Original & unengineered image in digital photography, is it possible?

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Abstract. This research aims to find whether the image coming out directly from the digital camera and unmanipulated via picture editing software is the authentic or original image that tells of the fact and is not engineered. A digital image that is published often sparks a debate on whether the image is true or manipulated beyond the tolerance of the journalism code of ethics. Some debate rises to question the authenticity of the image because the photographer or the photo-editor puts some aesthetics choice or tries to push the quality of the image during the process. Knowing whether the image coming out directly from the digital camera can be considered unmanipulated is a necessary beginning to other research in photography and digital photojournalism world. This finding will be a stepping stone to another research about image processing techniques in the digital photography era. It will help create a new understanding of what is digital photography. This research uses the qualitative method. There are three conclusions in this research. First, pictures coming out directly from the digital camera cannot be considered as an original image. Second, the picture from a digital camera directly cannot be considered as a picture that tells facts. The fact refers to the authenticity of recorded light from the scene forming the layout of things and colors of the image, not the event. Last, the picture from the digital camera directly cannot be considered as a picture that is not engineered.

Keywords: original and unengineered image, digital photography

1. Introduction
Photography in a journalistic sphere considers a photo that displays circumstances or situations as it is. In general, photojournalism is an image produced through a photographic process to convey a message, information, a story of an event that appeals to the public. Then, it is disseminated through mass media. Photojournalism is a photo that tells the fact, reality, or things that happen naturally, not engineered [1]. With advanced photography technology and images processing software, photos published on the mass media also do not escape image manipulation. In general, photojournalistic communities argue that photo manipulation is unacceptable for news and documentaries. However, at the same time, adjustment to photographs known as “minor change” (dodging, burning, toning, and color adjustment) is considered acceptable. It will be judged based on a case by case by looking at whether the context and the genre of the photograph [2]. Thus, there is a kind of collision in the authenticity aspect (originality) between
photojournalism that seeks to display photos that have integrity (honesty) and the photo manipulation applied in the process before published by the mass media. By questioning the originality or authenticity of the photo, we get the notion that the image coming out directly from the digital camera and unmanipulated via picture editing software is the authentic or original image that tells the fact, reality, things that happen naturally and are not engineered. To prove that notion, we must understand how analogue and digital photographies work in recording an image.

2. Research method
This research is conducted according to a qualitative methodology. The research model used is an inductive model in which the data are used as a starting point for conducting research. This research adapts and modifies the four-phase problem-solving process scheme by John Bowers [3]. It consists of data collection, identification, analysis, and conclusion. Data collection is done to understand what has been achieved from previous research and what information is related to the originality or authenticity of a photograph. Identification is done to parse the data to determine the stage in the image-making process of analogue and digital photography technology. It determines which data is appropriate for reference or object in researching. In the analysis stage, the data will be analyzed by comparing the process of producing an image using analogue and digital photography technology. In the conclusion stage, the researcher will conclude the analysis to answer whether the image from the digital camera directly and unmanipulated via picture editing software, is the authentic or original image, that tells the fact and is unengineered.

3. Analogue photography
Analogue photography uses film as a medium to record light. The process of recording the light on the medium is created by using a photochemical reaction. It is a reaction between light and silver halide crystals. The crystals, spread through the gelatin of the emulsion, are a compound of silver plus a halogen such as bromine, iodine, or chlorine [4]. In general, there are two types of film based on color performance: black and white negative film and color negative film.

A black and white film consists of sub-micron sized grains of silver-halide crystals that act as the photon detectors. Figure 1 shows the black and white film cross-section.

![Figure 1. Black and White Film Cross-Section. (Source: John Felix)](source)

By opening the camera's shutter, you form a latent image of the visible light reflected off the objects that you photograph. The brightest portion of the image exposes the majority of the silver-halide grains in that particular part of the film. In other parts of the image, less light energy reaches the film, and fewer grains are exposed. These latent images must be amplified and stabilized to make a negative image of the original scene that can be printed and viewed by reflected light. It is negative in the sense that it is darkest (has the highest density of opaque silver atoms) in the area that received the most light.
exposure. In places that received no light, the negative has no silver atoms and is clear. To make it a positive image that looks normal to the human eye, it must be printed onto another light-sensitive material (usually photographic paper) or scanned to convert it to digital file [5].

In a color negative film or chromogenic film, the processing chemistry is different in several ways from conventional silver halide film. A chromogenic emulsion contains dye couplers as well as silver halides [4]. These dye couplers are a chemical that will react to form color and this color varies depending on how the silver halide grains were spectrally sensitized. A different color-forming coupler is used in the red, green, and blue sensitive layers.

Figure 2 shows a magnified cross-section of a color negative film exposed to yellow light and then processed. In the additive color system, the yellow color is red plus green color. Therefore, in the film, the red-sensitive and green-sensitive layer has formed cyan and magenta dyes. The latent image in the different layers forms different colored dye when the film is developed. Red sensitive layer forms a cyan dye. Green sensitive layer creates a magenta dye. Blue sensitive layer forms a yellow dye.

During development, the presence of silver that has been exposed to light leads to a proportional buildup of dyes. Then, the original silver is bleached, leaving the dyes to form a visible image [4].

The colors formed in the color negative film are based on the subtractive color system that layered on top of each other, illustrated in Figure 2. When negative color is printed on a photo paper, the white light that comes from the enlarger will go through magenta and cyan dye transparent layer in the negative film. It produces blue light because, in the additive color system, blue is controlled by mixing magenta and cyan light color. Blue color light is necessary to produce yellow color on the photo paper because photo paper has three primary additive colors of light-sensitive layered emulsion. It will produce the subtractive primary color dye, just as how the negative being coated. When the blue light hits the photo paper, the blue light-sensitive layer on the paper will be activated and produce a yellow dye, the original color of the light/object that has been photographed. The illustration of the printing process can be seen in Figure 3.
It is clear that through analogue process, the camera can be understood as a picture-making device. At the time of taking pictures, there is an image produced via direct contact between photosensitive chemicals and the light that bounces from the photographed object. This chemical instantly produces an image that can function as the original image from which the copies can be made.

4. Digital photography

We always think that photography as a process that creates images directly when the shutter button is pressed. In the digital photography era, this understanding of the process of photography is not true. The photography process in the digital era is more likely to be a computational photography process. The
camera in the digital era must be understood as a data-collection device [2]. It gathers as much data as possible about the object and the environment that the object is in. Later, it uses advanced computational to process that data into the final image. The sensor inside the camera consists of two elements. First, Charge-Coupled Device (CCD) or Complementary Metal-Oxide-Semiconductor (CMOS) becomes electrically charged when exposed to light, with the amount of proportional charge to the intensity of the light. These components are monochromatic devices. They only measure the amount of voltage acquired by each pixel [4]. Thus, these devices are only sensitive to light but not to differentiate the wavelength. The light intensity is recorded via grayscale.

Second, to collect the color data, Color Filter Array (CFA) must be placed in front of the CCD or CMOS. It separates the wavelength of the visible light into primary colors. This process only collects about one-third of the samples in the color image. The rest is added by the computer with the process known as color filter array interpolation or demosaicing. Interpolation is a mathematical process of estimating a missing value by taking an average of known values at neighboring points [4, 5]. In most cases, the demosaicing process is conducted within the image processing chain in the camera, and the user is likely to have little or no control over the process [6, 7]. It is clear that in digital photography, two-third of the pixel is created by the computer. Thus, it can be concluded that two-third of your pixel is fake [7].

In computational photography, the process in which an image is produced begins with the RAW data. RAW data is the set of digitized monochrome pixel values for the red, green, and blue components of the image as recorded by the sensor. Additional metadata relating to the image processing normally conducted in the camera is also saved [6]. It means that Raw stores the pixel values directly recorded by the sensor before CFA interpolation and requires photo-editing software to perform the CFA interpolation, using a RAW converter. RAW is not an observable or latent image.

When JPEG format is chosen, the built-in RAW converter algorithms are produced by the camera maker. Installed into the camera, it carries out all the tasks to create a color image and compresses it into the JPEG format. The user has little or no control over the process. As a result, the JPEG pictures are the camera’s interpretation of the scene.

In conventional photography, there is a latent image, an image formed by the configuration of silver halide crystals on a film after exposure to image-bearing focussed light. This latent image is already formed and has all the detailed information of the scene where the shutter in the camera is opened. This latent image can be developed and become negative, which can be considered as an original image, to which the other copies can compare with. With digital photography, it is clear that digital photography has no “original image” by the process. The data collected by the camera will always require “post-processing” to be an image. It means there is no fully formed picture at the time of capture, only data that has to be processed.

5. Conclusion
It can be concluded that first, the picture coming out directly from the digital camera cannot be considered as an original image. There is no fully formed image at the time of capture. The sensor only records pixel values directly from the sensor before CFA interpolation. To convert it to the image, it requires a computational process using the RAW converter. If the JPEG format is selected, the camera will use its built-in RAW converter to process and interpret the pixel value and compress it to the JPEG image.

Second, the picture from a digital camera directly cannot be considered as a picture that tells a fact. The fact refers to the authenticity of recorded light from the scene that forms the layout of things and colors of the image, not the fact that the event has happened. The camera only collects about one-third of the samples in the color image. The rest is added by the computer with the process known as color filter array interpolation or demosaicing. It is not a fundamental property of light in the physical world.

Third, the picture coming directly from the digital camera cannot be considered a picture that is not engineered. The digital camera acts as a data-collection device, not as a picture-making device like the analogue camera. As digital camera is a data-collection device, there is no in-camera image in the form
of the latent image. Therefore, digital photography always requires post-processing. It may happen inside the camera through a built-in RAW converter that interprets the outcome of the picture. It may also occur outside the camera through software with the parameters controlled by the user to produce picture. In this post-process, two-third of the pixels is created by computational means. Therefore, the outcome image is already engineered.

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