Photo Forensics: 
Identifying Faked Pictures

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Recently a family member sent me a set of pictures supposedly showing Mexican headstones with insulting epitaphs:

- Rest in peace. A memory from all your sons (except Ricardo who did not pay any money)
- He was a good husband, a wonderful father, but a bad electrician
- Here is resting my dearest wife... Lord please welcome her with the same joy I send her to you
- Now you are in Lord’s arms. Lord, watch your wallet.

All of the images struck me as improbable: for example, the lettering was astonishingly clear and black on the headstones, as shown in the sample in Figure 1. Remembering a 2006 article in this column by two Norwich students summarizing a lecture they heard at Dartmouth college on "Picking out digital image forgeries,"<http://www.networkworld.com/newsletters/sec/2006/1016sec1.html> I decided to examine the
pictures in more detail to see if I could find evidence of fraud.

First, I went to Snopes <http://www.snopes.com> to see if anyone else had analyzed this particular collection of epitaphs. No luck. I did, however, find an entry about a real gravestone and cropped the associated picture to show what an unmodified gravestone can look like (Figure 2). As is typical of real gravestones, the letters are incised into the stone and are not painted in. This pattern accords with my own observations in cemeteries, including the locally famous Hope Cemetery in Barre, Vermont <http://www.vermonter.com/hopecemetery.asp> which is a couple of miles from my home.

![Figure 2. Authentic gravestone picture.](image)

The next step was to magnify the images. I expanded them to 10 times (10x) using my browser and took screenshots of the results. The unretouched picture (Figure 3) of the same headstone as in Figure 2 shows relatively fuzzy letters, whereas the fake headstone at 10x (Figure 4) shows dark, sharp-edged letters.

![Figure 3. Fake lettering at 10X.](image)  
![Figure 4. Unretouched lettering at 10X.](image)
The background behind the letters in Figure 4 also revealed evidence of fakery: it was much too uniform for a real picture. Compare the area shown in Figure 5 from the fake picture to the 10X detail of the unretouched photograph in Figure 6: you can see that someone erased the detail using a photo-editing program in Figure 5 whereas Figure 6 shows a complex, variegated background at that magnification.

In another case (Figure 7), the shadows in the deeply incised cross at the top show that the sun must have been high in the sky and directly in line with the gravestone. However, the shadow on the bottom left of the stone indicates that the original picture of the gravestone used in the photo-composition had a shadow cast from the sun off to the right of the stone.

A third picture show what appears to be an ancient, worn headstone which nonetheless belongs to someone who died in 1997. Something about the lettering set warning bells off in my right brain (pattern recognition) and I realized that the angle of the writing didn't seem to match the angle of the headstone. Using my photo editing tools, I carefully drew a green line exactly crossing the left and right corners of the headstone and then made it thick for better visibility. I then carefully drew thin red lines under each of the lines of text and extended the lines as far as I could to the left and right of the picture on my drawing surface. The results are shown in Figure 8. It looks as if the lettering was pasted onto the picture in a perspective that does not match the position of the vanishing point of the original photo. The red lines theme to be heading for an intersection that will not include the green line. Once again, faking pictures turns out to be a little more difficult than might be expected.

Finally, the fourth picture shows the same kind of error in perspective of lettering as the previous case. Figure 9 shows that the first four lines of text seem to have been painted in with one angle of distortion whereas the bottom four lines were pasted in with a
different orientation. In addition, the first three lines are not centered properly on the image of the pedestal.

So I had a good time playing with picture forensics. Should I have published this kind of demonstration in the column? Does the information increase the likelihood that criminals will learn how to fake their pictures more effectively to avoid detection?

This question is yet another instantiation of the “full disclosure debate” about which so much has already been written (type “full disclosure debate” with the quotation marks into GOOGLE for a list of some key articles). In brief, I think that the techniques illustrated in this article are elementary, well known to criminals, and more useful to the honest community as tools for spotting fraud. If you agree or disagree, feel free to comment in the discussion section following the column.

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