

Academic Image Integrity – Appropriate Image Manipulation in Research Publishing

Images are data used by researchers to explain their results and make evidence-based claims. A good-quality image boosts the chances of a manuscript being accepted for publication. Images should be submitted in their original, yet presentable form in line with publisher requirements.

Manipulating an image to present data or information originally not observed amounts to research misconduct and may attract punitive actions against researchers and institutes. The following guidance is designed to aid thinking about appropriate image manipulation relevant to your research discipline. It applies to research outputs including doctoral theses.

This guidance does not apply where images/photos are manipulated for illustrative or artistic purposes and it is clearly stated that this is the case, for example comparing an original image of a person against an idealised 'retouched' image of the same person.

What is image manipulation?

Image manipulation is the process of altering an image to a desired appearance. As almost all journals require figures to be submitted digitally, image manipulation is typically done using a computer programme.

Researchers often make minor tweaks to get a best representative image to generate publication-quality figures that can help readers interpret data easily. Such simple alterations are standard practice. Making images attractive to catch the eye of the reader may lead researchers to introduce inappropriate changes.

Inappropriate manipulation of images has become a significant problem for the integrity of scholarly publishing. Researchers must ensure they understand the difference between an acceptable enhancement for purposes of clarity or emphasis, versus publishing misconduct. Undocumented image manipulations can lead to papers being rejected, doubts regarding research credibility and accusations of research misconduct.

What can prompt inappropriate image manipulation?

Researcher making inappropriate changes to images may be unintentional or intentional, as they:

- do not appreciate the importance of acquiring good images.
- lack the knowledge or experience needed to capture publication-quality images.
- may be impatient.
- may be reluctant to repeat an experiment to capture a better picture. This happens when the researchers are sure about the validity of their data. Convinced that their work is flawless and conducted with honesty, researchers may consider minor amendments to the figure as ethical.
- may intentionally resort to unethical image manipulation to mislead readers about the research results and overstate the importance of insubstantial data. They may be tempted to indulge in this type of research misconduct because of the pressure to publish or the lack of reliable data to support their findings

Intentional fraud is relatively rare, inappropriate manipulation of images due to ignorance is more common.

For images and image alterations, transparency is key. This includes transparency on:

- The research method, including the data and image capturing process.
- The results, as represented through the data and images provided.
- The alterations (what, why, and how) made on the data and images.

Image integrity principles for researchers

- Researchers are responsible for proper data acquisition, accurate data labelling, retention of raw data, clear research records and adherence to FAIR data management principles.
- Researchers are responsible for ensuring that the results displayed in images accurately and objectively represent the data acquired and are not displayed in a misleading manner.
- Researchers are responsible for properly describing the underlying methods used to generate the data to render the research reproducible by others.
- Researchers should follow journal guidelines for permissible processing.
- Images should accurately reflect the circumstances and conditions of data collection.
- Images should be minimally processed as non-essential modification could have unintended side-effects.
- No specific feature within an image may be enhanced, obscured, moved, removed, or introduced.
- All changes made to an image should be clearly documented and the original unprocessed images should be retained. Original images must be produced by the researcher when asked to provide them.
- Images should not be altered to idealise results (aka 'beautification').
- Image alteration/processing should not be misleading or change the interpretation of the original data.
- Care should be taken when making changes to photographs of people or places. Types of manipulation that may be commonplace in print/online media may not be appropriate in research, for example:
 - Removing details ("re-touching") - to improve appearance (remove wrinkles, slim down) or remove distracting or unwanted elements
 - Inserting details - change facial features, add colour to skin, add elements to a scene in order to change the tone of a photograph
 - Photomontage - to pair images to suggest a relationship or create an entirely new image with a composite meaning
 - False captioning - context of what a photograph purportedly portrays is falsified to distort the meaning
- Any substantive image alteration or processing should be described in the caption, legend, or body text in a way that allows accurate, unbiased interpretation of the data. It should explicitly mention if images were modified or not and if modified, using image-editing software, which specific enhancement features were used.
- The grouping or consolidation of images from multiple sources must be made explicit by the arrangement of the figure and in the figure legend.
- For image duplication or image re-use from other publications, the original source and context, and the reason for re-use should be provided. Any license needed for reuse must be obtained.
- Authors must obtain consent for publication of figures with recognisable human faces.

Which types of changes to images are acceptable?

- Simple magnification
- Adjustments of brightness, contrast, or colour balance are acceptable if they are applied to the whole image and if they do not obscure, eliminate, or misrepresent any information present in the original, including backgrounds. Avoid using an image programme's auto contrast, auto levels, and auto colour tools, as these may overprocess your image.
- Image cropping to remove unnecessary information or empty space around the edges. However, cropping should not alter the results or introduce ambiguity. After cropping, if images need to be stitched together, the pieces should be outlined (or separated by some white space) to clearly show that they are from different sources.
- Use of arrows/boxes to direct the attention of readers to a specific part of an image
- Image resizing, as long as there is no pixel distortion

Minimising the need for image manipulation

- Plan ahead - If research is well planned it is less likely to be necessary to rearrange or manipulate images for publication.
- Take the best pictures – researchers should become familiar with the instruments and software used for image acquisition. Pictures should be taken at the highest resolution possible, and compression algorithms such as JPEG should be avoided and images saved as TIFF files.
- The best contrast and brightness settings should be identified before capturing images.
- Images should be taken under identical settings when they will be compared to explain findings.

Resources

- UKRIO Academic Image Integrity webpage <https://ukrio.org/ukrio-resources/academic-image-integrity/>
- Office of Research Integrity. Guidelines for best practices in image processing. <https://ori.hhs.gov/education/products/RlandImages/guidelines/list.html>

Tools

- The Office of Research Integrity online learning tool for research integrity and image processing: <https://ori.hhs.gov/education/products/RlandImages/default.html>

Further Reading

- Rossner M, Yamada K. What's in a picture: the temptation of image manipulation. J Cell Biol. 2004;166:11-15. Doi:[10.1083/jcb.200406019](https://doi.org/10.1083/jcb.200406019)
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- Committee on Publication Ethics: COPE. Fabricated data in a submitted manuscript. COPE: Committee on Publication Ethics <https://publicationethics.org/resources/flowcharts/fabricated-data-in-submitted-manuscript>
- Committee on Publication Ethics: COPE. Fabricated data in a published article. COPE: Committee on Publication Ethics <https://publicationethics.org/resources/flowcharts/fabricated-data-published-article>
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- Committee on Publication Ethics: COPE. Retraction guidelines. COPE: Committee on Publication Ethics <https://publicationethics.org/retraction-guidelines>