

Spotting Manipulation in Digital Photographs

By Sara Kubik

It is common knowledge that digital photographs can be easily manipulated, and terms like image manipulation have been replaced with the colloquialism, “Photo-shopping.” This article explains how digital photographs are manipulated and provides basic examples for detecting image manipulation. Lawyers need a basic understanding of what to look for when arguing for or against the authentication of digital photographs. Yet even experts can only offer their reasonable opinions as to whether photographs have been altered because manipulation may leave no traceable origin behind.

What can be manipulated?

Any image stored in a digital format can be manipulated—sometimes easily, sometimes not. It is important to think of digital files as being comprised of pixels rather than images of people, places, and things. A pixel is “any one of the very small dots that together form the picture on a television screen, computer monitor, etc.”¹ This concept is analogous to the painter Seurat’s technique in which he painted tiny juxtaposed dots of multicolored paint to allow the viewer’s eye to blend colors optically instead of physically blending the colors on the canvas to formulate the picture.

Simply stated, a person can alter the color of the pixels and thereby change anything within a digital photograph. This includes removing a person from a background or scene or inserting new objects into the original photograph. For example, a head shot



Original photograph



Manipulated photograph

of a person may be placed on the body of another who is scantily dressed. Or an image of a person’s once-empty hand may be altered to hold a beer bottle. The possibilities are endless because the basic process is that one part of a photograph is simply copied and pasted onto another photograph.

The following are ways to determine whether an original photograph has been manipulated.

The original photograph shown above is of a mother and her son. The manipulated photograph to the right of it shows the mother holding a beer bottle in her hand.

The manipulated photograph was created by first opening the original in Adobe Photoshop. Searching for the words “beer bottle in hand” in Google Images resulted in a display of photographs from numerous stock photography websites. The copyrighted image of a grasped beer bottle was then saved and opened in Photoshop. The hand grasping the beer bottle (or, more technically, the pixels that formed the hand and bottle shapes) was selected, copied, and pasted into the original photograph. The new part of the photograph—the hand grasping the beer bottle—was then reduced

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¹“Trial Practice” is designed to provide advice and guidance on how to effectively prepare for and conduct trials.

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in scale, rotated, and placed on top of the mother's original left hand.

Spotting the manipulation in a photograph

Here are some ways to determine that the original photograph was manipulated:

- **Inconsistent lighting:** The highlight on the bottle is inconsistent with the rest of the image. Given that the strongest light source appears to be from a camera's flash, the direction of the reflected light on the beer bottle is angled while the reflected light on the jam jars in the background is straight.
- **Inconsistent cast shadows:** The cast shadows of the fingers around the beer bottle are inconsistent with those of the child's fingers. The new shadows are angled down while the original were to the left of the objects.
- **Opaque color values in skin tones:** The hand holding the beer bottle not only has a different skin tone than the mother's original right hand, but the new skin colors are flat and opaque. Reproducing convincing skin tones is challenging because skin tones have many color values. Manipulated body parts often have opaqueness in their coloring.
- **White halos:** Erasing background colors is difficult and often results in a halo effect, meaning the copied-and-pasted image is outlined in white. In the altered photo, the halo around the hand holding the beer bottle resulted from copying and pasting a small amount of the background color from the copyrighted image into the original photograph.

- **Unusual patterns:** Beyond copying and pasting, Photoshop lets a user clone parts of an image and, essentially, paste it within the same file. However, careless cloning may lead to unusual, artificial, and repeated patterns, as shown in the image below.



There are so many ways a photograph can be manipulated that the possibilities are endless. For example, if a new body part is pasted onto a different body, an elongation or truncation may appear in the final composite such as a too-short or too-long neck. The edges of a copied/pasted part may not blend well into the original image, and the transition area may be excessively blurred to compensate. Sometimes, a body part (like an ear) is obviously missing or a final image has additional elements; in the altered photo of the mother and child, the mother's left hand has an additional thumb. Pay close attention to the rotation and perspective lines of suspected manipulated parts in a photograph. For example, a copied face may be a

full-frontal view, which is unnaturally placed onto a slightly turned body. Similarly, reflections should appear in areas such as mirrors, on metal (like on a car), in a puddle, and even in the eyes (a flash reflection).

These are some examples of possible ways to detect image manipulation. Ultimately, however, it is still about changing pixel values.

Conclusion

Because a manipulated photograph may not leave behind any obvious traces of its origin,² it may be necessary to hire an expert to proffer his or her opinion about its authenticity. But even then, an expert can provide only a reasonable opinion of the possibility of manipulation based on his or her level of expertise. Digital photographs are simply a collection of pixels that, when printed, become a bunch of dots of ink. The changing of pixel value means that manipulation is not objectively determined. Images may not show obvious signs of alteration. A trained expert should be able to detect the nuances that result when a photograph is manipulated. It is also becoming increasingly important for lawyers to understand these nuances when relying on photographs or other digital images to prove their cases. ■

Sara Kubik is an assistant professor in journalism at Central Michigan University. Her research explores the intersection of the use of technology, visual communications manipulation, and the law. She holds a PhD in technology from Purdue University, a master of business administration in marketing and management from the University of Miami, and a bachelor of arts in graphic design from the University of Notre Dame.

ENDNOTES

1. Merriam-Webster <<http://www.merriam-webster.com/dictionary/pixel>> (accessed August 19, 2014).
2. Parry, *Digital manipulation and photographic evidence: Defrauding the courts one thousand words at a time*, 1 J Tech L Pol 175 (2009), available at <<http://illinoisjtp.com/journal/wp-content/uploads/2013/10/Parry2.pdf>> (accessed August 19, 2014).