

Ethical Issues in Digital Image Manipulation

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Abstract

Image manipulation has a long tradition in art and photography, now extended into digital media. When designing and using digital systems for manipulating images it is desirable to consider the ethical issues, especially their effects on the end-users or consumers of the images. Many of these issues are related to those of IT ethics, but the visual aspects of imaging pose special challenges to systems engineers and educators alike.

Introduction

The ethics of image manipulation combines aspects of ethics in both information technology (IT) and the visual arts. These fields have evolved from the application of general ethics to professional practice, and can be defined as follows:¹

Ethics assesses the ways in which people behave and the quality of moral values that we exhibit. Ethics offers a way of enquiring into our behaviour and moral justification for choices and actions. The use of ethical theories may help to resolve conflict between alternative options.

Professional Ethics derives from general ethics in that it is applied to professional practice. It considers the ways in which professionals practise and encourages guidelines for codes of professional conduct. Professional ethics also deals with ethical concerns related to the power, role and position of professionals.

IT Ethics deals with issues arising from the application of IT to individuals, organisations and society. It includes areas of professional ethics for IT professionals employed by organisations, but also extends to the effects of IT products on people and society.

Most ethical theory relevant to professional ethics is derived from the so-called collective consequentialist school,² which has extended the utilitarian principle of maximising the pleasure or welfare of all to social contracts and communities. Free people acting ethically in society should choose to maximise their own liberty consistent with like liberty for others and a distribution of wealth in which the worst-off would still be as well-off as possible. Professional ethics generally falls into this school because the profession collectively dictates the source and direction of the ethical guidance. In medicine, for example, the Hippocratic oath presents the patient as the key stakeholder whose interests should be paramount, and for whom the right action by the practitioner depends on an empirical analysis of each situation as well as on the underlying medical principles.

IT systems introduce unique ethical challenges which stem from the nature of information itself and the means whereby it may be processed and communicated. Information is the means through which the human mind expands and increases its capacity to achieve its goals, and thus forms the intellectual capital from which people can organise their lives. Misuse of information, however, can result in social disadvantage and the loss of human dignity. Mason highlights four ethical issues related to information:³

Privacy What information about one's self or one's associations must a person reveal to others, under what conditions and with what safeguards?

Accuracy Who is responsible for the authenticity, fidelity and accuracy of information, and who is to be held accountable if there are errors?

Property Who owns information and the channels through which it is transmitted? Who can use them and what pricing structures are appropriate?

Accessibility What information does a person or an organisation have a right or a privilege to obtain, under what conditions and with what safeguards?

All of the above ethical issues apply equally to images. Images contain information, both literal and symbolic, which can be viewed and interpreted in various ways. Images can be encoded as digital information, moreover, then stored, transmitted, reproduced and combined with other information forms (text, graphics, sound, etc.) in multimedia presentations. Image manipulation must be considered in the context of the use and abuse of images generally.

Images and Media

When an image is reproduced the resulting reproduction is almost always different from the original. Usually the reproduction medium will have different colour characteristics from the original medium. For example the ink colorants in a four-colour process print will differ in spectral reflectance and gamut from the dyes of a photograph or the pigments of a painting. The surface texture and gloss are likely to differ. Also the image size will usually be different, along with the illuminant and viewing geometry. The rendering of the final image depends on every link in the whole reproduction chain from source to destination.⁴ In short, it is a rare occurrence when anything approaching a facsimile can be achieved. In most cases the disparity does not matter, because the consumer of the print probably prefers a pleasing reproduction rather than an exact colour match, even for apparently critical applications such as mail-order catalogues. If necessary, colour appearance

models and gamut mapping algorithms can provide a good translation of pictorial colour appearance from one medium to another.⁵

There are deeper issues in image reproduction besides those of colour appearance. By separating an image from its original context, its meaning and purpose may be lost or obscured. Simply cropping one area out of a larger scene may remove elements that determine how the image should be interpreted. Staniszewski refers to the powerful image of Michelangelo's Creation, where God's finger stretches out to enliven Adam. The original is part of the frescoes in the Vatican Sistine Chapel, and to consider the image in isolation is to sever it from its medium (pigment applied to wet plaster), from its context (the whole decorative scheme of the Chapel) and from its purpose (a metaphor for the beauty and horror of nature and humanity).⁶ Yet the image is widely reproduced as if the original were a self-contained painting and is revered as Art. Indeed the very concept of 'Art' is an invention of the modern era, something to be seen in galleries, preserved in museums and imbued with meaning and importance.

Photographs possess a curious ambiguity. In one sense they contain a literal truth, because they represent a view of a real world scene. It is said that "The camera never lies." Yet the image captured is of a particular place at a particular moment in time. An instant after the camera shutter has closed the scene may change and never again be repeated. The image captured depends on the photographer's choice of lens, depth of field, shutter speed, filters, lighting and film type. Furthermore it is a product of his or her creative eye, which fashions the selection of the subject, viewpoint, composition and treatment of light and shade, texture and form. The process may be candid and spontaneous or it may be carefully contrived and set up with models in a studio. Once it has been produced the photograph becomes a new object in its own right, a new original that can be copy-righted and reproduced in turn.

All photographs have meanings intrinsic to their subject matter, and most also have a specific meaning for the photographer related to his or her life experience and intentions. Such artistic meanings may or may not be apparent to anyone looking at the resultant picture, but good photographs always stimulate thoughtful interpretation. Szarkowski observes that 'It is today quite simple to make pictures that are as intelligent, cultivated, and original as the person who makes them—who remains, of course, the most interesting and undependable link in the system.'⁷

Digital images occur in three forms: the digital encoding of photographs; the direct capture or construction of real-world images without photographic intermediary (through digital cameras, for example); and the production of images that have no specific or causal referent in terms of objects or events. There is a dichotomy here between on the one hand the photographic digital image as purely representational arising as the product of a technological process, and on the other hand the image as an original work of art with an aesthetic integrity of its own. Digital technology has rapidly gained the status of a new image medium in its own right, and has served to accentuate this dichotomy. The new technology is, as Lister has put it, 'not one

which guarantees access to reality but one which celebrates that impossibility and offers to construct virtual realities instead.'⁸

Photographic Image Manipulation

We tend to think of photographic image manipulation as a process that changes existing images after they have been produced, but in fact images are routinely manipulated or changed in some way *before* they are exhibited or reproduced. The photographer's art is to manipulate all the elements of the scene to produce the desired pictorial effect. He may take a hundred shots of the same scene, to select only one and discard the remainder. He may adjust the developing chemistry to achieve certain effects. In printing he may select a certain grade of paper and crop the original to produce a print of the appropriate size, contrast, surface gloss and composition. The print may then be framed in a particular way and positioned in a gallery, juxtaposed with others at a certain height to achieve the desired effect. The point is that manipulation of an image takes place at all stages from the moment it is first conceived; it is not confined to one post-formative stage.

Photomontage has been practised almost as long as photography itself. It became common after about 1870, allowing group assemblies to be constructed from separate portraits of celebrities, committees, school classes, etc. 'Trick' photography became popular with amusing results achieved through double exposures with masking, such as the sitter holding a conversation with himself or a face at the heart of a flower. Seaside photographic postcards allowed the subject's head to be grafted onto a grotesque body or placed in a romantic landscape.⁹ Not until the arrival of the Dadaist movement after the First World War, however, was the expressive potential of photomontage realised. The juxtaposition of war images by Hausmann and others conveyed a sharply critical reflection on the futility of war, later used with powerful effect by Heartfield in his attacks on Nazism. The techniques of photomontage became essential vehicles for propaganda and its subtler derivative of advertising through the burgeoning mass media.¹⁰

Man Ray in the 1920s and 1930s established a new fluidity and level of abstraction for photography. Though he began his career as a painter he came to realise that photography gave him a simpler, faster and more expressive means of image formation than painting. He began to photograph his own paintings, then to destroy the paintings and exhibit the prints. He allowed the photographic process, not the original object, to control the image, first through contrivance of lighting, shadow and angle of view and then through innovative darkroom techniques.¹¹ He invented the process of solarisation, which emphasises the outlines of figures and faces with expressive prominence. Man Ray even produced a whole series of photographic images without any camera, by placing objects directly onto the wet photographic paper in the developing tray. These so-called Rayographs were described by Cocteau as 'Paintings with light'—visual inventions in which spatial and temporal relationships, depth, transparency and sequence become in-

ter-mingled in a non-Euclidean space that challenges the observer for an interpretation.

Physical and chemical manipulation of photographs is still used today by many photographers to achieve special effects. Polaroid, for example, recommend a process called 'Emulsion Lifts', by soaking a Polarcolor print in hot water then transferring the emulsion to a new receiver. During this process the emulsion can be physically manipulated, creating unique distortions of the original subject and attractive edge effects. The role of the creative photographer, after all, is to produce imaginative and appealing images, and there are many means to this end.

The advent of electronic imaging has brought new levels of capability to image manipulation. The widespread availability of desktop imaging systems means that software tools like Adobe *Photoshop* are accessible to almost anyone. The digital medium brings the advantages of precision, accuracy and repeatability, making it possible to produce complicated page layouts economically and quickly. Also new effects such as pixellation are possible through digital manipulation that would not have been feasible by traditional methods. Computer graphics also has developed the means of generating photo-realistic synthetic images, based on 3-D modelling geometry with sophisticated rendering algorithms. Electronic imaging widens still further the gap between the reality of the original object or scene (if it ever existed) and the resultant image.¹²

Ethical Issues

All technology has a moral content implicit in its design and capabilities. Just as human activity can span the entire moral spectrum from evil to good, so can the utilisation of any piece of equipment. The knife, the automobile and atomic fission all have the inherent possibilities of being used for either good or evil. But each specific design provides certain affordances which may make the object more or less suitable for a particular usage. Thus the dagger and the vegetable peeler are both knives, but one provides greater facility for homicide than the other. The Land Cruiser and the Mini are both automobiles but one provides greater utility to the 'ram raider' criminal than the other. The atomic bomb and the nuclear reactor both harness atomic fission but one is purposely designed to be destructive.

Following the utilitarian principle, both designers and users of all technological equipment have a responsibility to ensure that the greatest good results from their actions. This can mean ensuring that a user interface is ergonomically sound, for example, so that the operator of the equipment does not suffer injury or ill-health from its use. It can also mean ensuring that the end-products generated by the equipment are not illegal or harmful. A new type of colour photocopier, for example, might have the technical capability of producing perfect copies of banknotes, indistinguishable in every way from the originals. There would be a moral responsibility on the developer of such a machine to notify the appropriate government agencies of this new capability, and probably also to include some kind of distinguishing mark in the prints, so that the particular machine that produced them would be traceable. Nor is the

user of such a machine entitled to use it to produce counterfeit banknotes, despite the inherent capability.

Thus all of us who develop or use digital systems for manipulating colour images need to be aware of the potential implications of their use. For this discussion we may conveniently group image manipulation functions into the following categories:

A. Reproduction includes all aspects of reproducing real scenes in photorealistic form. The key issue is accuracy and how important it is for the purpose(s) to which the reproduction will be put. A colorimetric match will be necessary to reproduce a given corporate colour specification (e.g. a Pantone reference), whereas a pleasing (or preferred) reproduction will be more suitable for a picture of a holiday villa. During the process a proof will be used as part of the contract between print-buyer and printer, whereby the former signs off the proof as an accurate representation of the desired appearance of the final print, which then serves as a visual reference for the latter. Pleasing reproductions can frequently 'bend the truth' by making the scene or subject look more attractive than it really is. This might lead to difficulties if a contract were made on the basis of the reproduced image, for example buying a dress from a mail-order catalogue or (more seriously) the purchase of real estate or an arranged marriage. The image producer has a responsibility not to mislead deliberately, but because the producer can reasonably claim that the reproduction was accurate to some degree, the onus in all such cases is on the user of the image to check its fidelity; *caveat emptor*—'let the buyer beware'.

B. Retouching involves the making of minor changes to an image, either globally or locally, to change its appearance in certain ways. There are three main reasons for retouching:¹³ to correct for deficiencies in the original photograph; to match the characteristics of the destination medium; and to make editorial corrections. Benign examples are the digital removal of blemishes, such as scratches or dust on a photographic negative, or cracks on an old glass plate. But using pixel copying, etching and drawing tools, the technique can also be used to alter image content, such the removal of facial skin defects in a portrait or rust spots on a car's bodywork. Editorial corrections may range from subtle adjustments, to bring out details in the shadow regions for example, to more substantial replacement of areas or colour changes to whole objects in an image. Because the changes may be undetectable, there is an obligation on the image producer to include a warning label with images that could otherwise mislead the consumer, like the 'serving suggestion' tag on food packets or 'contents may vary from illustration' tag on other merchandise. Such changes may also be crucial where the images are presented as evidence in legal cases: ideally an audit trail should be established by attaching to each digital image file a history of its origin and all subsequent modifications.

C. Distortion involves gross changes to the appearance of an image, through geometric transformations, special effects filters, and compositing with other images. The resulting image may be grossly altered from the original, or placed in a different context, which suggests a different interpretation. Such changes are the most problematic from a

copyright point of view because the resulting image may be very different from the original (in the limit it may be unrecognisable as a derivative), yet must acknowledge the ancestry of the source image. Distortion of images containing people may potentially be libellous, if they are made to appear to have been in a certain place or in the company of certain people which would implicate them in some illegal activity or present them in a defamatory way. Invasion of privacy by the press frequently falls into this category.

D. Illusion is achieved through the creation of synthetic images. These may be an artist's fantasies, scientific visualisations of data, renderings of computer graphic models or virtual worlds. Such is the stuff of art, science and cinematic effects alike. Dangers can arise from such material when the viewer confuses the synthetic imagery with reality or is incited into performing damaging or criminal acts as a result of exposure to it. Especially in the new immersive virtual environments, when in the near future the quality of presentation becomes so good that the user cannot distinguish the virtual experience from a real experience, someone will have a responsibility to ensure that the user does not suffer injury, derangement or death from the experience. But whose responsibility will it be: the system technology developer, or the application developer or the owner of the site at which the equipment is used?

In all of the above cases digital image processing and manipulation is now so effective that it may be undetectable in the reproduction. The key ethical question is whether such manipulation is deliberately used to misrepresent the truth. What is the purpose of the resultant images - forgery, deception or titillation? The rightness or wrongness of image manipulation is ultimately determined in each case by the use to which a manipulated image is put.

Image manipulation has developed over the centuries through art and photography to present-day digital media. There is no essential difference in the techniques of digital media that separates contemporary image manipulation from what has been practised for a variety of purposes in the past. What is different is its pervasiveness and difficulty of detection. Today's electronic image manipulation must be seen as the latest phase of an activity practised in the past for many purposes: enhancement, insight, propaganda, fraud, etc. There seems to be no difference in principle between over-painting a canvas, chemically etching and dyeing a photograph and editing pixels in a digital image. An electronic montage is equivalent to the physical cut-and-paste of photographic prints or the artist's freedom to juxtapose image components of his choice in any medium. The decision in each case as to whether a given act of image manipulation is ethical requires an analysis of the consequences, from the point of view of each of the stakeholders, especially the owners of the image, any person represented in the image, and the effects on the consumers of the image.

Some Examples

Playboy magazine and others of the genre routinely retouch the pictures of their models to remove imperfections such as wrinkles, spots, moles and discolorations in the skin.

Soft-focus and blur filters are applied to skin texture, especially on the face, to make it creamy smooth and even, while normal sharpening (unsharp masking) is applied to hair to make it crisp and tactile. Skin colours (or 'flesh tones') are rendered warm, glowing and slightly tanned, underarm hair is edited out and even body contours can be altered, digitally removing layers of cellulite with the precision of the cosmetic surgeon's scalpel but without the pain. The resulting images therefore present a false perfection of young womanhood, a physical ideal that bears none of the blemishes of the actual human model. What are the effects of this portrayal on the stakeholders? The models presumably don't mind because they are paid well, because they have signed their rights to the images over to the publisher, and because an improved image may attract fame and further business. The viewers of the magazine ostensibly don't mind either because the resulting images support the fantasies they seek. But the perfection of the images is unattainable: ultimately it may be destructive because the men who view such images may find that their wives and partners fall short in comparison. And women who view such images (and their counterparts in a hundred women's fashion magazines) may likewise become deeply dissatisfied with their own physical imperfections.

Smirnoff Vodka (UK) have commissioned a series of stunning advertisements in print, poster and cinema which glamorise their product through clever image manipulation. In each of these the glass bottle in front of the scene acts as a 'magic prism', transforming the scene from the mundane or clichéd to the extraordinary. In the most recent, a Marxist 'new world ideal' group of proletarian workers reaching outward and upward is depicted. Through the bottle the worker has become a basketball player shooting for goal. The visual impact of these advertisements is immediate and powerful, and the intrinsic humour of the scene establishes a bond with the viewer that leads to greater receptivity for the subliminal message, which is that consumption of the product will endow one with the preternatural ability to perceive such hidden magic. The primary stakeholder here is the viewer-as-potential-consumer. Whether one approves of the Smirnoff campaign must depend on one's attitude toward alcohol—is it a pleasant social stimulant or the root of great social evil? Like all effective advertising it plays on deep-seated psychological desires for completeness, fulfilment and power.

The Conservative Party in England recently published a political press advertisement showing the leader of the Labour Party, Tony Blair, in a photomontage in which a strip across his eyes appeared to have been torn away to reveal a pair of demonic red eyes behind (Figure 1). This was a visualisation of the advertising agency's interpretation of the previous remarks by one of Mr. Blair's colleagues that his policies seemed to be manipulated by dark unseen forces. The intention of the promoters of the advertisement was quite deliberately to scare voters in preparation for the forthcoming election into believing that there may be something demonic about the Labour Party and indeed Mr Blair himself. By addressing the unconscious fears of voters, they are following in the tradition of earlier extreme right-wing propagandists such as the Nazi Goebbels in his

anti-Semitic campaigns. The interesting thing about this advertisement from an image manipulation viewpoint is that it is so crude. The eyes have not been seamlessly integrated into the portrait but have been photomontaged into the area of the torn strip to support the metaphor of unseen forces in the background. The effect is both memorable and distasteful, in the great tradition of Heartfield's political attacks. Ethically it is wrong, but experience shows that scaring voters is much more successful than trying to woo them with a fine manifesto.



Figure 1. Political manipulation through image manipulation

Conclusions

At the first Color Imaging Conference Jim King of Adobe made a 'call to action' for teaching Color Engineering as a new professional discipline, bringing together colour science with engineering and computer science in the cross-disciplinary mixture needed to produce the colour imaging products of tomorrow.¹⁴ To those of us involved in electronic imaging, in both industry and academia, the pursuit of his goal has been and continues to be a most rewarding challenge.

For imaging systems, especially those concerned with the reproduction and manipulation of high quality photo-realistic colour images, there are other equally important dimensions of understanding needed by the professional practitioner, beyond the basic technical and psychophys-

ical knowledge of the colour engineer. Two of these are visual literacy and ethical judgement. Ethics can be applied directly in the systems analysis phase¹⁵ of a complex information system, and can also be included for guidance to the operator in a desktop imaging system.

The challenge for educators now is to develop courses, especially at Master's level, that will endow graduate colour engineers with artistic and ethical awareness alongside advanced technical skills. Such higher-level graduates will be equipped to make significant contributions to colour imaging systems in terms of their human-computer interfaces and guidance on how best to use them, as well as to the visual quality of the images reproduced.

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