Digital Culture and the Practices of Art and Art History

The *Niña*, the *Pinta*, and the Internet

Kathleen Cohen

When I start a new class in art history and multimedia, I warn my students that they are signing on to the crew of the *Niña*, the *Pinta*, or the *Santa María*, and we are setting off on a voyage of discovery. We are not quite sure what adventures we will have or what we will find, but there will undoubtedly be times of frustration as well as of great excitement. Or we can join another metaphorical crew as we follow the siren song of the new technologies, for we will undoubtedly run into the cyber equivalent of the creatures that plagued Ulysses and his mariners on their mythic journey. Working over the years at the intersection of art history, education, and the new technologies, I find that I continually sail up to the brink, with visions of what lies just beyond the horizon, wishing for the skills and technology to take me there. A variety of experiences in this realm have led me to a deepening appreciation of the voyages of both Ulysses and Columbus. Ulysses' mythic journey epitomizes the lure of the unknown as well as the dangers that it poses, while Columbus's epitomizes the discovery of new realms.

There are many similarities between Columbus's journey into the unknown and our own attempts to enter cyberspace. To plot his course, Columbus had very sketchy maps to study (in our case, maps composed in arcane script by UNIX and Java programmers hunched over their workstations); he had to persuade someone to sponsor his journey and put up the funds; he had to assemble crews for his ships, and he had to convince the crew members to sail off into the unknown into that area marked on medieval maps with the warning, "Here be Dragons," where they might find treasure or fall off the edge of the world.

Just as Columbus's discoveries changed the way inhabitants of both Europe and the Americas viewed the world, so the information superhighway is changing the world of education as we know it. The ships that carried goods and information across the Atlantic and linked the sixteenth-century world in a web of commercial and political ties have been replaced by fiber-optic cables that allow us to send and retrieve information almost instantaneously. Just as the utilization of movable type and the printing press by Columbus's contemporary Johannes Gutenberg opened the possibilities of scholarship to a vast audience, so the utilization of the new technologies has the potential for opening the treasures held in the research libraries and museums of the world to us and to our students. I realized that we had entered a revolutionary age when I found myself at home one night using my modem to access the Internet and searching through the catalogues of the Bodleian Library in Oxford, looking up manuscripts that I had, many years before, been able to locate only by traveling to England. The possibilities became even more exciting when I saw that the Bodleian had digitized some images from the manuscripts and put them on the network so I could view their pages from my home.

Several years ago I walked past the open window of a classroom in an Egyptian village and heard a teacher reciting a text, which his students echoed in unison. As the process was repeated with each new passage, I thought of the way we often teach art history: reading our notes to our students, who write down our words, which they later try to replicate on examinations. The Egyptian teacher was using an age-old technique, one that for very good reason valued the ability to memorize. Some of that ability was lost when human beings learned to write, and scholars undoubtedly were concerned about what would happen to the younger generation when they lost the ability to recite long passages from memory. However, since written documents were expensive, the repeat-after-me mode of instruction did not change drastically until the advent of the printing press. Manuscripts that previously had been chained in the library could now be replicated and made available to scholars for their own libraries. As books have become more available, a whole industry has evolved around organizing and cataloguing them so that we can locate those we need. Pedagogy, however, sometimes lagged behind. I still remember with great angst one of the questions on my doctoral examinations: "List all the bibliographic entries for Michelangelo since World War II with place and date of publication." (And this was not an open-book examination!) Needless to say, I failed that part of the exam, but the academic gods must have wanted me to receive my Ph.D., because the next time around the professor asked for the entire bibliography on Jan van Eyck, which I had memorized. Old habits die hard, and old teaching habits die even harder.

Changes in the use of visual resources available to us have sometimes been met with the same conservatism that is found in the unwillingness to embrace the retrieval capabilities for textual resources. I have always felt that my primary task as a professor of art history was to get the students to the work of art itself so that it could speak directly to them. But in order to bring about that result, I had to give them some idea of the meaning of the work and to set it in an appropriate stylistic and cultural context. And in order to do that, I needed reproductions of the works.

Reproductions evolved from the casts and copies of paintings that graced every respectable art school to engravings, to black-and-white University Prints, and then to beautifully printed art books by Abrams, Skira, and others. The development of 35-mm slides, which permitted a greater use of color, replaced the large lantern slides that were used in the 1940s and 1950s; however, the price paid for color in the more convenient format was a loss of quality. This change was not

enthusiastically received by all, and the faculty of an eastern graduate school that shall remain nameless refused to give up its black-and-white slides, arguing that since the color might not be accurate, it was better to use black-and-white. I am not certain whether the school in question has now moved to color slides, but everyone else has, and the ubiquitous 35-mm slide has become the standard by which digital imagery is most often judged.

In this essay I would like to discuss some of the new possibilities and the new problems that arise from the introduction of digital imagery and networking into the teaching of art history. Colleges and universities across the country are facing a new and sweeping change as profound as was the invention of the printing press, and many of us share the mixed feelings about the new medium that I am sure were felt by sixteenth-century scholars and teachers as they saw their beautiful hand-painted manuscripts replaced by printed texts. It is important to realize that there will be trade-offs in digital technologies, just as there were in the previous technologies we used in our teaching. The electronic revolution may change our tools and perhaps even our methods of teaching, but it will not change our primary tasks of preparing students to encounter the works themselves with understanding and sensitivity and of teaching them how to think, to pose questions and suggest answers that can help others in turn gain new insights from our rich and diverse cultural heritage.

The digital revolution promises us a Magic Classroom in which we will be able to send our students on virtual field trips to the great works of art around the world. We might even take field trips into the past. We can imagine ourselves and our students in front of a northern Renaissance painting in Bruges with Erwin Panofsky to explain the iconography, or in Florence listening to Bernard Berenson discuss connoisseurship. We might ask Duby to place a particular painting in its cultural context and Heinrich Wölfflin to analyze its place in the development of style. Better yet, we might go up on the scaffold with Michelangelo and talk with him about what color effect he was trying to produce on the Sistine ceiling and his problems with the pope. While we may not be able to bring the dead back to life, we may soon be able to create virtual interactive worlds in which students can pose such questions. We might assign our advanced students the task designing such a world for a museum kiosk or a Web site.

Archives of primary sources, both visual and textual, like the Vatican Library, are being digitized at an ever increasing rate.[1] Museums and galleries are beginning to go on-line and to make CDs presenting works from their collections,[2] and CDs are being produced for special exhibitions along with printed catalogues.[3] And then there is the Web . . . what a wonderful place to go image hunting, as more and more images are mounted every day.[4]

The world seems open to us, and we are led to believe that we will soon have the corpus of human creativity at our fingertips. We are told that if we only buy the latest electronic gadget, the whole world will open to the click of a mouse. Yet, as we struggle with limited disk space, slow machines, and even slower networks and read of the demise of fair use, we wonder if it is all hype or if the dream can ever become a reality. We begin to question whether all the wonderful things promised by the digital revolution come down to mere vaporware, whether we will ever have on-line access to the world's cultural heritage,[5] whether we will have networked access to the images that we love and to the original sources and scholarly texts that we need to explicate them. We begin to realize that we will have to slay or charm a few of the guardian dragons before the promised treasures of our Magic Classroom open to us. Among them are the following:

- Standardized systems for image resources
- Legal access to huge archives of images
- Storage, speed, and bandwidth
- Reconceptualization of the way we teach

If machines are to be able to talk with each other and if human beings are to be able to find the materials they want, standards are necessary. Although computer makers and

1. It is interesting that one of the oldest institutions is taking the lead in the newest technologies. Funds from preservation efforts are increasingly being used to scan full text resources, although few are available on-line at the present time. Undertakings like the van Eyck project of information exchange between European art libraries are designed to enable photographic archives and collections to exchange both text and image information in electronic format. See Colum Hourihane, "The Van Eyck Project," *VRA Bulletin,* XXIII, no. 2, Summer 1996, 57–60.

2. For example, the CDs from the National Gallery in London published by Microsoft Home; the Frick Collection, the Egyptian Collection from the Brooklyn Museum of Art, and the Joe Price Collection of Japanese Art published by Digital Collections Inc. (now Digital Arts and Sciences Corporation); and *A Passion for Art,* a CD of the elusive Barnes Collection published by Corbis, to name just a few.

3. Economics point to even greater growth in this medium when one compares the prices charged for catalogues to the major exhibition *Splendors of Imperial China* held at the Metropolitan Museum of Art in New York with the price of a CD. The large hardback catalogue with 426 plates cost $85.00, and a smaller paperback selection with 120 plates sold for $29.95, the same price as an interactive CD containing 474 images plus details, audio pronunciation of Chinese terms and names, maps, chronologies, and the ability to "unroll" a virtual scroll.

4. See Diedra Stam, "Shared Access to Visual Images—The Potential of the Web," *VRA Bulletin,* XXIII, no. 2, Summer 1996. In September 1993, Mosaic, the first graphic browser, changed forever the way people communicated. Since then the Web has virtually exploded. At the time of writing, Digital's Altavista search engine indexed more than 30,000,000 documents located on 225,000 servers, with more being added daily.

5. For the issues involved, see David Bearman, "Overview and Discussion Points," *Research Agenda for Networked Cultural Heritage,* by Getty Art History Information Program, Santa Monica, Calif., 1996, 7–23.

6. The Visual Resources Association has also been very active in the area of standards for cataloguing and retrieval. See *VRA Bulletin,* XXIII, no. 2, Summer 1996.

7. The current tension over fair use is laid out in the positions articulated by Bruce Lehman, commissioner of patents and trademarks at the U.S. Department of Commerce, and Pamela Samuelson, professor of intellectual property law (University of California, Berkeley) and co-founder of the Digital Future Coalition, a group dedicated to protecting public rights in the digital world. Lehman stresses that he represents the interests of the United States economy in the global marketplace and that copyright law is intended as an aid to commerce. Although he maintains that fair use will continue to exist under the recommendations of the white paper developed by the NII (National Information Infrastructure) Committee, Samuelson and her group are concerned that many of its provisions will severely limit fair use Representatives of the publishing, movie, and music industries argue that fair use is anachronistic because all use can now be monitored, and that licensing should replace free access. See also Robert Baron, "Digital Fever: A Scholar's Copyright Dilemma," *Museum Management and Curatorship,* XV, no. 1, 1996, 49–64.

8. Current copyright law governing fair use is purposely vague, with courts deciding on a case-by-case basis whether a particular usage can be considered fair use or an infringement. Decisions are based on four factors: (1) the character and purpose of the use, (2) the nature of the copyrighted work, (3) the portion of the whole that was used, and (4) the effect of the use on the copyright holder's market.

cataloguers have been resistant to adopting someone else's standards, everyone is becoming more aware of the necessity of common standards, and solutions are being found both in communications protocols and image cataloguing. The Getty Information Institute (formerly the Art History Information Program) has contributed immensely to the development of standards through projects like the *Art and Architecture Thesaurus,* the *Union List of Artists' Names,* the *Categories for the Description of Works of Art,* and the forthcoming *Geographic and Site Index.*[6]

Access to large archives of digitized images is absolutely necessary if digital art history is to move beyond the sample projects stage. Educational institutions are beginning to scan their slide collections and to make the images available to students either on CDs or on campus networks. However, there is concern about the legality of scanning slide collections or even copying information from the Internet, and campus attorneys are concerned about the legal implications of such practices. Fair use is under attack as the country grapples with the issue of protecting intellectual property in the digital age.[7] While the law itself develops on a case-by-case basis,[8] users and providers of intellectual property have been meeting to draw up an agreement that essentially reassures users that if they abide by these rules, providers will not sue them. The draft of such an agreement, at the time of writing, was being hammered out by a subcommittee of the National Information Infrastructure Committee.[9] Many educational participants on the subcommittee believe that it is dominated by the publishing interests, and the proposed guidelines promise to put severe limitations on current conceptions of academic fair use.[10] Since there will undoubtedly be a case that deals with the rights of copyright holders of digital images versus the fair use of those images in education, we need to be aware of the legal implications of what we do. We must be respectful of the rights of copyright holders yet not agree to limitations that go beyond the fair use factors in the current copyright law, limitations that could prevent us from teaching effectively in the digital age. We must not sacrifice the digital equivalent of the free public library. Let us hope that Justice Sandra Day O'Connor is still on the Supreme Court when a case involving fair use in a nonprofit educational institution comes before the court, for in a 1991 decision she observed, "The primary objective of copyright is not to reward the labor of authors, but 'to promote the progress of Science and the useful Arts.' To this end, copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work. . . . This result is neither unfair nor unfortunate. It is the means by which copyright advances the progress of science and art."[11]

The three principal constituencies of the College Art Association—art historians, artist-teachers, and museum personnel—share the goal of helping people experience the riches embodied in the visual arts, but they harbor different interests in pursuing that goal. New media and copyright concerns can put them at odds, yet that need not be the case. We all have much to gain from the greater accessibility that electronic imaging and linked networks can provide. Artists and museums can have larger audiences for their work and their collections, and art historians can more effectively explicate the images created by the first and displayed by the second. The new means of reaching the public can allow us all to do our jobs more expeditiously.[12]

The World Wide Web not only offers a place for artists, museums, and commercial vendors to display their wares, it also provides a means by which teachers can share their images with each other.[13] The sharing of images from a variety of sources could offer us access to many new images that will help us get beyond the so-called canon, and the rich collections of art objects photographed by faculty members over the years can serve as a tremendous resource for arriving at that critical mass of digitized images that is necessary if the digital revolution is to affect the teaching of art history.

While the rapidly evolving computer networks offer a new way of making images available as needed, bringing this about

9. Both the College Art Association and the Visual Resources Association have been active in a subgroup of that committee dealing with fair use. See Virginia Hall, "Fair Use and Digital Image Archives: A Report on the National Information Infrastructure Conference on Fair Use," *VRA Bulletin,* XXIII, no. 2, Summer 1996.

10. If the proposed guidelines are accepted, access to copyrighted digital imagery would be limited to students enrolled in a specific class for that semester only. Were the images to be used again, permission would have to be sought from the rights holder, with the burden of locating the rights holder laid on the institution that wishes to use them. Given the incredible amounts of time and money that would be needed to obtain permissions for a critical mass of images, such a requirement would essentially prevent images from being utilized under fair use, for the labor involved in digitizing and cataloguing the images, much less writing lessons using them, could not be justified for a single semester's use.

11. *Feist Publications v Rural Telephone* 499 US 340 (1991) at 349–50.

12. We need a critical mass of digitized images to make the electronic enterprise worthwhile, and there are things that we can all do to help bring this about. I would propose first of all that artists put their own work out on the Net and allow art historians and students to download study versions of the images (something like 4-by-5-inch highly compressed images) and use them for nonprofit educational purposes. Larger, higher-quality images could be sold, and in some cases the works themselves will be sold. Museums can begin to digitize their holdings at very high quality and make them available over the Net in lower quality in a size appropriate for study. Higher-quality images appropriate for projection could be sold. If the cost is kept within a reasonable range, institutions will purchase them, for it is not inexpensive to digitize and catalogue slides from their own collections, and the quality will not be as good. In the same way, commercial image providers could mount small *pro bono* study images on the Web, using them to advertise higher-resolution images that they would sell.

Downloading images from the Net and scanning slide archives for nonprofit educational use should be allowed under fair use, but we must be willing to license large digitized images as they are available and to pay for rights for any commercial projects we might undertake. Fair use need not be sacrificed, as would be the case under the Fair Use Guidelines for Digital Images being proposed by the publishers at the NII subcommittee hearings. Image providers will make more money investing in making their images readily available than spending it for lawyers trying to chase down and prosecute slide curators and faculty members who are trying to do their job of educating the students who will be the creators of the intellectual property of the future.

13. Faculty members like myself at San Jose State University (http://gallery.sjsu.edu) and Allan Kohl at the Minneapolis College of Art and Design (http://www.mcad.edu/aict/index.html) are encouraging the sharing of faculty-owned images. Images would be shared for use on nonprofit educational projects with no royalties, but permission would be required for any commercial ventures. Faculty members like Christopher Witcomb at Sweet Briar College in Virginia are creating art historical Web sites with pointers to art historical postings, which can help us find our way through the rich Web environment (http://witcombe.bcpw.sbc.edu/ArtHLinks.html). In addition one can use Web search facilities like Yahoo, Infoseek, Lycos, and Magellan on the Internet to find art resources. One such site, entitled World Wide Art Resources, is found at http://wwar.com. Commercial companies are hard at work on better search engines and even "intelligent agents" that can be trained to search the Web for desired content.

is not a trivial task. High-quality images need large hard drives to store them and fast networks and servers to deliver them. Equipment is expensive and constantly needs updating; fortunately, computer speeds and storage capacities are rising while the cost of a basic system remains relatively unchanged. The computer and telecommunications industries are addressing the issues of network delivery. However, the land on the edge of the horizon keeps receding as we sail toward it, and it will be many years before we will have all the things that we envision. The Internet is clogged and slowing down. America Online (AOL) has become AWOL—American Waiting Online. Web sites notoriously come and go; they might be accessible at eight in the morning but not eight in the evening, or they might disappear altogether. Most campus networks are too slow to deal with high-quality images at a reasonable speed without interfering with everyone else's projects.

We must face the trade-offs between the quality and size of an image and the speed of access to it over a network. Course development in the digital realm is extremely time-consuming, and we must consider the implications of the techniques we choose. What is the best way of making review images available to students? Would CDs or the campus network be most effective? How should we develop course materials that utilize the World Wide Web? Do we want to have students dependent on images that they must access over the Internet? What is adequate quality? How long will students wait? Might there be different answers if we are teaching a basic survey course or an advanced seminar, if students must study particular images or are free to search and discover? Would a CD be a better way of providing basic images of high quality that could be augmented by images found on the Net? What are the legal implications of the choices we make?

We often think we have found an answer to a problem only to be faced with a new problem. After spending a great deal of time and effort obtaining a grant for eighteen multimedia machines to put in the campus library so that students could access the images for my art history course, I discovered that when more than three students at a time tried to access the large images, the network bogged down. I am currently offering the course using CDs that students can check out rather than having them connect to modules offered over the network, and I am writing grants for a high-speed network that is switched rather than routed and uses 100BaseT EtherNet rather than 10BaseT. This rather arcane terminology indicates that one shouldn't try to launch a digital art history project without the help of local computer and network gurus.

We are just beginning to explore ways in which the new tools can allow us to change the way we teach. Art historians around the country who are experimenting with the use of digital imagery find that it is transforming the way they teach and extending their reach beyond the traditional classroom.[14] One of the most interesting changes that I have experienced has been the replacement of solitary research by collaborative teams. Several years ago at San Jose State University we developed a multimedia master's program that brought together people from a variety of backgrounds to work on specific projects. As an art historian, I was particularly interested in how their skills could be used to create digital projects with art historical content. As a result, students from library science worked with art history students to catalogue the images in a database we are developing, while other teams worked on the issues involved in putting images on the campus network and on the Web.[15] Art and design students worked with art history students to create multimedia applications on a variety of topics. The course had an intensity about it because the students were active learners, working on real projects and trying to solve real problems. The work of advanced students contributed to the education of beginning students, for the image database provided the images for a digital art history survey course. Although the content is similar, the course structure is quite different from a standard art history course. The digital format of the material enables students to study it on their own schedules, and contact time is used for discussion rather than delivery of information, a technique that led to the development of higher cognitive skills than is possible in the typical "darkness at noon" art history lecture.[16] In all these activities I have found that my own role as instructor has changed dramatically from lecturer to teacher-coach and problem solver. And there are many problems to solve! There are times when I want to retreat to my slides and give a lecture, but ordinarily I experience

14. University-based projects have been assembling digital resources and re-creating artworks: the Perseus Project based at Harvard is amassing a huge collection of classical texts, images, and site plans; a corpus of Greek vases is being digitized and indexed at Rutgers; the Piero Project at Princeton used a virtual-reality program to construct a three-dimensional version of Piero della Francesca's chapel at Arezzo and has assembled primary texts to support advanced study of the artist; the Amiens Project at Columbia is developing a digital reconstruction of Amiens cathedral. Using images scanned at very high resolution, Charles Rhyne of Reed College, Portland, Ore., encourages connoisseurship among his students by having them work in pairs to examine images in great detail. Ellen Schifrel of Southern Maine University at Gorham is developing multimedia programs that demonstrate a variety of spatial conceptions: *Thinking Egyptian,* which actively involves the students in the visual logic of Egyptian painting, and *Linear Perspective in Context,* which is designed to clarify the differences between Renaissance and medieval spatial systems. Faculty members are utilizing the resources of the World Wide Web in a variety of ways. Terry Gips of the University of Maryland at College Park integrates both studio and art history students in a seminar that utilizes images that students gather from the Web along with others that come from the MESL project, which is exploring the issues involved in the licensing of museum images to educational institutions. Anne Souchaud de Luengas of Tampico, Mexico, has put together an art history course in Spanish, French, and English that is delivered over the Web and uses images that reside on the Web, and Jerrold Maddox of Pennsylvania State University, University Park, has developed a number of on-line distance education courses in art criticism and studio arts: (http://www/[erspma;/[si/edi/faculty/j/x/jxm22/JM/JMclasses.html).

15. Since we wanted to be free to use the images in a variety of ways, we digitized slides that I had taken in my travels and to which I owned copyright. The library students explored the ways in which we should apply the various developing standards for image cataloguing, and the art history students have honed important research skills through this work.

16. The course consists of twenty modules, each with some seventy images and related information, which is ordinarily delivered in lectures. Students work through the lessons with the help of a detailed study guide and then meet in small groups for discussion once each week. The CD format makes access to images of relatively high quality (1100 by 825 pixels) available to on-campus students who study in the library media center as well as for off-campus students without having to depend on the unpredictability and slow transfer time of the Web. My next project is to see how the human interaction of the discussion groups can be handled for off-campus students. Will a mailing-list manager such as Listserv be effective in such a context? We will have to try it and see.

teaching as an incredibly exciting adventure that I share with my students.

The descendants of ancient Scylla and Charybdis have taken over niches in cyberspace where they lie in wait for us modern voyagers, as their forebears had waited for Ulysses and his crew. We hope that our historical training and the help of our network guru guides will allow us to steer our way between the whirlpools—the dizzying spiral of technological change—and the clashing rocks—crashing drives and networks—as we follow the siren song of the new technologies into the stormy seas of cyberspace. If we are able to find our way through its swiftly changing currents and establish our network nodes, we will both discover a new world, as did Columbus, and find our way home again, as did Ulysses, to a new appreciation of the images we love.

The new technologies confront us with many opportunities, but a great deal remains to be done in finding the most effective pedagogy to take advantage of them. We must remember that our art historical knowledge and our experiences with how students learn are our most important assets, for it is that knowledge that will allow us to give "added value" (to use a marketing term) to the countless images of works of art that the new technologies are making available. We have an important role to play in linking the future to the past. Forward mariner! And remember the words of an anonymous sage: "The difference between an adventure and a crisis is a matter of attitude."

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What Are We Seeing, Exactly?

James Elkins

Digital imagery is a seductive topic in cultural studies and visual theory. It is intimately tied to questions of surveillance, power, voyeurism, pornography, the demise of the text, the emergence of cybernetic bodies, and the construction of virtual realities. At the moment it seems hard to assess the nature or direction of cultural theorizing on digitization.[1] The literature is diverse enough to harbor strongly divergent accounts of the nature of ocularity in the late twentieth century and its relation to pedagogy and "visual literacy."[2] Often ideas at issue in the humanities have drifted from their original contexts in science, so that the debates are effectively contextless.[3] Conversely, the production and criticism of digital images is largely cut off from historically informed writing on images, space, time, and the body.[4]

Given that turmoil, I thought it might be prudent to use this forum to make three very rudimentary observations. The first concerns the day-to-day appearance of digital images. In the rush to digitize artworks and disseminate them to our students we are not paying as much attention as we might to what they actually look like. I propose to show, in a straightforward and statistically indefensible fashion, that the average resolution of our images is plummeting and that their color is as undependable as it was back in the days of hand-colored lithographs. A second issue concerns computer art, which is widely ignored by art historians; a third pertains to the potential uses of digital images for research.

All three of these points are meant to be simple statements of existing conditions, but each one leads rapidly into thorny questions about the discipline in general: about the kinds of images we prefer and the art history that can be written using such images. I open those deeper questions just a little at the end of each section.

From Big Blur to Little Blur

Several universities are exploring the possibility of digitizing their slide collections, or at least putting images on-line for study purposes. Theoretically, it is possible to capture every visible detail and hue of an image to the limit of human vision, and if the university's computers have sufficient storage space, there is no reason why slide collections might not be converted entirely to digital files. The problems lie in the output devices that are most likely to be used. Even if an

My thanks to Kenney Mencher, former curator of the slide collection at the University of Chicago, for scanning and photographing most of the images that illustrate this article.

1. As evidence of that I take the recent essay by Scott Heller, "Visual Images Replace Text as Focal Point for Many Scholars," *Chronicle of Higher Education,* XLII, no. 2, July 19, 1996, A8.

2. See, for example, W. J. T. Mitchell's review of Martin Jay's *Downcast Eyes,* Cambridge, Mass., 1994, in *Artforum,* XXXII, no. 5, 1994, 9.

3. Examples are discussed in my essay "The Drunken Conversation of Chaos and Painting," *Meaning,* XII, 1992, 55–60.

4. I have argued this in "There Are No Philosophic Problems Raised by Virtual Reality," *Computer Graphics,* XXVIII, no. 4, 1994, 250–54; and "Art History and the Criticism of Computer-Generated Imges," *Leonardo,* XXVII, no. 4, 1994, 335–42. See also the discussion of digitized astronomical images in my "Art History and Images That Are Not Art," *Art Bulletin,* LXXVII, no. 4, 1995, 553–71; and Michael Lynch and Samuel Edgerton, "Abstract Painting and Astronomical Image Processing," in *The Elusive Synthesis: Aesthetics and Science,* ed. A. I. Tauber, Amsterdam, 1996, 103–24.

image is stored as a 100MB file, it will normally be seen as a 1MB file; and even if it is scanned at 2400 dpi, it will normally be seen at 72 dpi (or .28 dot pitch) on an ordinary computer screen. (To see the kind of effect I have in mind, try downloading one of NASA's images, first full-size—they are around 50MB—and then in a more common format—about 60K. The two images will be equally blurry on the screen.)[5]

Students make this situation worse when they use on-line images to prepare for exams, because an average student's computer will not be fast enough to open large images without an intolerable delay. If it takes a half minute to open an image that fills the screen, most students will opt for what are called *contact sheets,* in which tiny versions of the images—called *thumbnails*—appear in rows and columns. The thumbnails are about 100 pixels wide. At that size nothing more can be seen of an image than its overall color and a haze of abstract forms. From there, things get better: next come *wallet images* (typically 128 by 192 pixels), *snapshots* (256 by 384), *standard images* (512 by 768), *large images* (1024 by 1536), and *posters* (2048 by 3072).[6]

Most students will seldom open an image larger than a snapshot, because a standard image won't fit on a 17-inch computer screen. It's an unnatural business, scrolling up and down to see the entirety of an image, waiting as the computer redraws the screen, jerking the image down notch by notch.

The moral of this is that teachers who make study materials available on-line should be prepared for students to see relatively little. If the software allows for contact sheets, students will see just enough to help them tell one slide from another on an exam—the one with the black smudge, the orange one, and so forth. This problem takes as many forms as there are output devices, and if we include projectors and books as output devices it is possible to show, on a sliding scale, the disappearance of detail and the emergence of blur.

(1) The highest resolution "output device" is the original itself, in this example an etching of Jan Six by Rembrandt.

(2) Incrementally worse is a nineteenth-century photoetching (Fig. 1). From normal viewing distances, and for virtually all art historical purposes, it is an acceptable substitute. By enlarging just the face, it is possible to get a sense of the original and not be distracted by the printing technology of the *Art Bulletin* (Fig. 2). It is important to note that the image you see on the page is a print of a photograph of a photograph of a print of a photograph of a print, because the original print was photographed, made into another plate, printed, and photographed; and then I sent the photograph to the *Art Bulletin,* where it was rephotographed and printed. Each stage contributes its own blur, and there are very few people—mostly print technicians—who could dissect the various contributions. Given those inscrutable limitations, Fig. 2 is intended to show what would be visible to a student who had a magnifying glass and the original photoetching: it is an optimum amount of detail.

(3) Next come illustrations in books. Fig. 3 is from *Rembrandt: Experimental Etcher,* published in 1969; it is one of the best reproductions of the image. Already there is much less to see. The finely bit texture of the face has entirely disappeared, replaced by the half-tone dots of the photograph (which are plainly visible in the photograph I took from the book itself) and by the shadows cast by the fibers of the paper used in the book. Most lines of the hair have dissolved into a wash. *Rembrandt: Experimental Etcher* offers both a full-page illustration, slightly reduced, and a detail. Fig. 3 is from the full-page illustration, which is marginally better in quality than the detail (as often happens), but both illustrations offer only a soft haze where Rembrandt drew several hundred marks.

(4) One step further down brings us to high-quality slides, especially lantern slides. The University of Chicago still keeps a collection, but most have been replaced by 35-mm slides. Almost all lantern slides were black-and-white, and many teachers traded down to the less expensive, lighter, and more colorful format.

(5) Ordinary 35-mm slides may seem to have high resolution, and they are a standard against which digital images are usually measured. But consider what actually appears on-screen when a 35-mm slide is projected—in other words, consider what a student actually sees. Fig. 4 is a photograph of a good-quality slide as it looks when it is projected in a classroom. It was shot with the camera positioned at student eye-level, about 15 feet from the screen—an average distance. It is palpably worse than the reproduction from *Rembrandt Etchings:* here Jan Six looks exhausted, probably because he is a little distorted (a natural consequence of being photographed from an angle). A defect in the screen has added injury to insult, giving him a bruise just under his left eye.

(6) Worst of all are the digital images of the kind students might see on-screen. Fig. 5 is a fairly generous example, since it is a detail of a snapshot (that is a 256 by 384 pixel in age), and the whole etching filled about half of a 17-inch screen. Most students would not see an image this good. This is approximately the quality of images that can be downloaded from major museums via the Internet; the image files themselves are better than this, but the computer screens are not.

(7) The sequence could have ended with the equivalent detail from a thumbnail, but it would be indistinguishable from any other abstract grid of pixels. (It would be a watery collage of grays, roughly 10 pixels wide.)

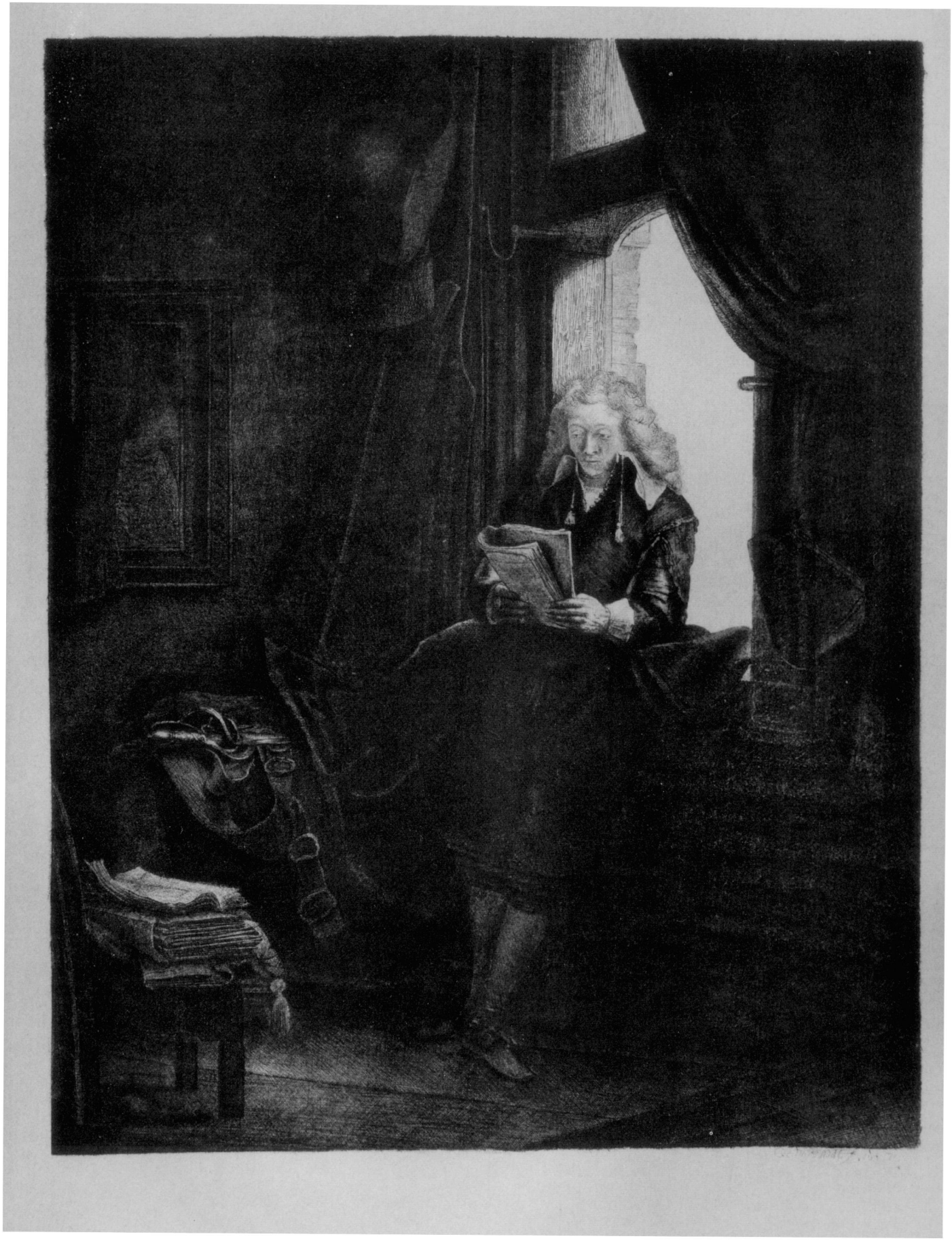
Advocates of digital imagery sometimes point to the quantifiable, permanent nature of their medium. Unlike slides, digital images do not fade, scratch, or discolor, and a good digital image needs only wait until the display technology catches up with it. In part that is true, but it needs to be said that there is nothing especially *accurate* about any digital image. Consider, for example, what happens to color.

There are sophisticated devices (hardware and software) for color regulation and comparison, and it is possible to track color accuracy from the object itself through the photographs and onto the printed page. The problem as far as academia is concerned is that the technology is not used.[7] A

5. See, for example, http://www.jpl.nasa.gov/archive/.

6. A color poster will be about 16MB, already too cumbersome for study purposes. I thank Macie Hall at the Johns Hopkins University for these numbers.

7 It is also possible to use a color-separation guide (also called a color-control patch), a small card that is held in the field of view of the photograph and then used to control colors in printing. Such cards are widely used in technical and medical photography and archaeology. They are sold by Kodak, and a version has been disseminated by the International Federation of Rock Art Organizations; see Robert Bednarik, "The IFRAO Standard Scale," *Rock Art Research,* VIII, 1993, 78.

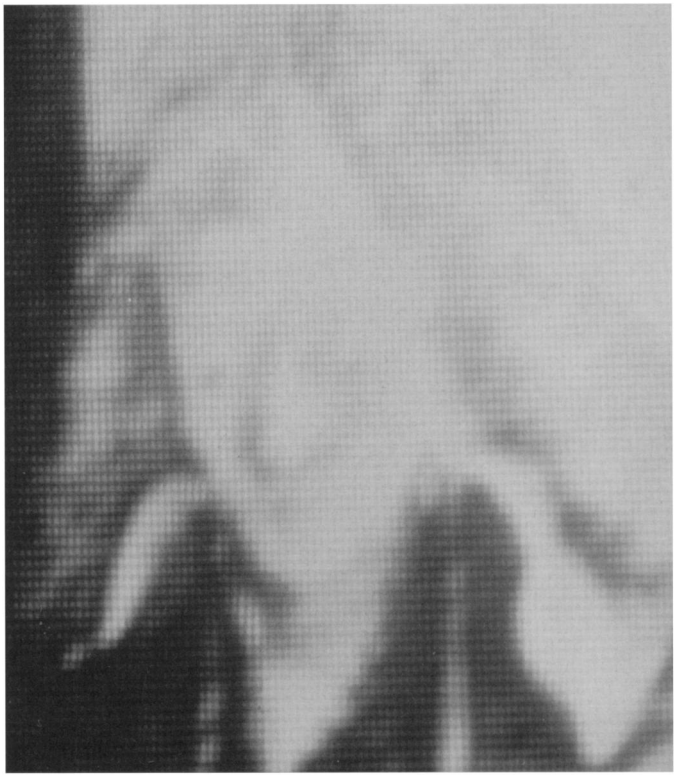


1 Rembrandt van Rijn, *Jan Six,* 1647, 19th-century photoetching

2 Detail of Fig. 1

3 Rembrandt, *Jan Six,* detail from Felice Stamfle et al., eds., *Rembrandt: Experimental Etcher,* exh. cat., Greenwich, Conn., 1969, 20

4 Rembrandt, *Jan Six,* 35-mm slide, source unknown, photograph of the slide as it appears projected in a darkened room



5 Rembrandt, *Jan Six,* detail of Fig. 1 scanned into a computer and displayed on-screen

typical personal computer monitor equipped with color-control software costs around six times as much as one without, and as far as I am aware no art history departments have hired people with expertise in color control. Since the slides and books that are being scanned come from unverifiable sources, there is no good reason to enlist a fastidious, quantifiable technology to duplicate them. Hence, color regulation normally goes by eye. Here is another sequence, intended to suggest the kinds of things that can go wrong.

(1) Consider one of the worst reproductions I know: the picture of Diego Velázquez's *Las Meniñas* in the frontispiece to the first edition of E. H. Gombrich's *The Story of Art,* published in 1950 (Fig. 6). In the book the painting is a turgid aquamarine, as though the Alcazar had been submerged in a huge, unclean aquarium and left to steep until a film of algae grew over the Infanta and her retinue. The saturated blues and reds and exaggerated chroma differences are recognizably the products of a particular process of color reproduction, now thankfully outmoded. (Fig. 6 is taken from a slide of the frontispiece. In the course of reproduction and printing it warmed a little, trading its bluish ceiling for gray-green rust. Each color reproduction in this essay has similar differences from its original.)

(2) Consider, in contrast, a scanned version of the same picture (Fig. 7). This was made with good hardware and software, and it represents an ordinary level of exactitude—basically the same procedure would be followed to scan any illustration for an art history slide collection. Yet the departure from Gombrich's "original" is pronounced. Bad reproductions often have their virtues, and Gombrich's frontispiece brings out a chain of red highlights that can be followed from Nicolasico, the midget on the far right, through the ribbons on the Infanta's dress to Velázquez's palette. The frontispiece is relatively sensitive to reds, even showing that the right hand of the dwarf (second from the right) is part of the same chain. All of these details disappear in the scanned version, where even Gombrich's shaky colors, including a warm ocher floor, are swamped in an excess of cyan.

(3) Looking for accuracy, we might choose to download the image of *Las Meniñas* that is available on the Internet. The result, as it appears on-screen, is shown in Fig. 8. It is a good reproduction, but clearly a little too green. Since the Internet image was made from one of the Prado's color photographs, its pedigree is better than usual, but in digitization everything depends on the output device.

(4) The next step might be to search for the best printed reproductions. Having made an incomplete survey, I find that the most accurate is the one in Hugh Honour and John Fleming's *The Visual Arts: A History* (Fig. 9).[8] Their illustration has a wonderful spectrum of grays, which is difficult to achieve in printing. Here, the reddish-gray floor has flamed into a carmine carpet. Even so, the lit side-jamb of the window preserves some of Honour and Fleming's moderate grays. When things get this good, the question of accuracy becomes especially subtle, involving memories of originals, lighting conditions, and even judgments made by restorers. In this case I mean that Honour and Fleming's illustration has a superior color balance: a treacherous criterion, since balanced colors are not a property shared by many images. (The "equalize" option in image manipulation software, which balances colors according to a "natural" standard, is not one that should be applied to paintings.)

(5) When color is at issue, illustrations like the one in Honour and Fleming's book are usually adequate, and far more reliable than digitized images. When it comes to classroom instruction, however, slides have to do. Fig. 10 juxtaposes the image from the Internet (in the inset) with a scan of one of several slides of *Las Meniñas* in the slide collection of the University of Chicago. The scanned slide is incrementally worse than the scan of the reproduction from *The Story of Art,* which is itself worse than Gombrich's original frontispiece, printed nearly a half century ago. Things are not getting better.

These rudimentary comparisons lead directly into a very complex issue. Certainly thumbnails and contact sheets would bother any teacher, and clearly no teachers would send their students to the reproduction in the first edition of *The Story of Art.* When poor slides crop up (and the one from the University of Chicago is by no means spectacularly bad), we apologize as best we can or ignore the defects. But I think few of us would be troubled about any of the other images—and that, I think, is curiously lax. Why is it that virtually everything worth saying about *Las Meniñas* or *Jan Six* can be explored using these undeniably abysmal images? Of course we counsel students to return frequently to the originals; but that does not explain why we can teach art history almost in its entirety using such images. It points to something deeply lodged in the discipline: by and large we do not look closely at pictures unless we are looking for symbols or historically pertinent signs. As a discipline, we seem curiously complacent or optimistic about this situation, as if we care more for the abstract possibilities of digital images than their concrete appearances. Below a certain level visual incident does not enter into historical thinking, and it is not at all easy to come up with a cogent defense of that fact.[9]

The Problem of the Intellectual Ghetto

Most readers, I think, will have quickly leafed by this introductory forum in search of nondigital imagery, unless they are members of three minorities in the art historical profession: those interested in using digital images for teaching; those with technophilic leanings; and those—not a small minority—who stop whenever they see a reproduction of *Las Meniñas.* Normally the art historical community greets the profusion of computer-generated images with studied indifference. Computer graphics often seem poisoned by naive notions of what pictures can be and constricted by techniques that belong only to the computer. If the truth were told, computer graphics seems to have more in common with the glamorous

8. Hugh Honour and John Fleming, *The Visual Arts: A History,* 4th ed., New York, 1995.

9. I have written on this from various points of view in *Our Beautiful, Dry, and Distant Texts: Art History as Writing,* University Park, Pa., forthcoming.

6 Diego Velázquez, *Las Meniñas,* 1656, from E. H. Gombrich, *The Story of Art,* London, 1950, frontispiece

covers of science-fiction books than with what happens in the art world.

In large measure those assessments are true. The offerings in the "art" section of the yearly SIGGRAPH (Special Interest Group on Computer Graphics) conference have been getting more diverse and responsive to the contemporary art market; however, there remains a preponderance of faux surrealist bodily distortions, garish video colors, glimpses into outer space or down people's throats, and unrepentantly sexist imagery.[10] The irony with which recent popular culture is received in the art world does not seem to have penetrated these practices.

Still, I think there is reason to be as forgiving and as engaged as possible. The history of artists' techniques is replete with examples of media that were invented outside the art world and slowly gained expressive range. Niello prints and silk screens are examples of methods that have long since lost their specific origins. It is not that there isn't good reason to spurn expressive narrowness. I think holography, for example, has yet to come to terms with its rainbow colors: they cannot merely be ignored (as they often are by holographers), because they will continue to signify the hallucinogenic 1960s; and as long as such meanings are not part of holographers' sense of what they do, they will continue to misinterpret their own works. But historically, expressively narrow media have grown into richer practices.

Computer-generated art is at an interesting juncture. The early paint programs were crudely modeled on palettes and brush shapes that were common in certain kinds of conservative midcentury realist oil painting. Now the software is based on a much wider historical range of techniques, and it has even begun to exploit possibilities specific to computers. The computer *palettes* (preselected ranges of colors, often with unpleasant titles like "oasis" or "metallic") are becoming more diverse. *Brush options* (selections that imitate different sizes of brushes and amounts of paint) have moved beyond oil painting models and encompassed watercolor, pastel, Japanese ink-brush painting, and enamel airbrush painting. *Paint options* (including choices of thick or thin paint) have progressed to the point where a color can be put down opaquely, translucently, transparently, and with a number of specific optical properties. (For example, I can paint in a "color" that turns every color it covers into its complement.) *Texture options* (software routines that modify images) are flourishing; it is now possible to turn a photograph into a crude but passable "Cézanne," or make it into a mosaic, or into an embossed sheet of metal. There are already on the order of a hundred Adobe Photoshop "Plug-Ins" (small third-party applications that offer specialized image modifications), with

7 Velázquez, *Las Meniñas,* scanned version of Fig. 6, displayed on-screen

8 Velázquez, *Las Meniñas,* image downloaded from the Internet, displayed on-screen

9 Velázquez, *Las Meniñas,* from Honour and Fleming, *The Visual Arts: A History,* 4th ed., 1995

more appearing each month. Art historians should be watching these developments, with an eye to understanding their historical sources and the assumptions they make about how pictures are constructed.

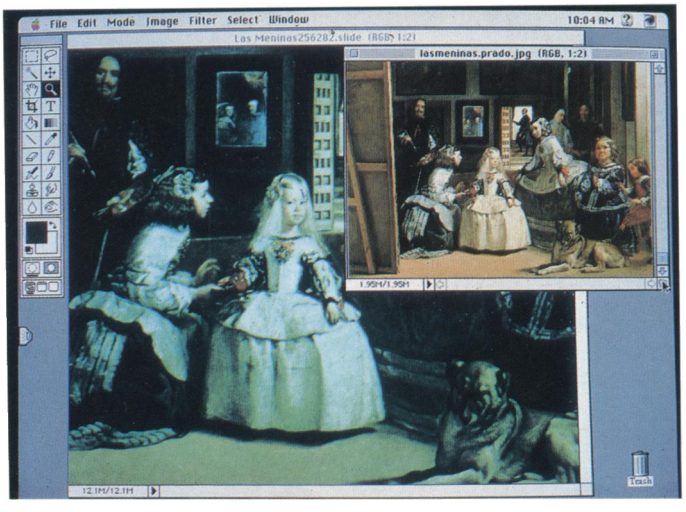
There is also an engaging critical point here, since people who work in computer graphics tend to say that many of their techniques are indigenous to computers—that they couldn't be done in other media. I do not think that is entirely the case; more often, computers just speed up the production of images. In computer graphics, a blue brushstroke can cover a red one entirely, leaving no trace of red—but that is also possible in oil or acrylic, if the artist is careful. Computer-generated images are naturally articulated in pixels, but handmade images can also be similarly articulated—Cubism, of course, being the canonical instance. The only method I know that may be entirely confined to computer graphics is the pressure-sensitive tablet, since it means that an artist draws in one place (on the tablet) and watches the image appear somewhere else (on the monitor). Aside from pantographs, that disjunction of hand and eye may be unique in the history of art. The lack of critical and historical discourse in computer graphics is eloquently attested by the fact that—in my experience—no computer-graphics artist thinks of the tablet as an opportunity for innovation. Instead it is imagined as a mild impediment to "ordinary" or "efficient" drawing and painting.

Although it may seem irrelevant, computer-assisted art also bears on the current directions of art history. The ghetto of digital imagery is a sure sign of the shape of our affection for popular culture: it is limited, for the most part, to images received under conditions of irony—those that can be understood as Pop, kitsch, or camp. Computer-assisted imagery is often very serious, and it works for its viewers as a vehicle of unapologetic transcendence—an insuperable obstacle to historical interest.

How Digitized Images Can Be Useful for Research

Finally, let me suggest a use for digital imagery that art history has largely bypassed. If a high-quality photograph is scanned, it can be written onto a CD-ROM or other permanent medium and used as an aid to research. I recently wrote a commentary on a late-seventeenth-century manuscript that has fifty-two small and extremely puzzling images. The lighting in the archive (at the University of Glasgow) was good, but I found much more in the paintings when I examined them on-screen. Using imaging software, I could magnify them practically without limit. Using *thresholds,* forms that had been too subtle or dark to see in the original emerged as the image slid back and forth from brilliant high contrast to turgid dullness. When I was unsure of the hue of a particular passage, I could sample it with an *eyedrop tool* and place the sample on a calibrated color wheel. In the end, I did not write about anything that I couldn't verify with the naked eye—but the computer helped me to see the images differently, revealing analytic possibilities and meanings I would otherwise have missed.[11]

The sciences are well ahead of art history in this. Image analysis and *image software* is the subject of widespread research in biology, medicine, physics, and chemistry.[12] High-



10 Velázquez, *Las Meniñas,* image downloaded from the Internet juxtaposed with a slide scanned from the collection of the University of Chicago (inset)

10. For information on SIGGRAPH, see the journal *Computer Graphics.*

11. These questions can also be approached from the cognitive-science side; see Andrew Watson, ed., *Digital Images and Human Vision,* Cambridge, Mass., 1993.

12. See C. A. Glasbey and G. W. Wittorgan, *Image Analysis for the Biological Sciences,* Chichester, Eng., 1995; and R. Wootton, D. R. Springall, and J. M. Polack, eds., *Image Analysis in Histology: Conventional and Confocal Microscopy,* Cambridge, 1995.

end programs are available that automatically find certain forms in images using *shape-recognition* software, so that computers can locate tumors in breasts or find galaxies on astronomical plates. Many new ways of thinking about images wait undiscovered in that literature.

It is not unusual for physicists and other scientists to rely almost exclusively on on-line papers for information about their specialties. The major physics journal, *Physical Review,* is sometimes regarded as a "backup"—an archival copy of data that is more quickly available on-line. Abstracts and full contents of papers given at physics conferences are available on the World Wide Web (which was invented by physicists) in a variety of formats for different kinds of computers.[13] So far art historians can find only bibliographic resources and image files on-line. Why not post papers as well? In the scientific community it is understood that electronic texts may not be polished, and the prefatory material normally specifies the degree of precision they have reached. Wouldn't it be interesting to be able to access recent papers and works in progress, from around the world, on any subject?

Here, too, an issue that seems wholly pragmatic and straightforward leads into deeper questions about art history. Part of the reason art historians don't post conference papers and works in progress has to do with the relative lack of technological expertise. But there are more interesting issues here as well: we do not collaborate as often as scientists, and we place a higher premium on polish. Sometimes those choices make sense, but often they don't.

Computer graphics is the brash offspring of technology, and art historians are developing a love–hate relationship with it. The ubiquitous blurriness of our images, the ongoing exclusion of computer-assisted art, and the widespread reticence about endorsing computers as research tools are not just problems that are best solved by specialists: they are opportunities to inquire into some of the fundamental assumptions that structure the discipline.

James Elkins has written on digital images for Leonardo, Computer Graphics, *and* Meaning. *His most recent book is* The Object Stares Back: On the Nature of Seeing *[Department of Art History, Theory, and Criticism, School of the Art Institute of Chicago, 37 S. Wabash, Chicago Ill. 60603, j.elkins@artic.edu].*

13. See http://xxx.lanl.gov/.

Making Computers Work for the History of Art

Marilyn Aronberg Lavin

The idea of combining computers and the history of art may still be problematic but it is no longer shocking. Art historians now understand that databases, electronic bibliographies, storage and retrieval, and high-quality digitized images may be complicated and expensive to create, and often to use, but are larger, faster, and more reliable forms of what we want and need to carry out our work. The question that remains is: How are these electronic services going to affect the *way* we work? Simply emulating what we already have, by massing random accumulations of digitized material, brings no solution to the coordination of images and ideas. We are now at the stage when we must think about why and how electronic facilities could change our personal research; how they could transform our approach to teaching; and, in the end, how they will affect the art historical direction in which a new generation of art historians will take the field.[1]

As I see it now, there are three types of art historical activities that will result from the electronic revolution, all of which will change and benefit the profession: (1) personal database construction, (2) collaborative research, and (3) interactive teaching. I will take advantage of the space allotted to me here to describe what I mean on the basis of both experience and desire.

To my great sorrow (which I have been feeling since the early 1980s), I have not been able to think of a term other than *database* for a collection of research material on a given subject put together by an individual scholar. Normally, the word *database* conjures up the notion of something encyclopedic, huge in size and public in nature. What I am looking for is an expression for a mass of material that is intellectually focused on a particular issue, that is constructed and used privately by a scholar in considering a specific problem, and that becomes a permanent, retrievable record of a sequence of personal ideas and sources. Assembling such private databases is the first step in making the computer work for you as more than a word processor. This first step is a big one because it takes some conceptual reorientation and not a little bit of time.

A natural reflex is to think that the computer will receive your facts and ideas in outline form, the way you would arrange them on cards in preparation for a lecture or a publication. You could, in fact, make such a collection using a normal word-processing program, but you would be able to search the text only word by word or, at best, phrase by phrase. You would not be able to search for ideas and combinations of ideas, and you would not be able to ask questions. The way to make the computer work for you is to choose a database program (by now there are many commercial ones available)[2] and give it a problem. Suppose you have a series of paintings that have lost their original frames and you wish to study the historical possibilities for reframing them. You have done research on the problem and found many works documented as being in their original frames, all of which match the period of your frameless examples. What the computer wants

first—indeed, must have—are the categories that make up the kind of material you have amassed. Technically, these categories are called *variables,* and to find your variables you must turn your thoughts around and literally (not theoretically) deconstruct your information. If you wish to record information about historic frames you must first think of as many elements as you can that associate one frame with another. Ironically, this means that in order to differentiate one frame from another, you must first consider what all frames have in common. To be specific, frame variables might look like the following:

original parts (top, bottom, sides);
shape (rectangle, square, gabled);
material (wood, stone);
dimensions;
surface treatment (molded, carved, inlaid);
decorative style (architectural, organic, geometric);
color (gold, brown, black);
name of maker (document);
date of construction (document);
cost (labor, materials);
associated painting (title and locale);
    support (wood, canvas);
    type (portrait: independent; altarpiece: polyptych, "pala"; main panel, superstructure, wing, predella, finial)

Tedious as this process may seem, you assign these *fields* once (in the database application of your choice), and forevermore you have a "place" (a box or pigeonhole) in the computer where that bit of information, and only that bit, is always found. There will be no more decisions to make, and no more wearisome searching through your notes. You find a new original frame and you know how to break it down, enter the data, find it again and put it back together, compare it, fill it, and use it in a new context. Moreover, by the time you have done the research and entered the salient features of six or seven frames from a particular period, you will have a profile and a reliable set of statistics from which to generalize.[3]

What I have described is a brief and simple example of identifying the characteristics you want to study, then storing them and making them available in a clear and consistent manner. At this stage, however, the database is flat or two-dimensional, adequate for statistics but not for analysis. You are ready to define the other dimension of your problem, namely, how to choose the appropriate form in which to reframe the paintings you are studying. To find what is historically and physically possible, you must make comparisons among types, shapes, materials, styles, colors, and so on. For that purpose you must add a third level to the database to make it *relational.* You must use a specific kind of software that allows you to create *links* to bring the separate elements of your information together into multiple relationships.[4] The links are defined fairly simply, using phrases such as: same as, looks like, similar to, taller than, same maker as, documented with, and so on. Obviously, matching the physical characteristics of frames is a stepping-stone to the examination of larger, more complex concepts of margins, boundaries, and borders, where, however, the same structure and study principle would apply.[5]

A textual database for the history of art is only half the story. When research starts with objects, images are the point, and, happily, multimedia was invented to respond to this need. However, when we move into the area of digitized images, we are no longer talking about the isolated scholar working alone.[6] The best way to combine a research textual database with visual images is to have a graphics specialist interested in art history as a colleague. (Incidentally, this is a field that must be developed and nurtured by art historians. It is our job to make work in this area more attractive and exciting than more profitable but boring electronic [graphic] work in other fields.) To compile a visual compendium with an intellectual structure, again there must be a problem to solve. This time, let us say you are asking how to relate Gustav Klimt's murals in Vienna to the Renaissance fresco tradition. To go with your textual database, you will want, aside from all the images of Klimt's mural works, comparative examples of public wall paintings on similar parts of buildings from previous periods. And you would want to see how all of them functioned in the architectural environment. Only the art historian knows which images to choose, where and how to procure them, which are of the best quality, and what is the most useful level of reproduction for the purpose (recogni-

1. In my opinion, most of the work of transforming the material of the humanities into electronic form now in progress is essentially aimed at doing "more of the same." Technicians try to figure out how art historians and other types of scholars work and then style their product to fit their interpretation of what we do. As far as I can see, their research is taking them deeper and deeper into the psychology of information transfer without giving much thought to the significance of the results we produce; see David Bearman, "Overview and Discussion Points," in *Research Agenda for Networked Cultural Heritage,* The Getty Art History Information Program, Santa Monica, Calif., 1996, 7–22 and passim. At the same time, slide curators are at the forefront of the battle over copyright. As we speak, they are fighting for our right to have the equipment we need to do the most rudimentary type of teaching. If they win (God willing), we will be able to have the slides we need and digitized versions as well, at least for in-house teaching. Students will have a more efficient study tool, and teachers will not have to gather slides again and again, each time they lecture. But little thought is going toward what we can do with the electronic images beyond merely using them as a replacement for slides.

2. Some examples are Microsoft Access; FileMaker Pro; Lotus; D-Base, and so on. I still use the old Q&A because the custom template is so easy to set up, but I don't like the difficulty it gives in printing.

3. Incidentally, you will have some information on the principles of interior design in your period, and you will have some evidence for the relation between style and function.

4. Many database frameworks, for example, Microsoft Access, can be programmed to be relational. Examples of larger, more complex applications are Calyx APPX3, Sybase, and Oracle, to which I will refer further below.

5. An example of another, more complex problem might be something like: analysis of Federico Zuccaro's academic theories in their historical context. Here it would be necessary to define 16th-century pedagogy, artistic aims and goals, and literary forms with variables such as the age of students; types of media; concepts of imitation; techniques of copying; antique models; live models; types of drawings. Other examples might be correlating the concept of infinity with Baroque ceiling painting (here the correlation would be facilitated with a database of formulas and images, manipulated with the three-dimensional *walk-through* facility), or connecting 20th-century artistic abstraction with alcoholism and/or drug addiction, with the aim of relating style to medicine and diagnostics, a statistical problem perfect for computers.

6. I am now speaking technically; see Howard Besser and Jennifer Trant, *Introduction to Imaging: Issues on Constructing an Image Database,* Santa Monica, Calif., 1995. I am not, in this case, concerned with the thorny problems of copyright. On the contrary, I would like to assert that the problem of fair use for nonprofit scholarship is a red herring, and that the pursuit of knowledge in the history of art is identical with unrestricted access to visual images.

tion, study, publication). But the technician will know the resolution at which to scan the photographs (and, in the near future, the objects themselves), how to execute the scan, how to send the scan into the proper place in the database for storage, and how to link it to the related textual material. In the case of three-dimensional environments, the subject of study in themselves or the locus for mural or sculptural decoration, the graphics expert will be able to suggest and create the most effective modes of display in the computer. These modes can include thumbnail/pop-up still images or three-dimensional quick- or real-time walk-throughs, all of which can be made to respond to relational searches in the text database. These remarks are based on my personal experiences in working with my collaborator Kirk Alexander and a group of technicians at Princeton University. Together, we have developed just such a framework for relational databases of text and images, one of which we have filled with material on the career of Piero della Francesca; it is now known as the Piero Project.[7] For this purpose, we produced a program we call Electronic Compendium of Images and Text, or ECIT, of which I will say more below.[8]

I have described one type of collaboration involved in electronic research activities. But that is only the beginning. In fact, I believe the days of the solitary scholar alone in a study are numbered. There is simply too much to know and learn; no one can keep up with all the literature in all the languages. I envision scholarship done in teams, with shared ideas and a pooling of knowledge, and I envision the process not only taking place as side-by-side activity but also carried out over electronic networks. This process is already in operation, at least in embryonic form. There are a few group electronic mail services dedicated to art and art scholarship. I am the moderator of one such called the Consortium of Art and Architectural Historians (caah@pucc.princeton.edu), numbering nearly a thousand participants (faculty and students) from all over the world. On CAAH, discussions are restricted to research and theory questions of a broad nature; teaching approaches; bibliographic searches; access to archives and collections; costs of photographs and publication permissions; copyright issues; contents of colloquia (often with abstracts of papers); previews of tables of contents of scholarly journals, with abstracts of articles when possible; questions of principles and ethics in the field; technical problems and innovations when they have to do with art and architectural scholarship. Very often a *thread* (a topic, question, or set of ideas) will take off spontaneously and stimulate input from various quarters. The moderator keeps a separate file and can relay, recap, or repeat the discussion on request. So far, these threads have followed the course of events, with no a priori guiding principle. I can imagine, however, a team forming around a given topic, with members of the group participating from their home countries, each having different resources and differing expertise to work with, pooling their research and producing results that are larger than the sum of the parts. Scientists have been doing this sort of thing for a long time because it is impossible for them to work any other way. Humanist scholars are not yet accustomed to the sharing of information. Once we see how profitable it is, I am sure we will embrace it. Research sharing can function on an international level (as it already does to some extent on the CAAH mail service). However, the approach would be even more efficient if used by members of a single university, or members of a single department, or members of a single seminar, mainly because the technical adviser would be close at hand to provide enhancements to the electronic interaction.

The framework for multimedia databases called ECIT, whose research potential was described above, uses the Oracle relational database software and was developed to operate on Silicon Graphics workstations; it is currently able to function, in a limited way, on personal computers via the Internet. It was originally designed for teaching and has been used for art history seminars team-taught at Princeton University by myself and Kirk Alexander, a graphics specialist who majored in art history as an undergraduate. What we accomplished was the replacement of the traditional slide lecture–passive student technique with a new teacher-machine-student relationship which might be called interactive. In brief, the new approach goes like this: the instructor fills the ECIT framework with all her/his materials for the class before the semester begins: all the visual images, still and moving, all the facts, all the conceptual ideas and interpretations, linked in multilevel relationships. At the beginning of each class session, the students at workstations with direct access to ECIT are given a number of key words pertaining to the day's subject (for example, in one class, I gave them the key words Heraclius, Arezzo, flags, and bare feet, all of which have to do with Piero's fresco cycle of the Story of the True Cross). Instead of being shown slides and hearing a lecture, the students searched in the database to discover for themselves images and textual information related to these words. There being no set way to search, individual students followed different paths with diverse links and thereby came up with varying results. Often the results seemed puzzling or even contradictory, and thus would generate questions. On this basis, conversations began between instructor and student, between student and student, between student and machine. Guided by the instructor and assisted by the technical associate, these discussions became the major instructional vehicle of the course.[9] Since ECIT does not spoon-feed the students a narrative of facts and the aim of discussions is not predetermined, each class is directed by the students' desire to understand paths of inquiry and to find resolutions to questions. With a new sense of empowerment, they receive information through participatory discovery. Their searches also lead to a range of bibliographical sources and thus the means to carry forward study and research outside the class. At the same time, with all the images and information related to the course on-line in ECIT, they obviously also have an extraordinary study tool.

It is important to keep in mind the following facts: as opposed to the implications of courses prepared on videotape or on CD-ROM, the ECIT interactive method cannot function without the instructor. ECIT is not designed to hold long prose explanations. Rather, it is the reflection of the instructor's research and preparation for the class. It contains isolated facts and ideas (concerning artifacts, people, content, and context) linked together in visual, historical, intellec-

tual, and sociological relationships. The instructor's job in class is to spark discussions, keep them on track, help develop and temper concepts, add material when relevant, and listen to student suggestions. One of the beauties of ECIT is that technically it is "alive": that is, information can be added, mistakes corrected, ideas expanded "on the fly," while the class is in progress, if necessary. The new material and the adjustments are immediately available in the database.

One use of the ECIT framework that has not yet been tried, but which seems like a good idea, would be as a repository for material assembled by the students. The students of a single class would make a kind of Seminar ECIT into which they would enter research material jointly. All of the students would also create a database of personal contributions directed toward the substance of their term papers and class presentations. The personal compendiums would initiate a permanent repository of their work, interests, bibliographies, discoveries, and participation in the field, which would remain valuable throughout their careers. Simultaneously, the Seminar ECIT would grow and become a permanent record of the class activity.

Alexander and I applied for a grant to help teach these techniques to a number of colleagues in a variety of art historical areas. Unfortunately, we were unsuccessful, essentially because the Department of Education (which had supported our original project) expected our "dissemination" to result in dozens of classes teaching hundreds of students electronically almost immediately. The truth is, making the computer work for you is a labor-intensive process, in which all the scholars involved must do their share. Starting with you and the machine, alone in the room, in the beginning you will invest quite a lot of time shifting your line of sight. But in the end you, your colleagues, your students, and the field of art history will have acquired the means to expanded horizons.

After spending fifteen years on Seventeenth-Century Barberini Documents and Inventories *(1975), Marilyn Aronberg Lavin created one of the first art historical databases to study a thousand years of fresco painting. She now works with electronic imaging and real-time movement for research and instruction. She frequently teaches at Princeton University [Princeton, N.J. 08540, malavin@princeton.edu].*

7. Marilyn Aronberg Lavin, "Computers and Art History: Piero della Francesca and the Problem of Visual Order," *New Literary History,* XX, no. 2, 1988–89, 1–22; idem and Kirk D. Alexander, "The 'Piero Project,' " in *Monarca della pittura: Piero and His Legacy,* ed. M. A. Lavin, Studies in the History of Art, XLIX, Washington, D.C., 1995, 314–23. Demonstrations can be seen on the Internet at http:/mondrian.princeton.edu/piero/.

8. This framework, in fact, can be used to hold the data of any humanities subject that makes substantial use of visual material.

9. In a situation with more students than workstations, the students work in groups but the technique is similar. Instructors of much larger lecture courses, having prepared material on a given subject and entered it into ECIT, perform demonstration searches with the contents of the compendium projected on a screen. They have available several techniques for making the material more dynamic than usual, including still and moving images that can be manipulated and three-dimensional walk-throughs to convey context. A chained-movement facility allows instructors to analyze complicated structures visually, as they continue to lecture. With more than one machine available, students can follow searches in class. Between classes, at their own pace, they would use ECIT on study workstations, not only for study and review but also, on the basis of facts gleaned in class, for assignments to search for new ideas and combinations. The very scarcity of machines might suggest the use of equipment in groups, thus introducing the notion of teamwork, a factor to be dealt with as technology becomes more complex. Far from offering easy answers and opinionated end points, such purposeful assignments, as well as the quizzes based on them, make use of ECIT as a springboard to further library research and truly enhanced visual literacy.

A View of the Intersection of Art and Technology

Nancy Macko

In 1988, as the most junior faculty member of my department who happened to be teaching "printmaking" or "graphics," I was asked to investigate computer "graphics." Fortunately, my forays into this new field were not only successful, but also gratifying—it was as if I had finally found my métier! At that time, SuperPaint only worked in a black-and-white mode, and Adobe Photoshop was barely cutting its teeth in a beta version form. The options available to artists who began to explore the world of digital imagery at this time were limited to very pixilated and bitmapped files, very few tools with which to manipulate them, and little ability to convert a given file to another software application, let alone output it. So, what drew our attention to the digital world and then held our interest? I remember learning somewhere along the way of my many years in art school that if it didn't take a certain amount of time to create a work, then that work was somehow less valuable or meaningful or important than one that did. But how many times did we make work that, two-thirds of the way through, we knew wasn't "right" and started over? The computer seemed to provide speed and ease, and frankly, it was a relief finally to work with a medium that could keep up with me in real rather than glacial time.

I think the insidious thing about computers is their intrinsic ability to emulate metaphors. Ironic? Not really. People often use metaphor and analogy when speaking of or about the computer. (For example, "The information didn't have enough time to get to the hard drive" was how my friend Bev described her sister-in-law Sandy's lack of any memory of her hang-gliding accident in which she fell 900 feet with no parachute after I'd been foolish enough to ask if she remembered anything.) We even name them. All the computers in the art lab at Scripps are named after goddesses, both ancient and contemporary; we have Sappho, Red Sonya, Vidietta, Medusa (she makes you want to pull your hair out), Techne (this one's mine; she's the goddess of art and science or craft and technology), Chimera, Hekuba, Electronica, and Madonna.

Do we think like the computer or does the computer think like us? I am writing these notes on an airplane to New York, and the man sitting behind me is explaining to the woman next to him that someone told him that our brains are just like the computer. Hello, isn't this backward? Who's the progeny here? Isn't the computer more like our offspring, designed to reflect the way our brains operate, and not the reverse? I once made a list of terms that are now part of our everyday usage—window, thumbnail, database, bitmap, download, point and click, icon, delete, on-line, noise, morph, snail mail, e-mail, dialogue box, plug-ins, wysiwyg (what you see is what you get). Technical terms have pervaded, invaded our everyday language on a scale equal only to their presence in our lives on an everyday basis.

And it isn't just the terms that are here to stay. The images—digitized, "videoized," animated—appear on book covers, billboards, buses, and signs we encounter in our daily movement; in innovative films—usually action or animation; and before our eyes in split-second hits as commercials on television. But with all this imagery, are we actually any smarter as a culture in interpreting the "meaning" or the symbolism inherent within many of these images? This is where education must play a vital role. Visual knowledge, visual competency, and visual information all draw on different skills.

Teaching computer art, I have observed how the learning curve for this technology delineates itself. First, developing hand-eye coordination (much less necessary now than five years ago, when you had to start students off with mouse training), then moving into desktops, menu bars, and submenus. Once the x and y of these are learned and memorized, we can begin to establish relationships between the mode choice and the adjustment to colors in Photoshop or the file size and resolution to image size and storage. Finally, the student realizes how all these parts relate to the whole, from the artwork in process on the screen to the means for output. Today we have choices between World Wide Web (WWW) or CD-ROM or interactive video or cibachrome photograph or inkjet printer, which is a giant leap from where we started. Previously, we had to photograph the image directly from the screen using a funnel-shaped device to block out the light with the camera at one end and the screen at the other.

The computer mirrors our ability to assimilate paradigm shifts by categorizing, synthesizing, and hybridizing. Multitasking led to hyperlinking but they both represent what began to happen when we were about eight years old: the cognitive ability to comprehend that an object was red *and* round, and not red *or* round, or what I refer to as both/and thinking rather than either/or thinking. This is the logic necessary to comprehend multiplication, a dynamic process resulting from the coordinates at the intersection of x and y rather than the static linear progression of $x+x+x$, $y+y+y$, or $x+y+x+y$. In liberal arts education, we call it the breadth and depth experience. The culmination of the intersection of x and y is often the senior thesis or senior project.

Metatasking—or multitasking at a higher level—is, I think, what keeps us coming back to the computer again and again. This is especially true in image making. I know I synthesize new pieces and parts in my dreams after twelve to fourteen hours of making images on the computer as well as when I've been away from it for two to three weeks. It's a rather amazing phenomenon—learning, while not learning. All of a sudden you understand things you couldn't quite grasp a few days ago. It's a learning curve with a very complex topography demanding that you stay current and keep up. With technology in our blood from the music of the 1960s, the Moog synthesizer, television, Nam June Paik's introduction of the video camera into art in 1965, and armed with a modicum of computer programming skills slightly beyond Keypunch 101, we set off to explore this new landscape. This same process is indicative of technology in general. Just look at the difference in the last eight years: software we relied on no longer exists if it hasn't kept up with changes through upgrades, machines with ten times the RAM and storage, and software that requires both for optimal performance. We now have programs that "talk to" and interact with each other. Last year's

practical marriage of Mac and PC for cross-platform usage certainly ended the debate about a two-party system. A five-year life cycle is now three, with the upgradable RISC chip promising to keep future expenses at a minimum, but peripherals and software also have to be upgraded regularly. It's an exercise in constant maintenance. The real questions are: Can you sustain it? Is it efficient? Well, it's certainly not efficient. Technology has created more work, not less. The endless pixel fix proves this: as in editing text, there's always a dangling pixel, an unindented pixel, a series of pixels unseparated by a comma, and an uncrossed and undotted pixel. Visual editing brings new meaning to "just one more thing."

What does making digital art mean? That you are using a tool that electronically digitizes images into computer bytes for the electronic transfer of information. What does this mean for the artist? That basically she can show her work anywhere that an electronic impulse/signal can be received/transmitted. For what purpose? Well, believe it or not, it is actually generating sales for some artists. People are buying work from a thumbnail image. But commerce is not the only, nor the greatest motivation. Does one adjust one's work to accommodate this procedure? Digital art was and is a natural outgrowth of video and photography. Yet it is more powerful than any other combination of video, radio, TV, film, text, and images. Now that one can create art that works only in an electronic field, this will certainly influence choices and decisions about the work itself. Let's say you prefer to think of yourself as a painter, or photographer, or sculptor who also engages in the digital construction/manipulation of your work as well as the transfer of images for information/communication purposes. How do you straddle both worlds? Right now the technology is in such a fluid state that if you make a commitment to some form of digital communication you can be assured the form and possibly the content will change in perhaps six months and no more than a year. Working back and forth will influence your thinking in both spheres and, undoubtedly, cause you to ask new questions of your work in the traditional medium as well as to look for ways to do new things with technology.

As a painter, as a photographer, as a sculptor, you can enter this medium with all your skill sets and achieve what you were after; in that process, you may also discover that which you didn't realize you'd imagined. Bits, bytes, pixels, sampled color, color tables, levels, modes—digital imagery is a microcosmic world with phenomenal attraction. The possibilities are endless, the manipulations remarkable: sizing, small to large to small again, cut and paste, blend, layers, image and text, collage, brightness, contrast. Like a good consumerist society, it goes on and on, packaged to give us the greatest number of choices and selections. The image itself exists in a space where you can make a virtual world. Whether it's two- or three-dimensional, abstract, hyperreal, collaged, montaged, static, dynamic, still, moving, or interactive, it can be viewed at a speed impossible with any other medium. Image access via databases, which provide speed in relationship to visualization or conceptualization or comprehension of knowledge, is creating visual culture, visual knowledge, and visual information.

Who sets industry standards: .gov? .com? .org? .edu? .net? I have a real fear that in the not too distant future the Internet will become one big infomercial to watch on your TV screen like an eternal home-shopping network. Artists are concerned that their needs and uses of the Internet will be entirely ignored in this process, especially if they do not represent some sort of commercial enterprise. It is critical that there be a place at the Internet table for the artist.

Although new software and hardware become available on a regular, almost annual basis, they are not necessarily affordable. When it comes to making their work using computer technology, artists are still controlled by outside economic forces. The example below of "trickle-down" access is only one of the many factors that actually create limits rather than freedom. Software and hardware development is a megamillion-dollar industry geared to attracting the general public. Artists are not working in the research and development departments of industry or government, and their vision and input are not part of the process that invents the original. We are not at the helm of authoring the new products, nor do we have access to them until much later.

Let's examine the relationship between the movie *Terminator 2* and new versions of related software applications produced for consumer use. In the early 1990s, Industrial Light and Magic (ILM) was hired by Carolco Pictures to create the special effects (aka fx) for *Terminator 2: Judgment Day*. Working with high-end Silicon Graphics IRIS 4D/340VGX RISC processor workstations, PIXAR, one of ILM's subsidiaries, developed new plug-ins for Renderman and Alias Studio 3.0 to create a morphing creature that was fluid and capable of multiple transformations.[1] The result was the T-1000, the "Cyberdyne Systems Model 101 v.2.4" or "mercury" creature in the film. After the film was released in 1991, this special effect eventually became a new feature in a number of software application upgrades, thus making it available to the general public.[2]

Is this just another case of "science becomes art"? Or, like a food chain, is it the economics of technology at work? A software program is developed as a tool for a commercial, albeit an artistic fx (special effects) use, which then becomes available to the general population. In most cases, artists have access to or are using the same software as the average person. What they do with it, the techniques that they employ, is a result of their training or background in art. The combination of training and education helps, but it also perpetuates a certain "art" mentality applied to a new medium. Obviously, in an academic environment like an undergraduate or graduate art department or an art school, this seems plausible. But what about the "art" put on the Internet by people who might be called untrained or unschooled? There is a difference. Is

1. *The Terminator Movies Home Page*, FAQ, v.2.3, http://www.geocities.com/Hollywood/6601/q7-8.html.

2. Prior to the release of the film, PIXAR shared some of its technical wizardry with those attending Special Interest Groups in Computer Graphics (SIGGRAPH) '91 in Las Vegas at an educator's panel on special effects.

this a "high/low" class attitude? Are we being "art" snobs? Or is the margin pressing in on the center in such a way as to cause new hybrids of visual work in which design plays a stronger role than before, when it was relegated to a separate field, and in which the untrained image maker has enough technical expertise to create visual work? How was it informed by the "art world" or an "art school" mentality? The very nature of the medium is cause for both celebration and concern for the "state" of visual art as we have known it. The beauty of this technology is the opportunity it offers to artists to expand the field, and artists must be part of the guiding body that regulates its use. Artists want greater freedom of access and expression to images than anyone else and, at the same time, equal protection of their images. We must advocate and represent a freer and more open use.

The field of technology sets up an attraction that is at once seductive and compelling yet restrictive and elite, establishing limits that are at best difficult to deal with and, at worst, impossible to overcome. Cost is one factor. Access is another. Being part of the fuller enterprise is a third. If this is my field, how can I adequately compete with the 1 percent of the artists (such as Nam June Paik, Jenny Holzer, Bill Viola) who have complete access to computer technology? If you're still painting, you can more readily afford paint and canvas, which gives you the freedom to express yourself and equal opportunity with established artists. If you are committed to working with technology, you can see the wide-ranging possibilities for working with this medium demonstrated all around you in the media, the industry (as we, in Los Angeles, refer to Hollywood), and science. The system that makes these opportunities appear available also prevents you from having real access through cost and pricing. You cannot, literally, afford to make critical statements about the very system you might be challenging. Grants are drying up. Everyone is competing for what's left. This becomes almost a moral dilemma in which the very soul and substance of being an artist is not only challenged but crushed in the economic process. One cannot reasonably afford to stay in the game without putting one's family and personal finances in jeopardy or debt.

Once again the artist's voice is eclipsed by factors totally unrelated to any kind of real aesthetic base—factors that inevitably affect the aesthetics of the work. The economics at play have a direct effect on the outcome, on self-expression and on the work itself. If we lower our standards and accept this situation, we are doing a disservice to ourselves as artists as well as to the students we are teaching.[3] I believe we have a responsibility to teach our students the most current material to prepare them for their lives ahead and for entering the work force. This becomes an impossible goal if one does not have input early in the development of new technologies, access to the most advanced technology, and a voice in establishing appropriate standards.

Contemporary art has long played a critical role in meaning making, relying not only on the intellect but also on personal meaning, the senses, imagination, and physical interaction to communicate ideas and form valuable cultural connections. The Internet, via the World Wide Web, has provided artists with global access to culture and visual information beyond anyone's past expectations or predictions. What we do with that is critical if we are to make sense of our world.

At Breakaway Technologies a "webraising" is taking place. Much like an old-fashioned barn raising, here the goal is to enable people from a variety of cultural organizations to put up their own home page on a Web site during a two-day workshop sponsored by the Getty Information Institute as part of the Los Angeles Culture Net project. Breakaway itself is a phenomenon. Located in the heart of south central Los Angeles and nestled in the interior of the African-American community, it is the soup-to-nuts of technology—from hands-on building of computers to workshops and classes teaching members of the community how to use software and access the Internet. It is an extraordinary effort by Joseph and Paula Loeb, the founders, to give the opportunity of access to everyone in this community. Based on the concept that technology is a neutral zone in which anyone can participate, they are providing a service to their community in the hope that the next generation will have it easier economically and can make valuable contributions to our society. Who attended this inaugural webraising? One or two staff members from each of twenty-two different organizations that range from museums (Autry Museum of Western Heritage, Los Angeles County Museum of Art, Korean American Museum) to arts organizations (Rachel Rosenthal Company, Highways Performance Space, LACE, Watts Towers), community organizations (LA Cultural Affairs, Plaza de la Raza, Watts Community Housing Corporation), AIDS service centers (Asian Pacific AIDS Intervention Team), and even a religious bookstore (the Word of Life Christian Bookstore). All were there to learn how to access the Web and create their own home page. The Getty will house the pages on its server for the first two months until each organization has found its own Internet service provider.

Why is this important and what does it have to do with artists? Its primary link is that it is about culture and, in this case, the diverse culture of Los Angeles. The culture of Los Angeles has long been a rich source of interest and controversy for artists—politically, ethnically, historically, philosophically. Some of us are also there to act as facilitators to help the participants learn to use the Web. Since the Web is so visually dependent, we are also there to guide and advise on the graphic components in relation to the textual information. Everyone is learning that a page with no images is one no one will read because it is too "text heavy." The visual elements are necessary to break up the page, provide related information, and keep the viewer-reader engaged.

Despite the notion that the computer will do all the work for you, working with the computer often causes changes in reverse. Individuals may have started out as painters, printmakers, photographers, or sculptors and applied those schools of thought to the work done using the computer, but eventually they become aware of thinking about their work as a result of what the computer can do or provide. Where once their imagination might have been limited by funding, access, or actualizing ideas in physical reality, the virtual world basically removes those obstacles, and artists begin to believe that they can do whatever can be imagined. Somehow there is a way, a software that can accomplish our wildest ideas.

All over the country, technology is causing faculty members in many disciplines to reexamine and retool their curricula. In the arts, the advent of computer technology in general and the digital image in particular has been the source of, and the cause for, curriculum transformation that would do away with media-based majors in order to focus more on process and content. Technology is insidious. It has or will permeate every venue and field. Why do we not just realize that now and begin to build a well-defined department with curricula that more accurately reflect the next stage in studio art practice?

Should you have a computer lab? If so, what do you need to know about building it? It could be integrated in any way that works in your school. The primary considerations are always going to be: money, money, money and support, maintenance, and a workable life-cycle replacement plan. A small endowment is a good idea for the last. Your lab needs to reflect a flexible design that can change and grow with the medium, the student demands, the curriculum, and the ever-changing software and hardware. Where we once began with static image making using funny little drawing programs like CricketDraw and PixelPaint Professional, now we are faced with installing enough storage and RAM to accommodate MacroMind Director to make small interactive pieces for CD-ROM and the World Wide Web. What was once static is now dynamic: from Photoshop we grew to Premiere for video compilation and editing, from e-mail to writing our own HTML and programming. (And you thought if you owned a Mac you'd never have to!) Well, programming has come full circle. Those few logic and statistics classes some of us took—even a little Basic C programming—make a reentry as HTML now in the packaged version of Web design tools and programs like Internet Assistant, WebWeaver, PageMill, Shock Wave, Front Page, and Java. It is also important to consider how you want to link your lab. Do you want to have it be part of another medium, perhaps photography or graphic design, or should it be a stand-alone lab that the other areas can link into? You may wish to refer to the "Guidelines for Faculty Teaching in Computer-based Media in Fine Art and Design"[4] as you begin to discuss and develop these issues.

How will art historians represent the images and the other phenomena created by the technical revolution in the arts and in the art world? Merely presenting digital slide shows, or even interactive slide presentations, barely scratches the surface of what is really occurring, which is truly revolutionary. As my colleague in the Department of Architecture at the Massachusetts Institute of Technology, Professor Leila Kinney, points out:

> There is an overall social significance to creating a situation in which artists feel comfortable making their work widely available for teaching and commentary. Art history has been notoriously poor at dealing with contemporary art, partly, I believe, because the visual material is hard to track down, and most slide curators would rather pick up the Saskia catalogue than call dealers or write to artists themselves. This impoverishes the critical discourse and hampers our ability to comment on contemporary culture. It would be wonderful to see artists, museums, and educators collaborate in changing this situation.[5]

How will contemporary artists' work on the Web be represented by art historians teaching contemporary art and art criticism? What pedagogy will they employ to discuss these changes? What changes need to occur in art history to include aspects of and theories about digital technology? It's a multimedia world—at home, at school, and on the Internet. How will you introduce this technology in your classes? This is how the future of teaching with multimedia looks to me: students will be using multimedia for their projects. We will all be designing and writing multimedia presentations. How we choose to interact now with this media will shape and determine its value and role in the future. At the end of *Terminator 2,* Sarah Connor carves the words "no fate." Remembering her friend Kyle Reese's words to her that "there is no fate but what we make for ourselves,"[6] she realizes that the future is not predetermined. I would like to believe that we, too, have the capacity to determine the shape of things to come and that the future is not set "in stone."

An associate professor of art, Nancy Macko is secretary of the board of directors of CAA and co-chair of the Committee for Electronic Information. She is presently at work on a new installation entitled Re:Envisioning the Melissae, *which will include* Telling the Bees, *a computer-assisted video [Art Department, Scripps College, Claremont, Calif. 91711, nmacko@scrippscol.edu].*

3. In many ways this is similar to the copyright dilemma for text-based researchers, who may soon be experiencing a lack of access to original archival material if the new Conference on Fair Use (CONFU) copyright recommendations are accepted as legislation.

4. Available from the College Art Association, this is the first document of its kind to provide direction and guidance for faculty and administrators working and teaching in this field. In development for more than three years, this document was circulated internationally via the Internet for contributions from artist teachers around the globe. It was unanimously endorsed by the CAA board of directors in October 1995.

5. Leila W. Kinney, personal correspondence, August 1996.

6. *The Terminator Movies Home Page,* FAQ, v.2.3, http://www.geocities.com/Hollywood/6601/q6–8.html.

Digital Imagery and User-defined Art

Gary Schwartz

"It's still the same picture, isn't it? What difference does it make if they change the label?" This is what we say when a museum demotes a painting from "Rembrandt" to "School of Rembrandt" or from "Caravaggio" to "Follower of Caravaggio." Incontrovertible as it may sound, this sentiment is not really accurate. As a physical object, the painting may indeed stay the same at first, but its fate will have been modified. It will be removed from the main galleries and put into storage, on one of those moving racks where it is far more likely to undergo damage or be misplaced. Its condition will no longer be a matter of great concern to the curators. Should a deaccessioning round come up, it will be near the top of the list; there are always gamblers out there who will pay a premium on the bet that the deattribution will be reversed. Once a downgraded painting leaves the protective museum environment, the odds on its long-term physical survival drop precipitously.

Public and scholarly perception of the merits of the painting is affected much more quickly. Hardly has the formula been intoned—"It's still the same picture, isn't it?"—before it starts looking like a different picture, with weaknesses we never noticed until then. Once removed from sight, very few deattributed works are ever asked for again. Their postcards are allowed to go out of print and none of the former admirers of the work complain.

Changes in attribution are not the only external circumstance with deep influence on our treatment and perception of art. The way in which they are reproduced is another. As an art historian working mainly on seventeenth-century Dutch painting, I find myself pondering the possible effects on museum objects of the changes now taking place in the way images are generated and transmitted. The following remarks are limited to one aspect of this many-sided question. Which practice associated with digital imagery is apt to have the greatest effect on museum objects and what form might this take?

The first place I saw color television when it was introduced in the 1950s was at the home of a wealthy family friend, our lawyer and state representative. He turned on his set and began fiddling with the dials that adjust the color. When the complexion of the people in the picture had reached a nice bright orange he grunted with satisfaction and went back to his chair. Before I could stop myself, I asked him whether he couldn't get the colors any better than that. He answered simply, "I know they're not natural, but I like them that way." Indeed, it was his television set and the pictures were being put at his disposal with no conditions attached. Why shouldn't he look at them the way he liked?

A jolt of the same kind awaited me the first time I edited a book with color illustrations, Horst Gerson's *Rembrandt Paintings* of 1968. The powerful lights the photographer turned onto the pictures we were photographing revealed more colors and details than could be seen in daylight—more than could have been seen by Rembrandt. His manipulation of screens and filters and exposure times completed a process that began with his choice of film, with its trade-offs between grain and speed, truth to color, durability, and cost of processing. The results were images that I knew to be full of arbitrary and subjective elements, and yet I was unable *not* to see them as accurate reproductions of the paintings. The following stages as well, technical as they may have been, piled one judgment call on another: sizing, cropping, photolithography, hand correction, platemaking. All of this was a prelude to the *moment suprême* at the press. Four-process colors—the three subtractive primaries (magenta, yellow, and cyan) and black—had to masquerade as Rembrandt's palette, and my artistic knowledge and editorial talents served as their alibi. Painful choices had to be made, safeguarded, and defended. Again, the final product looked to my eye like the paintings I had seen. Here was a microns-thin layer of printer's ink on a sheet of coated stock, with very dubious credentials, and I was seeing it as if it were a robust three-hundred-and-fifty-year-old creation by Rembrandt. I knew that I was deceiving myself, but not exactly how.

A number of things about these experiences upset me and continue to do so. Being forced to acknowledge the inadequacy of the techniques that bring us our daily quotient of images was bad enough. Worse was that our acceptance of images relayed through the media of television, photography, and printing reveals an extraordinary insensitivity to the originals we profess to worship down to their least details. The lowest common denominator between original and simulacrum is low indeed. To call paintings two-dimensional, as we habitually do, is indicative of this reductive attitude. If we are satisfied so easily that an original has been "reproduced," what in the original are we seeing in the first place? The fact that the simulacra are manipulated—guilelessly, unapologetically, as a matter of course—by intermediate operators or the end user means that the ultimate appearance of images we instinctively regard as the work of artists are to varying degrees determined by ourselves. Apparently, we like it that way.

This is not a one-way process. It is not simply a betrayal of the original by the reproduction. Our treatment of originals is also guided by these dysfunctional features in the transmission of imagery. As brilliant color printing captivated the art audience, and viewers like my state representative noticed that they preferred reproductions to originals, museums found themselves in competition with publishers and television producers. They began to glamorize their displays, to vie with the coffee table book. Not only did they introduce spotlights in the galleries to match the effect of the Skira tip-in, they also began restoring their objects more aggressively, to get at the colors that photographers had revealed to the public. Both of these moves necessitated the relaxation of conservation standards. Like a plate in an art book, museum objects were presented individually, out of context, against a plain white wall. Malraux's famous concept of the art book as a museum without walls or *musée imaginaire* is misleading. The

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art book was also a catalyst for turning the museum wall into a vertical coffee table. By the same token, the makeup and dress of television personalities soon came to be a function of the way viewers twitched their color dials. Although I did not go back to check, I have the strong feeling that my older friend was perfectly satisfied with the default setting for the colors of *Dallas*.

Looking back, I now see these developments not as radical changes in the direction of art but as arbitrary stages in the ongoing dialectic between original and copy, model and representation, between an integral prototype and a reduced or codified or otherwise reconstituted simulacrum, which in turn affects the model. Since one person's original is another person's copy, these concepts tend to replace each other and fall into regressive patterns. In one basic sense, the "original" is nature, while the simulacrum—whether produced by hand or by mechanical, photographic, or electronic means—is a work of art.

From this perspective, the digitization of existing images (once more: I am not speaking of digital imagery as a medium for artists) is nothing but another way of reducing an original, by means of a conventional code and its instruments, to a representation we experience as an acceptable surrogate. It is then to be expected that the process of digitization, like every other form of facsimile production, will introduce its own dysfunctions and distortions into this process. The next question to ask is: At what junctures, with what techniques, does digitization most critically intercept the path from original to copy and the reciprocal movements back to the original? Does it intrude on the process in essentially different ways from photography or video?

For the moment, digital imagery takes the same starting point as those techniques: the visual appearance of an object. In most cases, the "original" for purposes of digitization is photographic, so that the entire subsequent trajectory is subject to the limitations of photography. Digitization is, of course, theoretically independent of photography. Alternatives to photography—radar, thermal, and sonic sensing, radiography, reflectography—are presently employed for special purposes, and in the future may be used to create electronic, printed, or fully physical facsimiles without (or with partial) photographic input. This is a bridge we will cross in 2000-something. However, who can predict whether digitization will be essential or desirable for those purposes? My own feeling is that the present heavy reliance on digitization is excessive. The next breakthrough might well be in robotics or crystallography or another material technology. This may happen before digitization has even achieved its present goals. Digital imagery at the end of the twentieth century, after all, is still anchored, through its dependence on photography, in the nineteenth.

If not at the front end, digitization certainly *has* furthered new action at the output side of image facsimile. Properties of the image that, once defined, used to be irrevocable can now be changed further down the line. There is a steady downward shift, placing more and more power over the appearance of images in the hands of the end user. Since the end user is increasingly someone who scans images himself, maintains his own Web site, or passes on information in some other way, public or published images of any kind are subject to uncontrolled manipulation in an endless loop. No norm for reliability exists, let alone the means to enforce one. The appearance of a representation is a function of the taste and talent of the operator. Two generations after the introduction of color television, a new acme has been reached in the history of user-defined art, allowing the viewer fine-tune control over not only color but virtually every other visual aspect of an image.

As I remarked above, original objects are not outside the loop of mutual influence; they are right in it. Just as the art book affected museological restoration and display practices, so digital imagery is bound to have its effect on art objects. Predicting the nature of that effect is hazardous; I will attempt to limit the risk as much as possible by making the most obvious prediction I can think of, extrapolating on developments that have already begun. And that is: museums are going to give visitors more control over the appearance of works of art; they are going to make their holdings more user-definable.

Museums are already doing what they can to become more interactive. They provide visitors with self-chosen information on touch-screen monitors; they put their holdings on CD-ROM and mount virtual exhibitions on the World Wide Web. In view of public expectations, it is inevitable that they should do so. However, in terms of attracting and holding the attention of visitors, this is a self-defeating strategy. It places the museum in a competitive field where it will always come out second- or third-best to software publishers and Web providers. How many people will want to stand in line in a museum to look at a monitor offering information that they can access at home, with no one breathing down their necks?

Sooner or later, the museum will be induced to play its trump in this game: its control over original works of art. Of course, it is already doing so in negotiations with publishers over rights. But this development is a further slide toward audience loss, albeit compensated by cash. The trump trick I am contemplating would reverse this tendency, by making direct experience of the original an indispensable element for appreciating digital enhancement at its best. In this regard, another form of interactivity is a more appropriate model than the CD-ROM or the Web site. That is, the free-route audio tours one can now use in certain exhibitions or collections. While looking at the original, the visitor can access one or more kinds of commentary to enrich (or at least amplify) the visual experience.

In the scenario I am contemplating, the museum will augment such spoken information with personalized visual enhancements to its displays. Now that we have grown accustomed to looking silly walking around with audio headsets, we have been made ripe for virtual-reality helmets. Whether or not present-day VR can do the trick I do not know. But I do know what I would like to see with it. Let me take the National Gallery in London as an example. While looking at the Duccio *Annunciation* panel, I would like the helmet to show me, in a realistic but differentiable virtual projection, how scholars think it fits into the predella of the *Maestà* and how the *Maestà* looked on the high altar of the Sienese Duomo before it was removed shortly after 1500. If there are

differing theories, I would like to see the best of them visualized, hearing their authors defend them and perhaps debating with each other in front of the virtual display. If I feel like putting in my two cents, I would like to be able to do so. At Jan van Eyck's *Arnolfini Portrait* I might want to see what the effect of a less vigorous cleaning might have been, how it looks stripped, or how a new cleaning would leave it. (For that matter, why not execute that projected cleaning only in the script, and let the painting be?) What did Monet's *Water Lilies* look like in its original frame, or next to its nearest neighbors in the series? Rembrandt's sweet portrait of *Saskia van Uylenburgh as Flora* started out as *Judith with the Head of Holofernes.* May I see the X ray of the head in position? Please zoom in on the right hand of the cittern player in this Godfried van Schalken and enlarge it by a factor of ten. While you're at it, let me hear what chord he's playing. Show me the damage that vandal caused to the Rokeby *Venus.* The golden calf in the Poussin isn't gold enough for me. That's better. Kindly print it for me that way in poster format and have it ready when I return this stupid helmet.

To purists this will be anathema, but as I described it (no doubt in impossibly idealized form), such a display would be primarily an integrated presentation of information, hypotheses, and speculations now offered in diverse media: scholarly articles and monographs, exhibition catalogues, documentary films, digital reconstructions. The three great differences would be: the projection of images into the user's perceived space; the play between the virtual images and the actual work of art; and the user's control of these features.

Whether or not this particular technical application will come into being, I have succeeded in convincing myself that as a result of digitization museums will seek ways of putting more power over the appearance of their objects into the hands of visitors. What effect will this have on the perception of art? By rights it should further subvert the image of the work of art as an immutable creation, looking exactly the way the artist intended it to. The present appearance of an object in the gallery will take its place in a continuum of other thinkable and visualizable guises. In keeping with their work of the past decades, art historians will show works of art to museum visitors and to each other as the mixed products of physical survival, historical contingencies, and conceptual patterns. Ideally, empowered viewers will be able to see the effects of these factors, discount museum interventions, compensate historical losses, and perform viewing experiments of their own.

Although this is how I interpret current developments, I must say that alternatives are readily conceivable. There are other present-day developments that could feed into very different futures. The freedom with which images now change hands is under attack by holders of all kinds of legal rights, some of whom claim control over the form an image may or may not take. The boundlessness of digitization is giving rise to a countervailing need for touchstones, for authenticity, for unmanipulable values, for verity as an antidote to virtuality. To some, art fills this role. The art museum could be further sanctified, the art object exempted from the general thrust toward increasing individual control.

Perhaps both things will happen: the liberation and curtailment of user definition. Allow me to correct that. Undoubtedly, both things *will* happen. Digitization does not come with a compelling value system of its own. The digitized Bible is used by fundamentalists as well as text critics, and both communities also harbor antidigital schools. The research division at Microsoft will design tools that would grant viewers optimal insight into and control over art images while the legal department will be building barriers against their unrestricted implementation. Principled opponents of interference with the artist's work will agitate against virtual reality in the museum.

To predict the outcome of the free-for-all between cultural and commercial interests, techniques, and ideologies that is shaping up would be even more foolhardy than I have been until now. However, I feel strongly that we should be on our guard against one particular combination: the alliance of digital imagery with the sanctification of art. In this constellation, owners of objects and images would attempt to impose on users mandatory perspectives and canonical interpretations of art. The sanctification of art in a digital environment would also play into the unholy hands of the most successful manipulators of images now operating: the games merchants. The makers of pseudohistorical games are already milking the mystique of art for what they can get out of it. I see in this a potentially serious threat to the open discourse on art to which we are so dedicated, and in which we would like to train our students. User definition may not be an unmitigated blessing, but in its opposite lie the seeds of a nasty curse.

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The Policy Landscape

Susan L. Siegfried

Webraising is a term newly coined to refer to the construction of new sites on the World Wide Web (and the collective effort that the activity, like community barn raisings of old, entails).[1] It refers also to the consciousness-raising that goes with induction into the mysteries of communicating via telecommunications networks. The term nicely captures the great leaps in awareness of new communication systems that have penetrated even the most remote corners of academe and the art world during the past five years; most daily newspapers these days carry regular sections devoted to on-line information. The rapid expansion of information technology (IT) is having an impact on the ways information about cultural subjects is created, organized, used, and stored, which in turn directly affect museums, arts organizations, the art market, government agencies, universities, and, increasingly, academics, artists, curators, and dealers themselves. The IT revolution has generated a dynamic between, on the one hand, extreme fragmentation and multiplication of efforts—a kind of postmodern nightmare of disconnect—and, on the other, a need to define policies that will help chart a path through the chaos and the rush. Because such policies are essential to the formation of a stable and robust research environment, my interest centers on the effectiveness of groups specifically formed to make policy.

I have chosen five projects—three international, two national—concerned with policy formation at the highest level. Each embraces the arts and humanities or cultural heritage as a whole—remarkably broad definitions of the field that are politically necessary and technically logical. Each project addresses the basic "who, what, how" questions: Who has access to information and whose rights ought to be protected? What gets digitized and inventoried? What research is needed to make the technology meet the many special requirements of cultural "users"? How should our information be described and handled, organized, retrieved, and stored? Any one of those areas—intellectual property rights, user needs, or standards for the description, linguistic representation, and technical storage and transmission of data—is enormously complex, so much so that a variety of individual policy initiatives have evolved for each set of problems. By contrast, the projects discussed here aim to articulate or implement an overall plan for the field, identifying general goals and recommending acceptable procedures in several critical areas.

Such comprehensive policy formation carries the danger of arriving at (or departing from) an extreme level of abstraction that is not tied to material interests. On the other hand, the pull of self-interest in the opposite direction can lead institutions and projects to develop their own methods, probably incompatible with one another in the larger on-line environment. In Europe (including to some extent the United Kingdom), policies tend to be overarching plans, generated through relatively centralized state or multinational bureaucracies, such as that of the European Union, and these plans are not necessarily in touch with the day-to-day operations of institutions and researchers "on the ground." In the decentralized United States, policies tend to be makeshift affairs, formulated to accommodate the existing practices of institutions and projects that have their own momentum. The image of mediation between the general and the practical proposed for this discussion can be seen as a metaphor for the nature of telecommunications networks themselves: they are radically decentralized and yet depend on tightly regulated coordination, for example, in the form of technical protocols that remain largely invisible to the user.

The European Union

At first glance Europe appears to have its act more together than the United States when it comes to putting cultural information on networks. It has big budgets, an unquestioned belief in the value of cultural content, and strong administrative infrastructures that facilitate planning and coordination. But the European projects are distributed across various bureaucracies that are not necessarily in touch with each other. There seems to be little coordination of the projects, or any specific plans for their convergence in the long term. Those sponsored by the European Union, where most of the money and the initiative reside, have a strong commercial orientation, rendering their cultural voice weak. Nevertheless, they are brimming with confidence and motivated by a sense of urgency about using technology to disseminate culture. What drives this aggressive high-tech attempt to promote culture?

In a curious way the European Union programs recall the social democratic ideologies of the American New Deal, and even nineteenth-century European and American philosophies of cultural improvement that led to the creation of so many museums and art schools. The basic idea then was that culture provides symbolic unity for the state and also benefits industry. Then as now (in Brussels), monitoring spending was less important than spreading money around, in the belief that some investments were bound to produce good results. The European Union has sponsored nearly fifty major automation projects involving cultural materials since 1992, with more on the way.[2] These are funded at a scale that is mind-boggling by American (or other national) standards. Partly owing to an emphasis on research and development programs, projects sometimes overlap in their aims and areas of exploration. The proliferation is justified in sociological and economic terms, which follow confidently from the Treaty on European Union (signed in Maastricht on February

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1. The term originates with Los Angeles Culture Net, a project sponsored by the Getty Information Institute to link electronically arts organizations and museums in Los Angeles (http://www.gii.getty.edu/lacn/).

2. These are summarized by Bernard Smith, "Some EC Initiatives in the Cultural Area," *EVA '96: Electronic Imaging and the Visual Arts Conference Proceedings; New Technical Developments, Future Strategies and Visions*, London, 1996, 12.1–12.18.

7, 1992). New technologies are being enlisted to "disseminate the culture and histories of the European peoples" in order to "increase the citizens' involvement and reinforce the sense of belonging to the European Union."[3] (A subtext, mounting opposition to the threat posed by "Hollywood" culture, surfaced during the Maastricht negotiations.) The language of business is not far behind: "The cultural heritage contained in Europe's museums and galleries is one of the European Union's greatest assets," and many IT projects involving culture are designed to stimulate not simply the tourist industry but also the emerging "electronic information services market and multimedia content industries."[4]

Because reflection on this deliberate multiplication of projects has not been the European Union's style, Europe-watchers are wondering what to make of its sudden entry into the field of policy statements. The European Commission (EC), which proposes projects and implements policy for the European Union, recently issued *Multi-Media Access to Europe's Cultural Heritage: A Memorandum of Understanding and European Charter,* which is the highest-profile policy document currently afoot in Europe.[5] The European Commission went to some lengths to involve everybody in the effort, obtaining endorsements from museums, organizations, and agencies large and small, inside as well as outside the European Union. It set up an elaborate structure to help the cultural community articulate a vision of its role in the information society, consisting of a steering committee established as a result of the memorandum and four working groups in the areas of standards and protocols for interoperability; public awareness, audiences, and markets; ownership and protection of intellectual property rights; and priorities in digitization.[6]

Good-faith observers take the document at face value and believe the European Commission is honestly trying to move the cultural community toward consensus:

> European museums and galleries must formulate a common vision of their role and objectives in the developing information society. If this vision is dictated only by the IT industry or by the newly emerging industry of electronic publishers, the best interests of museums themselves may not be pursued. . . . Only by working together with industry can museums expect to protect and further their own interests, and thereby safeguard the cultural dimension of activity in this field.[7]

Others are deeply suspicious of the memorandum's sponsorship by DG XIII, the EC's information and technology division, while the cultural division, DG X, acts as a silent partner. Skeptics read the document as an agreement that museums will make their information available to the private sector for commercial exploitation. Indeed, companies have rather little cultural "content" to work with and need museums to supply it. Others see the memorandum as laying the groundwork for another round of EC pilot projects, in which more money will go to companies than to collaborating museums and cultural organizations.[8]

It is puzzling that the project, having been set in motion, has no budget and surprisingly little in-house support. Although private sector interests have not, as a result, dominated the working group meetings, only a few of the larger cultural organizations can afford to participate actively since they are required to pay travel and work-time costs for staff to attend meetings and allocate time for them to do the related work. Instead of being an active broker between museums and industry, the EC has left the players to their own devices. While the EC may never have intended to do more than facilitate others to take charge, there is the problem that its policy initiative may not have the dynamics to produce practical results. It is intriguing to speculate about whether the apparent limits on the memorandum's ambitions are symptomatic of larger uncertainties about the future direction of the European Union itself, particularly as its budgets come under increasing scrutiny from member states.

With the steering committee of the EC memorandum in the capable hands of Neil MacGregor, director of the National Gallery, London, one hopes for a positive outcome. In the final analysis, the authority and conviction that the memorandum carries will depend on the European Commission's ability to involve more, especially key, museums and museum associations than presently have a hand in shaping its policy statements.

The G7

Whereas the European Commission does not seem primarily interested in coordination and planning, the G7, or Group of Seven Most Industrialized Countries, is sponsoring a policy project focused on precisely those needs. The G7 Multimedia Access to World Cultural Heritage (not to be confused with the EC memorandum's remarkably similar title) recently identified the development of a long-term strategic plan for cooperation among countries as its major goal.[9] In a sense, coordination is the goal of the G7 project. In much the same way that ministers of the sponsoring countries come together

3. Ibid., 12.1.

4. European Commission, DG XIII-B, *Multi-Media Access to Europe's Cultural Heritage: A Memorandum of Understanding and European Charter,* Brussels, June 28, 1996, 9; and see the DG XIII Web site (http://www2.echo.lu/).

5. European Commission (as in n. 4). The document includes translations in twelve languages.

6. A fifth working group, on integration with libraries and archives, is envisioned but not yet off the ground. Working groups submitted their first reports to the steering committee in Nov. 1996 and were to have presented revised reports in Mar. 1997.

7. European Commission (as in n. 4), 11.

8. The Info 2000 program is often the example cited since it is designed to stimulate the multimedia content industry and was introduced at about the same time as the *Memorandum of Understanding.* Info 2000 is budgeted at 65 million ECU (approximately $65 million) over a four-year period from Jan. 1996 through Dec. 1999 (http://www2.echo.lu/).

9. As indicated in the report of the Sept.–Oct. 1996 meeting of the G7 Multimedia Access project (http://www.iccd.ministerobbcc.it/g7/g7oct96.htm).

10. See http://www.iccd.ministerobbcc.it/g7/.

11. See Robin Thornes, *Protecting Cultural Objects through International Documentation Standards: A Preliminary Survey,* Santa Monica, Calif., 1995; and http://www.gii.getty.edu/gii/pco/index.htm.

12. Getty Art History Information Program, "Report on 'Strengthening the Cultural Sector through Information Technology,' " a meeting hosted by the Getty Art History Information Program on behalf of the President's Committee on the Arts and Humanities, June 12, 1996, 12, 8.

13. For example, the Association of Art Museum Directors is planning an image bank "of thousands of works of art" called the Art Museum Image Consortium (AMICO) and intends to charge for access and other services such as "framing and packing" digital images and text to suit the needs of

to manage the global economy, the cultural heritage group is trying to facilitate information exchange on a global scale. This requires them to start from existing practices and work toward general agreements. The cultural heritage project is dedicated to respecting activities already under way in each country; in fact, the group's purpose is to leverage existing work rather than to create another new project. The group's challenge is thus to devise a framework that brings pluralism and common aims together. G7 Multimedia Access will base its plan on information to be gathered in four areas: standards (led by the United Kingdom), legal rights and fair use (led by the United States and Canada), technical research and development (led by France), and testing and application, including education and training (led by Italy). Germany and Japan will actively contribute information. The group expects to make its findings publicly available on its new Web site.[10] Prestigious and truly international in scope, the G7 project hopes to set the example for convergence and coordination rather than proliferation and commercially driven competition.

Protecting Cultural Objects

A strongly interventionist approach to policy formation has worked remarkably well in an international project of the Getty Information Institute called Protecting Cultural Objects in the Global Information Society. This initiative set out to establish a worldwide standard for a core set of categories of information needed to identify a specific cultural object, enabling the information about stolen objects to move as quickly as the objects themselves.[11] To bring this off, the Getty managed to bridge chasms of noncommunication among professional groups as different as museum record-keepers, police agencies, insurance companies, national inventory specialists, appraisers, dealers, commercial art-theft databases, and standards organizations such as the International Council of Museums Documentation Committee (CIDOC).

The secret of success? Beyond the Getty's diplomatic skills and expertise, it probably lies in having engaged the participants' self-interest. Art theft is global, and the only way to impede it is for all parties concerned to agree on a common method of documenting art objects and moving that information rapidly. Oddly, a strong sense of nationalism works here to reinforce international cooperation: countries want to preserve their cultural heritage as a source of national identity in the international world. They are consequently willing to support a broad-based international agreement (the standard is based on responses from eight hundred institutions in eighty countries), which is further endorsed by highly respected international organizations such as UNESCO, the International Council of Museums, the Council of Europe, the U.S. Information Agency, and a host of professional and governmental organizations. The project also appeals to financial interests vested in the transport and sale of art: dealers, for example, might consider a standard that helps them distinguish between legitimate and illegitimate transactions. All in all, people are prepared to put money and resources into cooperation if they believe they are getting a return on their investment.

NINCH

In the United States, the government believes that it needs no shared nationalist ideology, nor the attendant cultural trappings, to hold the country together. The culture of capitalism is accepted as binding. Although the mavens of American culture worry about its "homogenization . . . by mass media," they are in fact losing faith in the old model: "The inability to articulate the social values of art and culture makes it impossible to argue effectively for their support."[12] As a sign of the times, cultural organizations are making peace with the market economy as they consider their IT future.[13] The Clinton administration has recognized private-sector investments as the mainstay of IT development in all areas.[14] With little government or commercial support in sight, American cultural organizations are attempting to draw together on their own initiative.

Engaging the self-interest of these organizations is the major challenge facing the National Initiative for a Networked Cultural Heritage (NINCH). In an unprecedented move, twenty-two arts and humanities organizations, including the College Art Association, have joined forces to protect their common cultural flank, so great is the threat of being bypassed by the increasingly commercially controlled electronic superhighways.[15] The National Initiative is trying to affect rather than set policy. NINCH provides a forum on IT issues for cultural organizations busy with other concerns; in fact, part of its mission is to educate members and build a sense of community among them—no small task, given their diversity and lack of history of working together. At the same time, this new coalition needs to demonstrate value for money to its financially stretched members. The common ground they have found is advocacy.[16]

educational or other clients (see http://www.AMN.org). In effect, museums are taking into their own hands the exploitation of digital images that Bill Gates began with his company CORBIS. In an educational context, the final phase of the Getty Information Institute's Museum Educational Site Licensing (MESLE) project is an economic study (funded by the Andrew W. Mellon Foundation) of what it costs museums to ready images for digitization and universities to use them in classrooms (see Howard Besser's home page at http://www.sims.berkeley.edu/~howard).

14. See the National Information Infrastructure Agenda for Action, sec. 3, "Need for Government to Complement Private Sector Leadership," http://www.usgs.gov/public/nii/NII-Agenda-for-Action.html. President Clinton has pledged some federal support of IT development in the educational sector, urging the Federal Communications Commission (FCC) to mandate discounted rates for the provision of telecommunications services to schools and libraries and proposing federal monies to help universities and national research laboratories build the "Next Generation Internet" or "Internet 2." Progress in either area still depends on private-sector investments. For a summary of the FCC and universal service, including voluntary private-sector initiatives such as Net Day, see *Networked Cultural Heritage Newsletter*, nos. 3, 4, Oct. 23 and Nov. 8, 1996 (published through the NINCH-Announce listserv of the National Initiative for a Networked Cultural Heritage, ninch-announce@cni.org, and in a hyperlinked version on the NINCH Web site, http://www-ninch.cni.org/news/news.html); on Internet 2, see articles in the *Chronicle of Higher Education*, XLIII, Oct. 11 and 18, 1996, and announcements from Oct. 15, 1996, and earlier posted on the Coalition for Networked Information Internet/World Wide Web site (cni-announce@cni.org). It should be noted that museums and other cultural organizations are not on the Clinton administration's map of the new electronic superhighways.

15. For a list of members and other information, see the NINCH Web site (http://www-ninch.cni.org).

16. David Green, "Building the Machine: A Start-Up Strategic Plan (draft 4)," Mar. 1996–Sept. 1997 (courtesy of the author).

The National Initiative's first opportunity to exercise leadership is coming in the vexed area of intellectual property rights. NINCH was among those organizations that recently persuaded the Department of Commerce to suspend a proposal for copyright legislation covering the national telecommunications networks, on the grounds that any decisions would be premature. In the ongoing debates, NINCH is agitating for broader consideration of principles such as fair use in the digital environment and plans to mobilize its constituency to respond to an interim report of the Conference on Fair Use, a document that will be referenced in the revised copyright legislation.[17] In representing the diversity of the cultural community, the coalition could serve as a vital point of convergence between the deeply divided positions of rights holders and rights users and help move them toward consensus, setting an example for the field as a whole.

Arts and Humanities Data Service

While NINCH, my American example of a national policy initiative, is situated outside and even opposite government, my British example is funded and coordinated by the state. The United Kingdom's Arts and Humanities Data Service (AHDS) is comparatively robust thanks to government funding, with an agenda that includes nitty-gritty, labor-intensive tasks (collecting, cataloguing, and preserving data, for example).[18] The Arts and Humanities Data Service has all the earmarks of pluralism that characterize the 1990s on-line environment—it is decentralized, standards-oriented, and promotes flexible frameworks. Its modus vivendi seems to be "divide and conquer," as it has divided up responsibility for collecting data among five service providers, respectively concentrating on history, textual studies, archaeology, the visual arts, and the performing arts. Each provider further specializes in knowledge of a particular format (media type); thus the consortium based at Surrey Institute for Art and Design, in charge of the visual arts, will develop an expertise in digital images.

At an epiphenomenal level the Arts and Humanities Data Service looks like a thoroughly disinterested organization. But government funding doesn't come in Britain these days without being tied to a scheme for saving money or making sure that it is well spent. The AHDS is part of a culture of accountability. "Distributed" though this "virtual collection" may be, its highly rational organization, with pods linked to a central executive in London, is conceivable only in a relatively centralized bureaucracy. The AHDS appears to make good use of that bureaucracy, in contrast with other British initiatives involving IT and culture that have issued blanket policy statements that seem remote from the organizations affected.[19] In coordinating laterally with governmental and nongovernmental agencies, the AHDS has gained the support of key grant-making bodies, such as the British Academy and Leverhulme Trust, which require or recommend that their grant holders deposit any data sets they produce with the AHDS or other national archives. The AHDS will establish benchmarks for evaluating data sets—it means to promote the creation of well-documented, reusable digital resources viable over the long term—which can ultimately help scholars gain professional recognition for their work. In turn, the Higher Education Funding Councils of England (responsible for creating the AHDS) are prepared to consider deposited databases—those accepted and evaluated by such approved archives—alongside traditional print publications when they assess scholars' research, during the so-called Research Assessment Exercise that determines the allocation of funding to university departments.[20] This is the dream that "wired" American academics in the humanities have had for some time—how to get tenure committees to evaluate computer projects on a par with print publications.[21] But its realization in the United Kingdom comes with conditions. The AHDS makes it possible for the government to monitor its expenditures on research in a given area and helps to make that research more accountable. Whether or not Great Britain's multiplying procedures for monitoring research produce truly useful results, they create the illusion that the government is spending money in a responsible way.

The emergence of parallel policy initiatives in the area of IT and culture can be taken as a sign of health—evidence that cultural organizations are speaking up for themselves, evidence of a potential for synergy. Yet there is also concern that the efforts will amount to nothing, that they will turn out to be all framework and no substantive application or, despite calls for cooperation, will bog down in duplications of effort that the cultural field can ill afford. There is something surreal about the fragility of the present moment: the issues and developments outlined here are extremely important and bound to affect us all, but if any of the policy initiatives were to fail most of us would not even be aware of it. Yet what is at stake is nothing less than the ability of all cultural "users" to participate in the new world defined by network connections. For that reason it is worth stressing a few points.

The United States and the European Union are similar in the extent to which their development of telecommunications infrastructures has an intensely political dimension. For all their differences, policy initiatives in both places are being shaped, if not determined, by political forces that have very little to do with information technology, culture, or education. These forces contribute to the absence of administrative coordination among national and multinational projects that characterizes the field and they also make it the more difficult, yet all the more critical, for policy initiatives proactively to work together. International coordination on IT development is the greatest need facing the cultural community today. Are French leaders of the G7 working group on technical research and development aware that the American cultural community has already outlined technical needs, in *Research Agenda for Networked Cultural Heritage*?[22] To cite another example, no fewer than three of the projects discussed here, and others besides, have declared their intention to gather information on standards (descriptive, linguistic, and technical) and recommend relevant practices.[23] Even if they are aware of each other's work, awareness is not the same thing as coordinating research and recommendations within an agreed framework. Similarly, formal calls have been made for cooperation between the working groups of the European Union and those of the G7 projects, but cooperation among the lower echelons will have limited results without coordina-

tion spearheaded and supported by the top levels of administration. To be effective, coordination must proceed from a strategic plan for bringing the world's cultural heritage into the digital environment in a comprehensive and coherent way. Such a plan would "survey existing projects, link them where such links (of whatever type) make logical sense, reduce the duplication of effort that wastes scarce resources, and address the many infrastructural issues that block the formation of a coherent cultural information universe."[24]

The problem of the distance separating some policy initiatives from the day-to-day operations of institutions on the ground is exacerbated by a gap in resources and training. In the United Kingdom, for example, institutions of higher education, the primary clients intended for on-line archives such as the Arts and Humanities Data Service, lack the front-line resources and the support and training staff that would enable academics and students to integrate digital resources effectively into their research and teaching. Where monies are available they tend to be invested in equipment and the infrastructure rather than in staff training and user support. Much the same holds true in the museum world. Only two of the projects discussed here, the G7 Multimedia Access project and the AHDS, highlight the education and training of users as priorities on their agendas. More attention needs to be paid to addressing such real needs of educational and cultural institutions, since IT development tends otherwise to support the needs of technology production.

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17. For up-to-date information on the Conference on Fair Use, see the NINCH Web site (http://www-ninch.cni.org/; click on "Copyright and Fair Use"). The conference's final discussion of the report on fair use took place on May 19, 1997.

18. In 1995, the Joint Information Systems Committee of the Higher Education Funding Councils of England committed £1,500,000 ($2,250,000) over three years to establish the AHDS. Its annual budget ($750,000) is more than five times that of America's NINCH ($145,000 per annum, based on three-year membership pledges). For a detailed account of the AHDS, see Daniel Greenstein and Jennifer Trant, "The AHDS: Arts and Humanities Data Service," *Ariadne,* no. 4, 1996, available on-line at http://www.uk.oln.ac.uk; see also the AHDS Web site http://www.kcl.ac.uk/projects/ahds/top.html.

19. For example, United Kingdom, Department of National Heritage, *Treasures in Trust: A Review of Museum Policy,* July 1996, DNHJO168NJ.

20. Daniel Greenstein, "Connecting Scholarly Communities and Networked Resources: The Arts and Humanities Data Service and the Urgency of Collaborative Endeavour," Nov. 1, 1996, sec. 3, "Collections Development" (courtesy of the author; a similar description is given under the heading "Collection" by Greenstein and Trant [as in n. 18]).

21. See Carolyn Lougee, "The Professional Implications of Electronic Information," in *Technology, Scholarship, and the Humanities. The Implications of Electronic Information: Summary of Proceedings,* New York, 1993, 14–16. The full-text version of Lougee's paper has been electronically published by the Coalition for Networked Information on its Internet/World Wide Web site (http://www.cni.org/docs/tsh/www/Lougee.html) and in paper by *Leonardo,* XXVII, 1994, 143–54.

22. Getty Art History Information Program, *Research Agenda for Networked Cultural Heritage,* Santa Monica, Calif. 1996; and see http://www.gii.getty.edu/agenda/home.html.

23. For instance, the United Kingdom's Museum Documentation Association also plans to survey terminology standards; see *MDA Information,* II, no. 2, 1996, 11.

24. Marilyn Schmitt, Getty Information Institute, letter to Minister Plenipotentiary Antonio Puri Purini, deputy chief of mission, Embassy of Italy, Washington D.C., June 5, 1996.

Educating Digiterati

Barbara Maria Stafford

We have finally sailed into the imaging age and, strangely, art history is not at the helm. Perhaps I am not alone in thinking that there is something deeply embarrassing in our having relinquished to communication schools and literary studies departments, almost by default, any leadership role in the sweeping visualization revolution. It is as if we take no pride in our skill—not as some territorial possession but as a hard-earned accomplishment that cannot be merely exchanged with an alphanumerical literacy. If we do not believe this, no one else will, should, or, in fact, does. This renunciatory stance also begs the fundamental question: To what purpose and why, then, should we be allowed to train students?

Not only has computerism unseated its conceptual parents, poststructuralism and deconstruction, in terms of cultural prestige and social policy,[1] but also the Internet continues to hasten the postmodern liquefaction of media, their lightning-speed transportation to, and combination at, remote sites. Thinned and contextless digital bits drift across countless domestic and office monitors, unmoored from an originary point and disconnected from traditional methods for gauging their reliability. Vannevar Bush, meditating on the impact of the first generation of military-inspired association-making machines, already foresaw in 1945 the future importance of recording and storing the vanishing trails left behind by disembodied and disappearing information. In the aftermath of World War II, manufacturers were intent on devising better word and number calculators. During the last thirty years, however, the expanding techno-communications industry has devoted most of its energies to comprehensive image capture, the development of multisensory immersive systems, and the production of inviting screen displays suitable for Bill Gates's omnipresent "telecommuter."[2]

This paradigmatic shift from linear text to overall pattern is fretted with radical epistemological, pedagogical, political, and organizational consequences. Yet, ironically, the drive to visualize almost everything appears to have gone largely unnoticed by our profession. To be sure, there has been much discussion (spearheaded by the Getty Information Institute)[3] of the computer as *tool*, including the analysis of software, display capabilities, archiving, retrieving, copyrighting digital information, standardization of representations, disparity of equipment, and the broadening of network access. But the very field of scholarship whose historical raison d'être has been thinking with, about, and through pictures has not grappled with the profound *intellectual* ramifications of the digital revolution.

Significantly, symbol-processing technology, initially stemming from the Office of Naval Research, became privatized during the late 1970s and early 1980s with the dissemination of the personal computer. This "counter-cultural machine," in Peter Lyman's felicitous designation,[4] generated fluid forms that challenged former aesthetic values because, paradoxically, they were created precisely in order to be transformed. Unlike the relatively fixed and enduring medium of print, this dynamic and open-ended electronic medium democratically encourages everyone wired into the system to make changes. Further, the optical, auditory, and, eventually, tactile pleasures afforded by surfing the World Wide Web or entering virtual environments and the phenomenal success of navigational browsers such as Netscape entice exponentially multiplying viewers to become part of a global, yet discrete audience in which each person interacts individually with deracinated, mosaicized material, reconfiguring it differently at will. Thus, the delights and enchantments of playful software are modulated by the dangers of romantic solipsism. Visions of rampant "indecency," ominous surveillance, and the destruction of civic life taint the aura of frontier freedom surrounding the Internet.[5]

In my book *Good Looking*, I recently laid out what I thought were some of the major challenges facing the imagist on the threshold of the twenty-first century and then tried to exemplify a pedagogy grounded in visual pragmatism.[6] In my proposal, a gamut of images from the past and present serve both to illuminate optical formats and to communicate or construct research across diverse fields. I can draw attention to only three concerns raised by the universe of binary codes and of icons generated through light pulses that go beyond conceiving the computer primarily as apparatus. Although these issues are central for the arts and humanities and the social, biological, and physical sciences, I want to relate them specifically to an expertise in imaging, that cross-disciplinary area to which, I believe, art history must aspire if it is not to be put out of cognitive and fiscal business.

First, given the fact that legislation affecting distance learning is being contemplated in almost every state, what are some of the key implications for teaching visual matters electronically in light both of a dwindling professoriat and across-the-board cutbacks in graduate studies? Second, in view of the "new, ruthless economy," as Simon Head terms it,[7] what sorts of jobs should we be envisioning for our graduate students pursuing master's degrees and doctorates, and what kinds of general training in visual competence should be broadly available to undergraduates and the public at large? Third, and most important, what can a transfigured art, architectural, and design history substantively and uniquely contribute to one of the major, if not *the* major intellectual and practical issue of our times? How can it help identify and solve real-life problems arising from the digital presentation of information as mutable multimedia that make its study an indispensable skilled necessity? Possessing distinctive expertise is not an elitist aspiration, especially given the current

1. See Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment and the Eclipse of Visual Information*, Cambridge, Mass./London, 1994

2. Bill Gates, *The Road Ahead*, New York, 1996. See also Fred Moody, *I Sing the Body Electronic: A Year with Microsoft on the Multimedia Frontier*, New York, 1995; and Clifford Stoll, *Silicon Snake Oil: Second Thoughts on the Information Highway*, New York, 1995.

3. See the excellent series of essays gathered in Getty Art History Information Program, *Research Agenda for Networked Cultural Heritage*, Santa Monica, Calif., 1996.

4. Peter Lyman, "Technology and Computer Literacy," in *Rethinking Liberal Education*, ed. Nicholas H. Farnham and Adam Yarmolinsky, Oxford, 1996, 114.

contracting job market and the imploding university. As cognitive psychologists would say, we possess domain-specific information. Such working knowledge of a wide variety of visual operations is needed for additional and extensive learning about imagery to occur. I would ask any readers who doubt this if they have noticed colleagues in other subject areas handing over their specific competencies to us.

Scarcely a day goes by without a newspaper headline announcing the formation of yet another virtual university. Western governors claim theirs will be completed and begin taking on students by the summer of 1997. Earlier, Washington State University pioneered asynchronous classes stored on the Internet, CD-ROMs, or other computer platforms. This means members of a course may log on at any time to read the exchange of comments in their classes and add to it. On the opposite coast, Maine has been televising college courses throughout the state for the last seven years. Distance-education systems—whether broadcasting from mural campuses or computer-based ones that emanate from Ethernets—usually allow students to hear and see an instructor, but the instructor can only hear the students. Video-conferencing is growing in popularity because it relies on two-way audio-visual communication, but since it is more expensive, its use remains limited. While controversy surrounding remote instruction has focused on the undue centralization of power in network managers and the competition a supposedly "merely" supplementary "cyber-ed"[8] poses to brick-and-mortar institutions, artists and art, architectural, and design historians might well raise informed questions concerning the ethical, psychological, and learning implications of watching a professor on a small monitor, with poor image and text resolution and without sensory contact beyond e-mail or telephone. Surely the history of studio practices and of art education from the Middle Ages forward has much to contribute to current debates about the value of, and alternatives to, face-to-face instruction. Academics offer sophisticated models for interweaving technologies of reproduction with self-instruction and teacher-guided courses. But this still begs the larger question of what, exactly, is the impact on human perception of intervening instruments, whether deriving from a past lens or a contemporary digital culture?[9] Beyond the present quantum leap in technological mediation lies the dramatic recurrence of an eighteenth-century phenomenon: individualized learning. As every beholder of Chardin's paintings of tutors with children recognizes, the personal computer and a crumbling public educational system are bringing about not just the introduction of the school voucher but the return of informal curricula and of private instruction in the home.

Thus far, I have conjured up only the conventional academic scene. What of the growing number of alternative "colleges" sprouting amid the corporate world in which companies increasingly rely on CD-ROMs and off-the-shelf simulating templates for training their employees, bypassing traditional teacher-led instruction? Multimedia technology—typically designed by people who possess computer know-how but are not interested in conveying a rich, well-rounded educational experience, variegated approaches, and nuanced context—currently prepares pilots to fly under dangerous conditions, cashiers to deal with unruly customers, transit drivers to maneuver down mean streets, assembly-line workers to operate robotic apparatus,[10] and illiterate employees to read, write, calculate. Imagists should be troubled because such rudimentary training by splashy illusionism bypasses the higher-order thought processes imagery is capable of stimulating and mobilizing.

If adult education in industry appears too lowbrow a concern, what of the aggressive competition being mounted by other "high" cultural institutions for prospective students? Art museums realized early on (the Louvre being a trendsetter) that mature visitors enjoyed touring exhibitions on-line, either by themselves or accompanied by knowledgeable electronic guides. Now, potential viewers of the fine arts—young or old—are actively solicited on the Web not just by other universities but also by art, history, or science museums, galleries, opera companies, orchestras, and alternative sites of every stripe. This heady expansion of credit and noncredit digital education is bound to have an impact on enrollment in conventional mural universities. How are these material and immaterial loci to be intelligently bridged? How is the exhibition of concrete artifacts to be reconciled with their simulation? How are the traditional objects of art history to be connected in reflective ways to newer imaging modalities?

On the practical level, cyberspace will surely result in more adjunct faculty members being hired, like consultants in the business world, based on the number of classes they develop and teach on the Net. The fiscal motivations driving the expansion of on-line classes are clear. What remains unclear are the intellectual ramifications of shifting from the concept of a university (or any organization, for that matter) as a physical place where one goes to learn vis-à-vis others in department-generated programs to individually tailored electronic information created, selected, and altered by countless users. This is a general concern. But there is also a concern specific to our profession. Being on the Web allows instructors in all fields to incorporate pictures, photographs, film clips, video, and animation in their presentations. Who, precisely, is responsible for educating them and their students—and who, in fact, does—about the significant distinctions existing among the media comprising multimedia?

Not coincidentally, the expansion of the uses of information technology in all facets of education comes at a critical moment, when the stagnant American economy is rife with "restructurings" and "downsizings," done in the name of "lean production." Why, then, do we persist in believing that the professoriate—certainly a labor-intensive service indus-

5. Thomas J. DeLoughry, "Upset with Internet Law," *Chronicle of Higher Education*, Feb. 16, 1996, A26.

6. See Barbara Maria Stafford, *Good Looking: Essays on the Virtue of Images*, Cambridge, Mass./London, 1996.

7. Simon Head, "The New, Ruthless Economy," *New York Review*, Feb. 29, 1996, 47–52.

8. Goldie Blumenstyk, "Learning from Afar," *Chronicle of Higher Education*, May 31, 1996, A15–16.

9. I am organizing an exhibition, sponsored by the Getty Research Institute for the History of Art and the Humanities, in the fall of 1999 on this theme.

10. Kate Murphy, "Pitfalls vs. Promise in Training by CD-ROM," *New York Times*, May 6, 1996, C3.

try—is less prone to "reengineering" than the laid-off middle managers at IBM? What, exactly, is it about art, architecture, or design programs that makes it vital to maintain their existence within a shrinking educational system,[11] one governed by a constantly discussed ideal of intellectual interdisciplinarity and an undiscussed reality of fiscal interdisciplinarity?

Many factors contribute to the brutal instability of the higher-education marketplace: the crescendo of complaints aimed at the climbing costs of tuition, mounting student debt, disturbing increases in college graduates without jobs, the wholesale elimination of programs, the erosion of tenure,[12] and the growing caste of part-time professors.[13] But the coup de grâce will certainly be delivered by the combination of high technology with the development of first-rate instructional software—an enterprise in which we rarely, and to our detriment, take part. Together, these presage the eclipse of the teacher-centered classroom.

Yet in spite of such depressing trends, and because colleges are emphasizing experiential learning programs occurring outside their walls, our profession could shine if it boldly extended and innovatively reformulated the internships it now has established with museums. Why not construct analogous off-campus independent study and research projects—led by instructor-mentors—in law firms, hospitals, and science laboratories, for example? Art provides sophisticated models for embodying perceptual, affective, and cognitive experiences that either elude or find no adequate correlative in textualization. In addition, by learning the changing or enduring fundamentals of visualization, previously script-bound professionals will be encouraged to make informed perceptual judgments.

Conversely, the flood of nonart informational images[14] entering our self-defeatingly boundaried discipline would serve to raise and expand its lowered and contracted horizon. At the very least, they challenge us to justify dubious systems of categorization and false divisions. One foreseeable consequence of such experimental outreach might be the creation of meaningful jobs for our dismally unemployed or insultingly underemployed students. Graduate schools, too, would gain a larger, more flexible, and truly cross-field purpose rather than being dedicated to the simplistic reproduction of kind.

If the Internet is all about links leading to other links and the Web's hypertext swiftly produces resonating connections with distant sites, why not give concrete expression to the interdisciplinary idea that everything in the universe is allied by applying our expertise in a stunning array of representational genres and graphic functions to joint problems? This entails adventurously forging bridges spanning seemingly alien professions, industries, and businesses caught up in the visualization revolution. They, like us, suffer from the rarity of innovative thinking about what this electronic medium might be good for. As Marie Redmond remarked, old formats, such as the book, are often just translated into CD-ROMs or copied on-screen.[15] Paradoxically, metaphors of "page," "scroll," and "file" dominate a system that is no longer Gutenbergian. The histories of art, photography, film, video, and design offer striking antidotes to this lack of visual imagination, since they are filled with cross-cultural examples of many different types of compositions—ranging from illumination to montage—that thought-provokingly and stylishly configure or embody novel concepts in varied ways and for various purposes.

Another quandary vexing the digitization of images, words, and sounds is the resulting absence of context. The granularity of the individual media making up multimedia and the dense nebulas of contingencies swirling around each object or event are often lost in bytes and flashes. In addition, there are problems with poor image resolution, miniaturization, fragmentation, and loss of contrast. Making matters worse, selection is frequently an illusion. Crude, small, prefabricated databases proffer mere caricatures of user choice. On the other hand, the literature of art criticism from the Baroque era forward is rich in demonstrations of the beholder's share in any aesthetic transaction. Reminiscent of Leibniz's *ars combinatoria,* past strategies of spectatorial involvement might usefully be incorporated into contemporary experimentation at the interface.

Contributing firsthand to the understanding and design of the gamut of intelligent images would give the lie to the ubiquitous sophism that anything pictorial does only negative work in our society. Instead of constantly borrowing goals from other fields, our programs might be looked to, for a change, as leading the way. Finally, by showing how vision matters, both now and then, our flexible, multiskilled students would become indispensable in a euphemistically named "generalist" economy bent on their elimination.

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11. "The High Cost of Higher Education," *U.S. News and World Report,* Sept. 16, 1996, 91–93, 101.

12. William H. Honan, "Minnesota's Proposed Tenure Changes Lead to Union Drive," *New York Times,* Sept. 22, 1996, A19.

13. Robin Wilson et al., "The Widening Gap in Higher Education: A Special Report," *Chronicle of Higher Education,* June 14, 1996, A12–13.

14. James Elkins, "Art History and Images That Are Not Art," *Art Bulletin,* LXXVII, Dec. 1995, 553–71.

15. Marie Redmond, "Appropriation and Context: Digitalizing Text and Image," paper presented at the Word and Image Congress, Dublin, Aug. 14, 1996.