having a home computer that could process digital photographs.

As computers developed more processing power it made sense to manufacture cameras that had more resolution. The race in cameras was to make ones with higher and higher resolution.

Then came the iPhone and the associated camera. The photos were not as good as a dedicated digital camera, but the convenience factor (always in your pocket or purse) made it extremely practical. Also, the trend was not to print photographs but to display them on the phone, computer or iPad or your home TV. That is now how most photographs are reviewed.

So, what do you need to display beautiful photographs in this fashion? Well the new iPhones produces relatively small 12-megapixel photographs, yet they look beautiful even on a 60 or 70-inch TV screen. The reason for this is that the new phone cameras use digital magic to make the photos look so spectacular. When you shoot a single photo, the camera may produce 9 or ten images and meld them into one. It uses algorithms to select the best pixels to form a single near perfect image. It can adjust the brightness and contrast and focus to make the photos look truly remarkable. The expectation is that with these and additional tricks and refinements the need to lug around a big and heavy camera which produces huge computer files will not be necessary. The exception will probably just be professional photographers who wish to print huge photos with extraordinary detail. The rest of us will have more than we ever wanted.

So, do the new iPhones raise the bar? Seems that they do. The iPhone 11 has two lenses while the Pro and Pro Max have 3 separate lenses. The cameras are each 12 megapixels. There is a telephoto lens, a mild wide angle lens and a very wide-angle lens added on the Pro models. Why is this an advantage? Well you can't always get as close to or far away from your subject as you would like. Having multiple cameras solves that problem.

Let's look at the camera shooting menu.

From left to right the options are time-lapse, slow-motion video, photo, portrait, and pano(ramic). For this talk we will not discuss the first three as they require special techniques and equipment.

So, we will start with the basic photo screen. This screen changes somewhat depending on whether the camera is held vertically or horizontally.

I suggest that before we go on, we go to the Settings menu. Scroll a long way down until you see Camera. Click on camera. Go to Preserve Settings. Select Live Photo and turn on. Live Photo can be very useful, and it is easy to turn off if you don't want it on the main camera screen. Next turn on Grid. Grid will display on the screen white vertical and horizontal lines that will help you compose your photos using the Rule of Thirds (see below). You want the photo showing placement of subject at the junction of the Upper horizontal and vertical lines. Placement of the subject using these lines is a basic principal used to obtain a pleasing image.

Next if you have a iPhone 11, turn on Photos Capture outside the frame. This will allow the ability to add to your photographs things that are missing such a person or body part or object. This can occur when you take a photo using the telephoto lens or the mild wide-angle lens. The camera will for example store the image from the next widest lens for 30 days. You must edit the photo using the editing program before that time or the wider image will be deleted.

Now let's open the camera app on the iPhone 11 and start navigating the Camera Shooting Screen. In the vertical position at the top of the screen far left there is a lightning symbol which allows you to turn on or off the flash. Next to that is a circle with lines through it that increases the exposure time for low light situation. The minimal increase is 1 second, but the camera will automatically determine if more time is needed. For longer exposures you need to hold the phone as motionless as possible. To the far left top of the screen is the button to turn live photos off or on.

At the lower end of the screen you will see .5, 1x and 2. This allows you to select which camera you want by pinching the screen wider or smaller. Increments other that the basic value of the camera uses digital interpolation which may cause some distortion in the image.
Below the lens selections there is the photo mode selection and below that the shutter button. To the left of the shutter button is the button to select to front camera (for Selfies) or the back cameras. At the top middle of the screen is an arrow pointing up. Click on this to see additional functions including flash on or off, low light adjustment, live photo on and off, photo timer, and color mode selector. Most but not all of these adjustments are also available with phone in horizontal position.

Recommendations for Better Photographs

Make sure you are comfortable with clicking the shutter. This can be especially difficult with selfies. Consider using the timer.

Rule of Thirds
As mentioned previously an attractive format is to use this rule which places the subject near or at the intersection of horizontal and vertical lines.   Be sure if it is a portrait that the subjects are looking toward the center of the photo and not toward the outer edges

Photo of rule of thirds
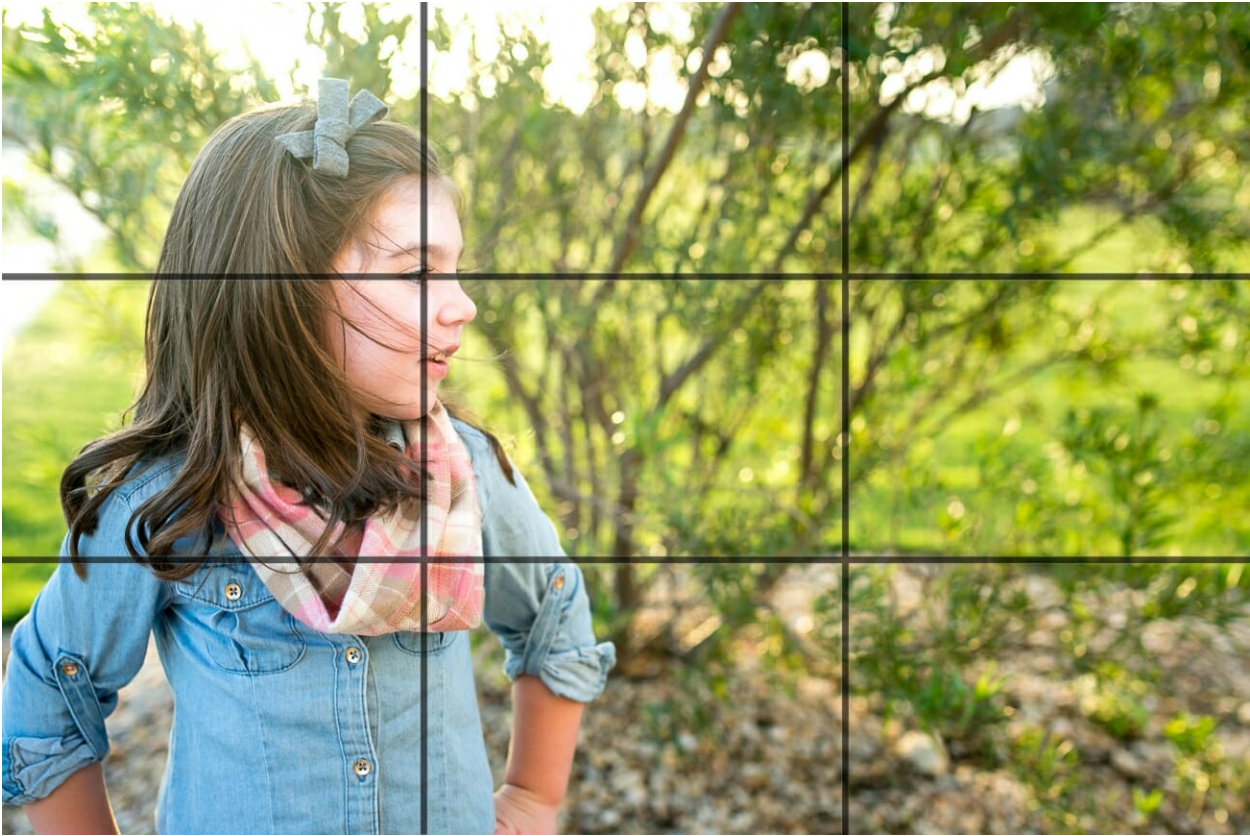
Leading Lines or curves

Depth of field

This can be controlled in Portrait mode. Can shoot with telephoto lens with subject very close and background distant

Use wide angle lens to have everything in relative focus

Focus point should be 1/3 up from the bottom

Fill the frame specially for portraits

View point especially for architectural shots

The Amazing Calculations Involved in Portrait Mode

Play with portrait mode. The iPhone camera app will tell you if you are too close to subject. The camera will make amazing technical decisions regarding lighting. To achieve the level of precision needed for fine-grain Portrait Lighting adjustments, the Photos app uses an advanced segmentation technology that locates and separates the subject from the background of an image with great detail and clarity. With iOS 13, this technology has been updated to identify specific facial regions, semantically allowing the device to isolate hair, skin, and teeth in a photo. Semantic segmentation allows the device to understand which regions of the face to light, like skin, while determining which areas, like beards, need to be preserved when simulating studio-quality lighting effects across different parts of the face.

Segmentation mattes

Apple uses person, hair, skin, and teeth segmentation mattes. When a user takes a Portrait mode photo, the Camera app uses the Apple Neural Engine in the A12 Bionic chip (and later) and runs multiple on-device machine learning models. This process analyzes data from the

camera sensor, depth data, segmentation, and the pixels of the image itself to determine if a person is visible and locates the unique geometry of the subject's face. If a face is visible in the photo, the device will generate a final output image, as well as multiple auxiliary images, like person, hair, skin, eyes, and teeth segmentation mattes. Each of these images is used when applying the following Portrait Lighting effects, all of which are accessible by third-party developers:

• **Primary image**

Displays the user's Portrait mode shot with all effects. For example, the subject on a blurred background with a depth-of-field effect.

• **Depth map**

Indicates distance from the camera to that part of the image (either in absolute terms or relative to other pixels in the depth map).

• **Person segmentation matte**

Separates the subject from the background.
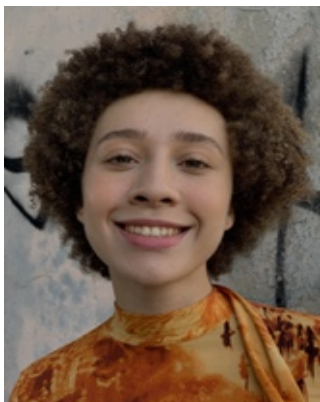
• **Hair segmentation matte**

Separates the subject's hair region from the non-hair regions. It even separates hair details, like small strands of hair, from the background.

• **Skin segmentation matte**

Locates the skin regions of the subject.

• **Teeth segmentation matte**

Locates the subject's teeth when they are visible.

Using Machine Learning to Move Light Virtually. With the ability to analyze unique facial regions in real time, Portrait Lighting now lets users virtually move the position of light sources right on their iPhone, helping them dial in their portraits—whether they're shooting in Camera or editing in Photos.

Understanding Each Lighting Effect

Portrait Lighting is inspired by the real studio lighting setups of the world's best image makers. Each effect is designed to create a slightly different look, representing unique lighting arrangements of soft-boxes, reflectors, diffusers, absorbers, and spotlights:

• **Studio Light**

Emulates the effect of visiting a photographer's studio, like the use of a soft-box light, along with kick lights and a reflector to evenly illuminate the sides and the area underneath the subject, surrounding and filling in the face evenly with light.

• **Contour Light**

Simulates a black velvet absorber draped on the side of the face, preventing light coming from underneath the subject, leading to a contour effect on the sides of the face from a soft-box.

• **Stage Light**

Creates a look that's similar to the Contour Light effect, with a spot lit face against a deep black background.

• **Stage Light Mono**

Similar to the Stage Light effect, but the photo is in classic black and white.

• **High-Key Light Mono**

Emulates the use of a soft-box, similar to the Studio Light effect, with more contrast in the face, a monochrome black-and-white subject, and a high-key white background.

Portrait Lighting Control

Each Portrait Lighting effect includes a slider that lets users control the intensity of each studio lighting effect. This slider virtually changes the relative size of the primary light source to the relative size of the face. As the user virtually moves the light source closer, moving the slider to

the right, the effect adds more light to the face, making it appear brighter and softer. Moving the slider to the left virtually moves the lights away from the subject, adding subtle contrast to the face.

Increasing the intensity of each Portrait Lighting effect creates the look of sharpening eyes, brightening facial features, and smoothing skin. To sharpen eyes, the device identifies the eye regions and enhances the details, increasing clarity and sharpness by preserving the blacks while brightening the area. Portrait Lighting then analyzes the local contrast of skin regions of the face, providing an even illumination across the entire face while adding light to shadow areas. This creates an effect similar to a soft-box in a photo studio, where the light removes contrast throughout the face, including regions like wrinkles.

Portrait Lighting isn't designed to remove all the contrast of the face. For example, there are many regions, like beards, beauty marks, and freckles, where the device preserves contrast for the image to appear realistic. To do this, Portrait Lighting uses the embedded skin segmentation matte and analyzes each pixel of the face, using a frequency separation process that determines which areas should be left alone.

Editing in Photos

Editing photos in iOS 13 and macOS Catalina is designed to be easy while also providing users with fine- grain control over every aspect of their photos. There are over 17 adjustment tools in the Photos app, ranging from one-tap controls like Auto Enhance to   pro-level adjustments like Noise Reduction. These effects include:

• **Auto Enhance**

Automatically adjusts the color and contrast of a photo, bringing the important features, like deep blacks and properly exposed highlights, to the foreground.

• **Exposure**

Adjusts the tones—the amount of light—throughout an entire photo.

• **Brilliance**

Applies region-specific adjustments to brighten dark areas, pull in highlights, and add contrast to reveal hidden detail and make a photo look richer and more vibrant.

• **Highlights**

Changes the highlight detail, the brightest areas of a photo. By decreasing the Highlights value, the brightest areas of the photo will become more dark.

• Shadows

Adjusts the detail that appears in shadows and other dark areas. By increasing Shadows, the darkest areas of a photo will become more bright.

• Contrast

Controls contrast, the range between the lightest and darkest parts of a photo.

• Brightness

Adjusts the brightness—the overall lightness or darkness—by raising the midtones of a photo.

• Black Point

Sets the point at which the darkest parts of an image become completely black without any detail. Setting the black point can improve the contrast in a washed-out image.

• Saturation

Adjusts a photo's overall color intensity.

• Vibrance

Boosts muted colors to make a photo more rich without affecting skin tones and saturated colors.

• Warmth

Balances the warmth of an image by adjusting color temperature (blue to yellow).

• Tint

Adjusts the warmth of an image by adjusting color tint (green to magenta).

• Sharpness

Changes a photo by making its edges crisper and better defined.

• Definition

Increases image clarity by adjusting the definition slider.

• Noise Reduction

Reduces or eliminates noise (such as graininess or speckles) in a photo.

• Vignette

Adds shading to the edges of a photo to highlight a powerful moment.

Auto Enhance

Auto Enhance is the best place for a user to start when creating the right look for their photo or video. With just a tap, Auto Enhance approaches the image how a pro photographer would, analyzing each and every pixel of the image and automatically adjusting the tonal extremes of the photo, bringing the important features, like deep blacks and properly exposed highlights, to the foreground. And in iOS 13 and iPadOS, Auto Enhance now lets users control the intensity of their automatic adjustments. As users increase or decrease Auto Enhance, they'll see other adjustments—including Exposure, Brilliance, Highlights, Shadows, Contrast, Brightness, Black Point, Saturation, and Vibrance— intelligently change with it.

Brilliance and perceived color

Brilliance is a color-neutral adjustment, which means that no saturation is applied. However, there may be a perceived change in color because brighter images with more contrast often appear more vibrant.

Because every photo is unique, Auto Enhance is designed to optimize each and every photo in an intelligent way. Each editing adjustment relates to the others to create a balanced, properly exposed image.

When a user taps the Auto Enhance button, the following steps happen:

• Image analysis

Analyzes the tone curve of the full image using a histogram, and corrects for common lighting scenarios like a backlit or underexposed photo.

• Face detection

Intelligently determines if there's a face in the photo and adjusts the white balance, Warmth and Tint, to account for skin tone. This ensures that the automatic adjustments do not wash out the person's skin tone.

• Sets initial adjustment values

Sets the initial values for each adjustment, letting the user view the results. Each individual adjustment, like Brilliance or Vibrance, can then be independently controlled to fine-tune a single aspect of the user's photo.

• Determines Auto Enhance range

Generates the relationship between each of the adjustments for a specific shot, letting the user turn up or turn down the Auto Enhance effect using a macro slider that controls many adjustments at once.

Auto Enhance is designed to simplify the photo and video editing process, whether the user is a professional photographer or just getting started. As the slider changes, there's visual indication that other adjustments are changing with it. This enables the user to view and modify what's happening to their photos, providing them with a unique look at how each adjustment relates to the others. As the user slides to the right, Auto Enhance makes the image brighter without blowing out the highlights and affecting the image's white balance. As the user slides to the left, the effect darkens the image without losing shadow detail.

Smart Adjustments with Brilliance and Shadows

While many tools, like Exposure, provide global adjustments, meaning that they apply adjustment levels uniformly across the entire range of a photo, Brilliance and Shadows are designed with even more power for smart, spatially localized image editing. Both Shadows and Brilliance apply region-specific adjustments that produce dramatic effects without impacting the overall image. For example, with Shadows, the user can adjust the detail that appears in shadows without impacting highlights. With Brilliance, the user can brighten dark areas, pull in highlights, and add contrast to reveal hidden detail and make their photo look richer and more vibrant.

To create these effects, Photos divides the image into a 31x31 grid in real time, taking a closer look into each region of the shot. The device identifies one or more image characteristics for each tile, creating a region-specific histogram and tonal curve. This provides the device with an approximation of the exposure of each area of the image, and the Photos app treats each region as if it were a tiny image itself, computing the proper Brilliance or Shadows adjustment for that region.

The device combines the results of these regions and preserves areas where adjustments are different between regions. This helps ensure that spatially adjusted regions don't create artifacts in the areas of an image that transition from dark (underexposed) to bright (overexposed), such as where the foreground transitions to the background of a photo of a backlit subject. Finally, the device creates an adjustment curve for each pixel, determines the range for the slider, and adjusts the original photo, completing the user's edits.