Image manipulation; how far is too far

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Recent advances in science and technology has helped researchers gain faster and easier access to scientific resources and achieve optimal results more efficiently and effectively. On the other hand, considering the increasing demand for science production around the world, researchers might face challenges in performing high-quality research. However, modern technology has not always been handled ethically by researchers. Although modern search engines have aided researchers in finding relevant published articles in line with their research interest in order to add novel findings to existing publications, they are sometimes used unethically by junior and sometimes senior researchers to produce articles that are not necessarily written by them. In such an environment, ethical issues in publication might be neglected.[1]

Publication ethics is gaining higher accreditation in the age of technology in which ethical misconducts are becoming more common and sophisticated. Therefore, ethical issues are gaining a more professional image.[2]

The most common forms of research fraud or misconduct are plagiarism, data fabrication, data falsification, duplicate publication, and redundant publication.[3-5] One of the less discussed, but increasing forms of research misconduct, especially in developing research environments, is image manipulation.[6] In a recent study comparing the publication ethics policies of central and eastern European countries, image manipulation was among the least addressed issues among the journals of all the countries under study.[7]

Image manipulation is the act of altering or enhancing the quality of an image in order to present the image better. Images can be tampered to support findings, promote a specific technique over another, strengthen the correctness of poorly visualized findings, remove the defects of an image, and to misrepresent an image from what it really is.[6] Based on the researcher's intention to mislead reviewers and the type of manipulation, image manipulation can be categorized as appropriate and inappropriate. Appropriate manipulation does not change an image in a deceiving way, while inappropriate manipulations are most often intentional.

Appropriate forms of image manipulation consist of minimal change of an image's contrast, brightness or size in order to beautify the appearance of an originally captured image. This could be done using the related tools in Photoshop and other image processing software. However, too much change in brightness and contrast could distort the image. Adobe Photoshop can also be used to manipulate images deceivingly. Researchers often use the tool "clone stamp" or "rubber stamp" in Photoshop to clean up and erase unnecessary background. However, the cleaned background could contain biologically important data that the researcher has missed, and might be detected by a reviewer. Manipulation of blots, slicing lanes together, erasing or adding a specific feature, misrepresentation of a microscope field, and overt adjustment of colour and brightness are other examples of inappropriate manipulation.[6]

Image manipulation can be detected by the same software used to create it. Inconsistencies and blurred parts of an image can be found by enlarging an image and carefully examining it. Also, inconsistencies in data and background (erased sections or smudged parts) can be detected by adjusting the contrast and brightness levels of submitted images in Photoshop (Image > Adjustments> Brightness/Contrast). To detect these manipulations better it is best to increase the contrast and lower the brightness. Moreover, amateur manipulations can be detected by changing the saturation of images in Adobe Photoshop. The Image Processing Toolkit that Photoshop provides consists of Forensic Droplets and Forensic Actions are available on the ORI website and can detect image manipulation.[6]

ImageJ is an image processing software used for manipulating images to make them look better and is being widely used in biomedical sciences. Similar to Photoshop, by changing the brightness and contrast of images imported in ImageJ, inconsistencies can be identified. Other purchasable software that is mostly used in forensic sciences can also detect finely manipulated or distorted images. At other times, fraudulent images are detected by colleagues, journal editors, or even grant application reviewers.[6]

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Whether image manipulation can be considered as high profile misconduct or not is still debatable; however, it is important to realize that this form of misconduct could have a crucial impact on research integrity.[4,8] The number of detected image manipulations is more than expected. From 1994 to 2000 the Office of Research Integrity (ORI) had only four cases of image manipulation, but it had reached 15 cases from 2000 to 2007.[6] Since then, the subject of image manipulation and its red lines gained some controversies and the extent to which image beautification was ethical was debated among researchers.[9]

Many associations and committees have now been established to educate researchers, journals, and all individuals involved in scientific medical publication regarding ethical issues, such as the Committee on Publication Ethics (COPE), Eastern Mediterranean Association of Medical Editors (EMAME), and European Association of Science Editors (EASE) to name just a few. A website was developed with a grant from the ORI in order to help students and faculty members differentiate between appropriate and inappropriate image processing. This website provides 12 guidelines for best practices on image processing. As mentioned on this website cropping and making simple adjustments to an image are usually acceptable, while cloning objects into an image and the lossy compression (reducing the size of the image file while maintaining the integrity of the image data) of an image is deemed questionable. Moreover, researchers are advised to save the raw image file and manipulate copies in order to be able to better judge whether their manipulation has distorted the real image or not as well as to be able to submit the raw image to the journal office if required.[10]

Many journals now have specific guidelines stated in their instructions to authors for these misconducts.[5] Journals, especially those that publish anatomical, radiological, taxonomic, or biological manuscripts should clearly state appropriate image manipulation guidelines in their Instruction to Authors section and establish related protocols for handling forged images.[11] In a study evaluating the misconduct of 399 high-impact biomedical journals according to the Journal Citation Reports, although duplication, plagiarism, and image manipulation were the most frequently mentioned misconducts the journals were concerned with, only 154 journals had clearly mentioned image manipulation as misconduct.[12]

In scientific journals, effective peer review can also be helpful in detecting image manipulation. However, most reviewers try to focus on the scientific quality of an article and miss the chance to detect misleading images. Therefore, training reviewers through workshops and peer-to-peer interactions, either face-to-face or through scientific blogs could be an initial step towards improving the peer review process.[5] Similarly, researchers should also be pursued to practice ethical image processing guidelines and be aware of the consequences of distorting images. If image manipulation is proven, it can damage the scientific reputation and future career of a researcher.[13]

Considering the increasing incidence of manipulated images, the whole scientific community should become aware of related guidelines on image manipulation. Journals should provide explicit and uniform policies regarding image manipulation based on available sources of policy. Moreover, researchers, reviewers, and editors should be trained on how to use image processing software to manipulate images ethically or to detect fraudulent image manipulations. In a broader spectrum, the principles of professional medical journalism should be emphasized through international and regional conferences, workshops, and training courses.[1]

References

1. Astaneh B, Masoumi S. Challenges and approaches to ethical publishing. European Science Editing 2012; 38: 10-11.
2. Astaneh B, Masoumi S. Professional medical writing and ethical issues: a developing country's perspective. European Science Editing 2011; 37: 85-6.
3. Cromey DW. Avoiding twisted pixels: Ethical guidelines for the appropriate use and manipulation of scientific digital images. Sci Eng Ethics 2010; 16: 639-67.
4. Martinson BC, Anderson MS, de Vries R. Scientists behaving badly. Nature 2005; 435: 737-8.
5. Roberts J. An author's guide to publication ethics; A review of emerging standards in biomedical publication. Headache. 2009; 49: 578-89.
6. Parrish D, Noonan B. Image manipulation as research misconduct. Sci Eng Ethics 2009; 15: 161-7.
7. Broga M, Mijaljica G, Waligora M, Keis A, Marusic A. Publication Ethics in Biomedical Journals from Countries in Central and Eastern Europe. Sci Eng Ethics. 2013 Mar 1. [Epub ahead of print]
8. Cromey DW. Digital images are data: and should be treated as such. Methods Mol Biol 2013; 931: 1-27.
9. Rossner M, Yamada K. What's in a picture? The temptation of image manipulation. J Cell Biol 2004; 166: 11-15.
10. Online learning tool for research integrity and image processing. (Online) (Cited 2013 March 4). Available from URL: http://ori.hhs.gov/education/products/RIandImages/default.html.
11. McInnes SJ. Is it real? Zool An. 2001; 240: 467-9.
12. Bosch X, Hernández C, Pericas JM, Doti P, Marušic A.Misconduct policies in high-impact biomedical journals. PLoS One 2012; 7:e51928.
13. Young JR. Journals find fakery in many images submitted to support research. The chronicle of higher education 2008; A1: A10-11.