

IS IT REAL? IMAGE MANIPULATION IN RESEARCH ARTICLES

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THE FUNDAMENTALS AND ESCALATION OF IMAGE MANIPULATION

Advancing technologies have put control of scientific images in the hands of researchers and authors. These images, for example, the blots and gels that accompany and represent data in an article, may be manipulated in a variety of ways. However, there are two basic categories of image manipulation or image editing in scientific research articles: 1) Clarification and 2) Deception.

For clarification, an author may, quite ethically, attempt to “clean up” an image in order for it to be more readable by the audience (e.g., the peer-reviewer). Image editing software, such as Adobe’s Photoshop, allow for the digital manipulation of an image to highlight areas of interest and diminish areas that distract from the relevant information. It would seem to be in everyone’s best interest to take advantage of this tool. However, if the author fails to note that the image has been altered, this could lead to trouble – the author could be accused of misconduct and the journal could be accused of publishing inaccurate or misleading material.

Deception is quite straight-forward. If the data do not match the author’s conclusion, the author may edit the accompanying image or images to mirror his or her claims. One can imagine that, with the pressure to publish so intense at many universities, it would be quite tempting to tweak an image to go along with findings that, perhaps, aren’t completely valid. In this case, there is a lot more than reputations at stake in the scientific world if the deception is not caught.

In 2002, many journals and publishers began allowing authors to submit their work electronically. Coupled with the advancements in and wide distribution/usage of image editing software, the stage was set for an increase in the manipulation of scientific images.

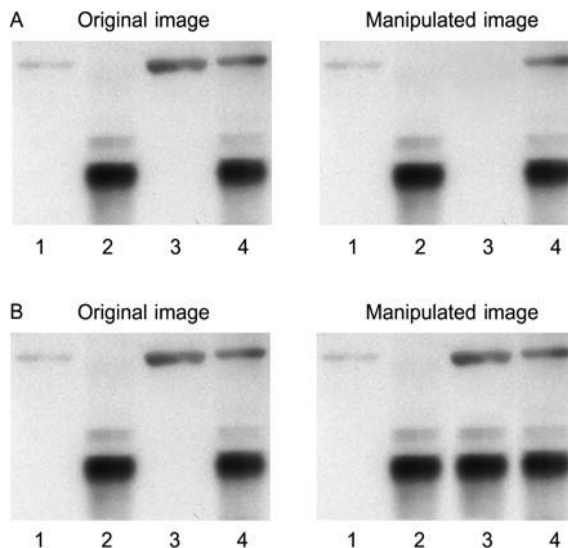
Elisabeth Bik, a microbiologist at Stanford University, Arturo Casadevall, and Ferric Fang co-authored a paper ([“The Prevalence of Inappropriate Image Duplication in Biomedical Research Publications”](#)), which researched the prevalence of image manipulation in scientific research publications. They screened 20,621 scientific papers from 40 journals dating from 1995-2014 and found that 782 of those papers (3.8%) contained at least one figure with a manipulated image. They also found that incidences increased after 2003.

(For further summary of this paper, please go to the [Scholarly Kitchen](#).)

WHO IS RESPONSIBLE?

Responsibility for ethical and accurate data representation in scientific images lies mainly with the author. However, peer-reviewers must be vigilant, and journal editors must be the final gateway – setting clear guidelines for authors, spending the time and money to thoroughly review and investigate article submissions, and following through with consequences for clear cases of image manipulation.

Here is an example from the [Journal of Cell Biology](#) of clear manipulation of data:



Moving into the electronic age may have made some areas of publication easier for academic journals, but this is one area where there will be no substitute for the investment of time for inquiry and funding for the appropriate investigative tools. It all hinges upon the establishment of clear guidelines for authors so that there can be no question, in anyone's mind, about what is acceptable and unacceptable manipulation of scientific images.

GUIDELINES AND INVESTIGATIVE TOOLS

What is needed, then, are guidelines for authors, reviewers, and publishers, as well as investigative tools that keep pace with digital image editing software. Guidelines regarding image manipulation should be a standard part of article submission guidelines for authors. In addition, there should be guidelines for peer-reviewers and journal editors so that they know what to look for when they are examining data in the form of an image.

The [Council of Science Editors](#) (CSE) has published some guidelines set forth by the Rockefeller University Press, which outline what is acceptable and unacceptable image manipulation. The CSE has also developed a procedure for "Handling Guideline Violations," intended to provide direction to reviewers and journal editors. The CSE

emphasizes that guidelines will serve no purpose if editors are not willing to follow through with repercussions for misconduct.

Investigative tools will also need to be available as widely as image editing software. John Dahlberg, PhD, Deputy Director of the [Office of Research Integrity](#) (a division of the US Government's Department of Health and Human Services), gives examples of some forensic image tools in an article by Anthony Newman, published by [Elsevier](#):

- Forensic Droplets - small desktop applications in Adobe Photoshop that can be used to compare two black and white scientific images, and can detect image editing
- Adobe Bridge - digital asset manager that allows the user to efficiently locate, organize, browse, preview, and batch process content files
- ImageJ - public domain Java image processing program, which allows multiple images to be displayed on the screen at one time

Other tools and investigative techniques continue to be developed.

IMAGE DATA INTEGRITY AND SOLUTIONS TO THE ISSUE

In 2006, Mike Rossner (then managing editor for *The Journal of Cell Biology*) wrote about a case of image fraud for [The Scientist](#). In reading the article, one can sense his annoyance regarding a case of image fraud perpetrated by Woo-Suk Hwang. He makes a clear case for setting and enforcing guidelines and the usage of image fraud-detecting technology for all scientific research submissions. At the time, the methods and tools used at *The Journal of Cell Biology* would have caught this fraud.

Mike has gone on to establish his own company, dedicated to issue of image manipulation – [Image Data Integrity](#) (IDI). The company provides “consultation for concerns related to biomedical image data manipulation for institutions, journal, funding agencies, and legal counselors.” The fact that someone in the field of scientific research has gone on to establish an entire company around this issue indicates that image manipulation is a problem that is not likely to go away soon. Constant vigilance is required.

Journal editors would do well to make guidelines clear to authors up-front, establishing what constitutes acceptable image editing and what is unacceptable. They should make it clear, as well, that there will be consequences for knowingly and purposefully manipulating images in an unethical fashion. *Science* provides some good examples of such guidelines:

http://www.sciencemag.org/site/feature/contribinfo/prep/prep_revfigs.xhtml

SOCIAL MEDIA LANGUAGE

#ImageManipulation #ScientificImageEditing

Prevent unethical #ImageEditing in scientific research