

BETWEEN HUMANITIES AND THE DIGITAL

edited by Patrik Svensson and David Theo Goldberg

The MIT Press
Cambridge, Massachusetts
London, England

Daston, eds. *Early Modern Science*, vol. 3, Cambridge: Cambridge University Press, 2006. Print. *The Cambridge History of Science*, 305. While labs would continue to serve multiple purposes for several hundred years, science labs would become increasingly specialized. See Stivilla, Besiki, et al., "Composition of Scientific Teams and Publication Productivity at a National Science Lab," *Journal of the American Society for Information Science and Technology* 62 (2: 2011): 270-83. Print.

4. See Patrik Svensson, "From Optical Fiber to Conceptual Cyberinfrastructure," *DHQ* 5 (1: 2011): no page. Print. Svensson offers an important meditation on the design of studio space might be articulated within a digital humanities lab.
5. Twitter feed, July 18, 2012.
6. Jonathan Arac also calls for work that is "laboratory" based. Jonathan Arac, "Shop Window or Laboratory: Collection, Collaboration, and the Humanities," in *The Politics of Research*, ed. E. Ann Kaplan and George Levine, New Brunswick: Rutgers University Press, 1997.
7. Borgman lists collaboration as one of the primary areas of exploration that the humanities might examine.
8. Humanities scholars have some forms of trained collaboration. Peer review offers a form of collaboration and co-authored scholarship occurs. However, the norm of the lone scholar continues to dominate training and practice.
9. For additional information about the Praxis program, see <http://praxis.scholarslab.org/>

29 A MAP IS NOT A PICTURE: HOW THE DIGITAL WORLD THREATENS THE VALIDITY OF PRINTED MAPS

Patricia Seed

When you see a printed map in a book, a calendar, or poster, you might well be looking at a picture significantly altered from the original map. As the general public has been increasingly aware, fashion magazines considerably transform front-page pictures of celebrities, leading to calls, and in some countries such as the United Kingdom, laws against any but the most minor retouching of advertisements.¹ As it turns out, unbeknown to many, printed maps have been subject to the very same process of airbrushing with one major difference.

While the editors and publishers of magazine covers of famous people have deliberately modified the images, museums and libraries have rarely played such a role in the alterations. Instead, many librarians and curators are only discovering now, to their great dismay, that printed reproductions of their holdings are inadequate, distorted, or in the most extreme cases, just plain false.

Print has long been the gold standard for reproduced maps. Images of maps in books have been judged more reliable, more trustworthy, and more accurate than those reproduced on microfilm or even in digital media. Part of this respect stems from the widely held conviction that print materials are inherently trustworthy. That conviction rests upon knowledge that one or more experienced or knowledgeable individuals have vetted the book prior to publication. Additionally authors presumably have closely scrutinized the final version. As a result printed maps have shared in the generally higher repute accorded published texts.

As the digital world has struggled with means of validating knowledge, it has suffered from a generally held belief that digital and online information are inherently less reliable. In a twist of fate, however, digital technologies have recently exposed previously unrecognized flaws in print maps; deficiencies that fundamentally challenge the reliability of maps in print. The reasons for this challenge reside in the history of map reproduction.

Prior to the era of high-resolution digital scanners, cameras, and high-powered software, images of maps were relatively hard to acquire. Most maps were either transported to photographic studios where a professional photographer created a print or a slide of the map. Often

libraries and museums would wait until they had a significant number of requests before sending the images over to the studio. In cases where the maps were extremely large, the photographer would bring his equipment to the museum or library. However, that visit had to coincide with a day when the museum would be closed. As a result, through the end of the 1990s, photographs were expensive and slow to be created and transmitted to the individual scholar, library, or publisher.

Furthermore to compare a printed version to an original was a daunting task. Printed maps books are often large, very heavy, printed on thick, coated paper, and highly expensive. Carrying around a twenty-pound book in order to compare one map to the original remains impractical. Most libraries and archives holding rare maps refuse admittance to anyone carrying or holding a book for fear the book could be used to conceal stolen maps. Cutting an image out of such an expensive book for comparison with an original remains equally unrealistic. Even then, comparison of a removed book page with an original would remain impressionistic and imprecise since the map could only be placed alongside the original.

Ironically, earlier, nondigital methods of reproduction (Xeroxes or printed copies) failed to raise any of the challenges introduced by digitization. Some copiers introduce subtle changes in the size of objects, which might not disturb the overall impact of an image but might alter the location of a place on vertical and horizontal axes. For example, a copy might bring Umeå closer to Stockholm (vertical axis) or move London closer to the English Channel (horizontal axis).

Colors have also been integral to the composition of the map in many traditions. For example, a red color signified south in traditional Chinese directional maps based on the heavens, and a red-green contrast became critical for Mediterranean nautical charts over six hundred years ago. While color copiers have improved, they vary widely in the ways they represent colors' hues, chroma, tints, and shades. Grays may be bleached out; high contrast reds muddied, and so on. Without the red for orientation on the Chinese map or the red-green contrast for Mediterranean charts, a scholar might wrongly interpret the map. To lose the correct color would alter both understanding and interpretation.

Digitization, however, has profoundly altered the study of maps on many levels. Very high-resolution digital images allow for more detailed study than possible with print or even conventional magnification. Customarily stored as well as laid out on a flat surface, huge maps—2 by 4 meters, for example—remain very difficult for a human to physically examine beyond a narrow border. With a digitized version, lines, shapes, colors, and names in the center of the map can be scrutinized in a way not previously possible.

Comparing digital pictures to printed maps has led to increasing recognition of the differences between the original maps and their representation in books. For purposes of comparison with an original, digitization has primarily vastly improved the portability of maps. The

low cost and widespread availability of high-quality digital cameras has made it possible for researchers to photograph printed maps from impossibly heavy as well as from rare or remotely located books and bring their digital images of print maps to compare to the original. Instead of a weighty tome, a one-ounce thumb drive allows researchers and curators to transport an image of even a very large printed map. The digital image of the print on a screen, projector, or even a printed version of the digital image on the same scale as the original permits comparisons not previously possible. For example, if you take a digital photograph of the map in a book, calendar, or poster, you can print that image out using a translucent or transparent material. If you overlay the image you have printed out on top of the book, poster, or calendar, you can adjust the proportions so that the digital print exactly matches the map in print. When printing to archivally safe paper such as vellum or mylar, you can safely place the image of the reproduction on top of the original. Since the original will remain visible through the translucent material, you can compare and measure major differences as well as smaller distinctions between the map in the book, and the original.

In addition to cameras, a second digital technology has dramatically improved the quality of map reproductions. This second change rests upon the vast improvement in scanners. Beginning in the mid-1990s, scanners became capable of reproducing higher quality images from books. As scanners became increasingly more complex, their manufacturers began to include features such as retaining the x and y axes and adjusting the color saturation or hue (Allman et al. 2007). More precise than any form of photography, digital scans can be calibrated to allow more accurate reproductions of the maps.

Suspicion that not all scanners performed equally well led to a critical reevaluation of machines used to digitize maps. One of the pioneers was the Catalan Institute of Cartography (Institut Cartogràfic de Catalunya). Near the end of 2005, technical staff members realized that the scanners were producing map images of widely varying color hues, chroma, and resolutions. Recognizing the importance of accuracy and consistency, members of the Institute conferred over the course of the next year and agreed upon standards for a new map scanner. In 2007, they held an open international competition inviting manufacturers to scan the same maps and compared the resulting digital images with their originals. Eventually they discovered, to their surprise, that the best scanner came from a boutique Italian firm that provided superior results to those of better-known finalists from Germany and Japan (Roset 2012).

All of this digitization and improved access to maps, however, has resulted in an unanticipated discovery—that the image on a printed page may not actually reflect the map. In 2011, the publisher of a popular calendar of maps in a European Union country asked a relatively obscure library in that country to include a photograph of a map in their collection a popular calendar. Although the cartographer of the map was widely esteemed and had imposed a variety of maps of the area, this calendar would mark the first time that the

version in this library would appear in print. The library consented, the photographer took the picture, and the calendar subsequently sold with great success. Viewing the image in the calendar, a well-known historian concluded that the copy in the more remote library belonged to a certain style of maps that this cartographer had designed. When this scholar arrived at the distant library expecting to see the map pictured in the calendar, she was dismayed to discover that the library's original was a significantly different variation of the map than the librarians had trusted the printer to publish. The librarian's faith in the photographer's integrity was shaken when the scholar requested the original from the collection and placed it alongside her digital enlargement of the calendar image. Only then did the curators become aware of the substitution.²

While a digital image enabled the discovery, it required comparison with the library's original to complete the evaluation. Thus the digital representation created an affordance, the quality of an object that allows an individual to perform an action, in this case, comparison done by a skilled human hand and eye. Digital technology's role as an affordance in this and similar cases remains an often overlooked aspect of its function.

As it turned out, the calendar had simply published an already existing and widely circulated image of a map from another library. Whether the mistake was deliberate or inadvertent, the substitution of a photo of one map for that of another showed the absence of prior inspection of the printed map. Scholar, the general public, as well as the librarians themselves were misled.

Not all such alterations result in the complete substitution of one image for another. More subtle changes, similar to those performed on magazine covers are sometimes deliberately made.

The logic behind these deliberate actions taken behind the scenes remains impeccable from the standpoint of marketing. In the early 1990s, on the occasion of the quinqucentenary of Columbus's arrival in the New World, the imaging department of the French National Library (Bibliothèque Nationale de France), on its own initiative, produced a very attractive poster of a map reportedly created by Columbus, which it sold in the library's gift shop.³ Seven years later, I had the opportunity to see the original for the first time and was struck by the very different background color as well as the overwhelming number of deep creases, disconnected lines, and stains obvious on the original. Without any great expectations, I visited the library's imaging department to see if I could acquire a digital picture of the original, furrows and all. The official immediately called up a remarkably well-scanned image of the stained and crinkled original. When I asked why that image differed so much from the one appearing in the poster that they had been selling only a few years before, he looked at me oddly. If we were selling an image of the obviously damaged original, he replied, how on earth would we have been able to sell it? Of course, they straightened the lines, evened out the colors, and eliminated the creases. Only a

carefully photoshopped image would prove popular with purchasers. He was right. Few, if any, visitors to the exhibition would have found the original appealing. The shop was selling poster maps to commemorate the show. In short, the same rationales for editing photographs on the cover pages of magazines were used to sell copies of maps.

However, any serious students of maps would have been led astray, had they mistaken the poster for the original. What appeared as a straight line between two different places on the map turned out to be nothing of the sort. One place had been slightly shifted so that it lay in a pleasingly straight line from another larger feature on the map. While the change was minor in an artistic sense, it would have led to erroneous conclusions about the original.

One solution for such publicity-worthy goals may be for the publisher to acknowledge that the poster is "based on" or "derived from" the original. While this step may deprive the bookstore of sales, because visitors think that they want a picture of the real map, this small acknowledgment would allow libraries and museums to sell publicity materials while at the same time acknowledging the re-composition or artistry exercised on the image offered for sale. It would also alert scholars that they would need to contact the library or museum before embarking upon a study of the map.

Although digitization can vastly improve the quality of reproductions, the same structural problems remain. Just as in the days of simple photographic reproduction, major libraries and archives on both sides of the Atlantic continue to grant a monopoly concession to an outside company to produce images requested by researchers, television, and newspapers. The company holding the contract follows its own customary policies and practices, usually without input from the guardians and those knowledgeable about the object. Institutional rules sometimes constrain map curators and staff even at several major EU national libraries from supervising imaging process within their own organizations. All they are able to do is complain, but the distorted and airbrushed images keep reappearing with the seal of their institutions. The need for such review is imperative as the following fortunate case illustrates.

In Switzerland two years ago, a map curator discovered by accident that a very expensive scan of a valuable map in the university's collection was being altered by the scanning company, just as the company was putting together the CD. Near the scheduled completion date, the map curator decided to go to check on the status of the scan. He returned to the reading room aghast. The original map consisted of three entirely separate sheets, but when he arrived at the imaging company, he discovered to his great dismay that the scanning organization, on its own initiative, was in the process of joining the separate scans together, so the parts would align perfectly. He was able to call an immediate halt to the proceedings, informing the imaging department that for many centuries the original had been kept in three separate sheets for good reason—and that the scans needed to reproduce the sections. The imaging department recovered the original scans and released the CD the next day. But for his checking

the status in person, the final scan would not have shown the original map but a distorted one. This curator, renowned for his attention to detail, would have recognized the problem as soon as he looked at the final image. Had he uncovered the alterations later, the scanning department might have simply separated their photoshopped images from the original ones. But by visiting the scanning department in advance, he managed to prevent either a delay or an expensive disaster requiring rescanning of all three large sheets.

Severe repercussions have resulted from the publication of altered reproductions, and the unrealized distortions have misled even prominent writers on maps.⁴ Over the past fifty years, a reproduction of a world-renowned atlas purportedly reproduced on the size of the original has widely circulated to libraries around the world. The print version, introduced and published by prominent European map scholars and printers, has served dozens of academics and researchers in lieu of the relatively inaccessible original.

Despite its proclaimed fidelity to the original, this widely circulated reproduction reduced the atlas's pages by varying degrees. Some were reduced by 3 percent, some by 7 percent; others by 12 percent, and a final striking example reduced the original sheet by 33 percent. However, an opportunity to study the original or even a reproduction on the size of the original would have shown that the reproduction had significantly altered the map. The status of the author and publisher misled a number of unsuspecting prominent map scholars into publishing mistaken arguments about the map and its controversial method of composition. While no one knows exactly how this alteration in scale came about, the process probably developed as follows. The well-known historian of maps wrote an introduction, preface, or careful explanation of the group of maps. He studied the original with great care, and took meticulous notes on his observations. When the printed text was sent to him for revising to catch any typographical errors or other mistakes, he reviewed the text carefully. He might or might not have seen the reproductions of the map prior to their printing, and if he did, he probably gave it a perfunctory look (relying on the reputation of the photographer to have performed his task properly) or he might have forgone this step entirely because he placed the image as secondary to his textual exegesis. As a result the printed map failed to undergo the kind of scrutiny usually accorded the printed word and appeared in print without having been subject to further scrutiny or evaluation.

Passing over the visual material in a print medium still occurs frequently today, since no recognized standards or methods exist to evaluate the accuracy of a printed map. While the proofs of words are carefully inspected by the author, no similar scrutiny is accorded the map. Such examination is most definitely needed at two stages in book production.

From the photograph of the original map to its layout and printing, opportunities for alterations multiply. The reasons reside in the fact that imaging departments, printers, photographers, and scanners have adopted the same approach to maps as they have to other

images. In other words, they have treated maps as pictures and strived to create the most aesthetically pleasing object to place in a book. In both processes—creation of the image and its placement for print—they may correct the color or the contrast, straighten out crooked lines, and eliminate bumps and wrinkles so that the printed object will look attractive in a publication.

During the preparation of the book for its printing, alterations may creep in, just as they do in straight forward text. While getting the manuscript ready, press staff may crop an image, increase the contrast, or change the colors or proportions so that the image better fits the flow of the text. Such alterations can be checked if caught when reviewing the proofs.

A second stage in which alterations may slide in occurs during printing. Printers may correct lines, heighten color contrast, or brighten or darken underlying colors, sometimes unbeknown to the publisher. In interviews with printers who work for major US academic and commercial publishers, all admitted that they had frequently altered or "fine-tuned" images in the course of printing. While major color shifts would be noticed, none of the printer's finer adjustments had been detected, nor had any of them ever had their rectified images returned. Both additional sources of potential distortion in the map suggest that maps deserve the same scrutiny accorded the text prior to appearing in print.

Minor alterations to colors, boundaries may be suitable for artwork, since paintings, drawings, and sculptures often convey an emotional rather than a literal understanding of the scene, person, or object. So the longstanding practice of brightening and sharpening images to make them clearer or more attractive is understandable, especially when seeking to reproduce the emotional message of the artwork effectively.

Often a single photograph or scan may leave an important area of an artwork obscure or shaded, despite help from lighting experts. Because of the expense of color, several photographs lit from different angles are sometimes joined (photoshopped) together so that the reproduced image shows all parts discussed by the author, instead of what a viewer would see gazing at the actual painting, drawing, or sculpture.⁵

But maps are not pictures. Although they are also visual images, they depict spatial relationships. Hence any effort to visually enhance the original image may alter the relationship of space—size, distance, or direction—between objects depicted on the map. However imperfectly the map-maker might have represented space, changing those relationships in the process of printing distorts what the original drafter was trying to convey in haphazard and random fashion.

Even minor alterations can distort a map. As noted earlier, altered colors can significantly lead readers of a map. If a photographer or image processor changes colors, the identity of the original feature is lost. Beyond this element lie additional reasons why maps cannot be treated as illustrations.

Let us take-maps that represent the earth as an example.⁶ Since the world is a three-dimensional object, it has to be flattened into a two-dimensional one in order to become a smooth surface, or a map. Taking a simple paper globe and smashing it would yield torn pieces of paper and a two-sided shredded object—that could only be seen from a single side at a time. In order to create an orderly solution to this problem, mathematicians and astronomers since Hipparchus in the second century BCE have devised the many systematic means of flattening the earth.

Since any three-dimensional object cannot be translated into a two-dimensional one without some type of distortion,⁷ professional map creators choose a particular representation to conserve specific features such as area or direction, depending on the purpose of their maps. Distorting a line here or a shape there would alter spatial relationships and render the retouched printed map unsuited for its objectives. If a map was created to compare areas of decimated rainforest, a prettified map could lead to targeting the wrong region for reform. If the map were showing the direction of a river, the loss of fidelity could result in poor planning for irrigation projects. The consequences for altering maps are, potentially, highly significant.

In short, unlike texts, there exists no standard process for vetting the quality or accuracy of maps reproduced in print. Nor is there any indication that such standards existed in the past. However, clearly standards are needed. First, curators and librarians need to be brought into the process of evaluating the digital image of a map rather than being excluded. Visiting the scanning department, as the curator did in Switzerland, is one such opportunity to provide better digital images from the outset.

Second, when a map is altered for publicity purposes, the copyright notice should state clearly that the image is “after the original,” thus acknowledging the changes. If the publisher seeks to create fictional, visually lush images for coffee table production, that objective (and the techniques used) needs to be acknowledged in the beginning. When accuracy is the goal, publishers’ production teams need to reframe their practices prior to their printing, verifying the proportions and colors of originals rather than taking the liberty to create sumptuous illustrations, unless that is their openly stated objective.

A strategy for so doing might adopt the standards outlined earlier for the evaluation of a print map at a museum or library. If the image is blown up so that it is the size of the original, and printed in grayscale on a translucent sheet of paper such as vellum or mylar in the fashion described above for verifying the print reproduction of an original, the production staff as well as the author would be able to judge whether the image producer (photographer, scanner, company, or department) had altered the content of the map in any significant way. Ironically, the digital age has brought any previously unknown retouching of maps into the open, making it easier for scholars and curators to recognize changes made to maps appearing in print and challenging the validity of the one-time gold standard for reproduction.

Notes

The author wishes to thank the editors of this volume for their helpful comments. Patrik Svensson provided a wonderful opportunity to visit the Digital Humanities Lab at Umeå University where I enjoyed his and his colleagues enlightening discussions. Additional thanks are due to Kim Ricker, Jean Aroom, Francis Hebert, the staff of the Institut Cartogràfic de Catalunya, and the audience at the 7th International Workshop on Digital Approaches to Cartographic Heritage in Barcelona for their support and helpful commentary.

1. The United States Better Business Bureau’s National Advertising Division banned a misleading photo-stopped advertisement in 2011. Jim Edwards, 2011, “US Moves toward Banning Photoshop in Cosmetics Ads,” *Business Insider*, December 16; Christine Haughney, 2012, “Who Can Improve on Nature? Magazine Editors,” *New York Times*, July 20; Jessica, Seigel, 2012, “The Lash Stand Will New Attitudes and Regulatory Oversight Hit Delete on Some Photo Retouching in Print Ads?” *Adweek*, May 29. The United Kingdom’s Advertising Standards Authority has made similar bans. Fashion and Apparel Team: Sheppard, Mullin, Richter & Hampton LLP, 2011, “About Face: Lancôme’s Airbrushed Makeup Ads Banned in the UK,” *The National Law Review*, August 21. The UK’s advertising authority also maintains a website where the public can post complaints: <http://www.asa.org.uk/>.
2. Greek map historian, personal interview, Barcelona, 2012.
3. “Carte dite Carte de Christophe Colomb,” Bibliothèque Nationale de France, Paris.
4. Mercator, G., & Hoff, B., 1961, Gerard Mercator’s Map of the world (1569) in the form of an atlas in the Maritiem Museum “Prins Hendrik” at Rotterdam Reproduced on the Scale of the Original. Rotterdam: Maritiem Museum.
5. John Berger pointed out the selectivity of reproductions. “Photographs are not, as is often imagined, a mechanical record. Every time we look at a photograph, we are aware, however slightly, of the photographer selecting that sight from an infinity of other sights.” John Berger, 1972, “Ways of Seeing,” London: British Broadcasting Corporation, 10.
6. Celestial and galactic maps also use the same techniques for producing two-dimensional images.
7. Carl Gauss’s (1777–1855) “Theorema Egregium” or “Remarkable Theorem” provides mathematical proof of the impossibility of simultaneously retaining direction and area. Carl Friedrich Gauss, 2007, *General Investigations of Curved Surfaces*, trans. Adam Hiltebeitel and James Morehead, Bel Air, CA: Wexford Press.