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Proxies

The Cultural Work of Standing In

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4 PROXY JUSTICE (OR THE LENA IMAGE, PART 2)

An article in the 1997 issue of the *Electronic Engineering Times*, written by engineer and journalist Sunny Bains, begins:

The most famous female face in the field of electronic imaging was honored last week. Engineers were urged to meet her and get her autograph. Conference speakers were encouraged to include her work in their publications. What did this woman do to gain such respect and admiration? Did she win a Nobel Prize? Was she voted the best Ph.D. supervisor in the country? Did she invent a device or algorithm that earned her company oodles of money?

None of the above. In fact, she took off her clothes for *Playboy* a couple of decades ago, and a (presumably male) reader decided that her centerfold would make a great subject for some image-processing experiment.¹

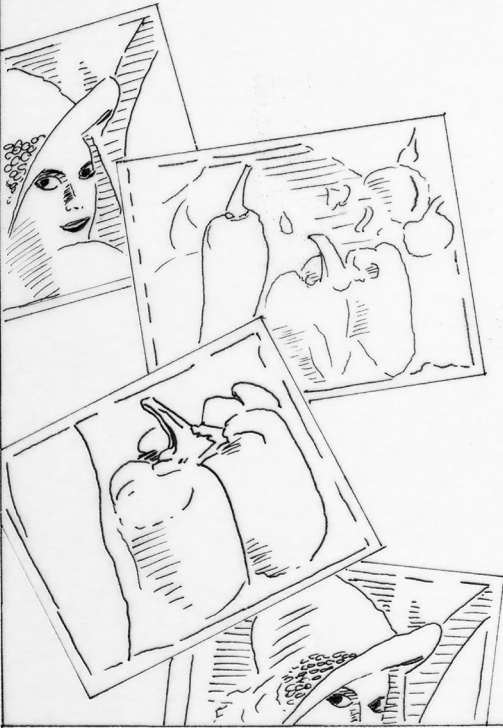
By the 1990s, the Lena/Lenna image was no longer a curiosity of test media from a southern California lab. It could now be called the “most famous female face in the field of electronic imaging”; however, as this passage hints, its notoriety as both an industry standard *and* a centerfold was beginning to create friction. Bains herself was critical of the image’s use, and the tone of the passage indicates her disdain for the context that created it.

In chapter 3, we examined the origins of the Lena image (see figure 3.1)—a photo of a woman’s face, partially covered by a hat and a feather tassel. The image was cropped from the centerfold of the November 1972 issue of *Playboy* magazine, where the full image shows “Lenna Sjööblom” naked in an attic (the spelling of Lena/Lenna has varied over time). When

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■ Special section on
Visual Communications
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Figure 4.1

An artist's interpretation of the cover of *Optical Engineering* (July 1991), featuring the Lena image and another widely used test image of bell peppers. Image: R. R. Mulvin.

engineers at the Signal and Image Processing Institute (SIPI) at the University of Southern California (USC) digitized the image in 1973, they created a new proxy for digital image processing.

SIPI went on to shape the digital image standards of our contemporary world and the ways that images travel and appear in networked communication. All the while, this work was tested and displayed through the image of a *Playboy* model. This background to the institutional and cultural context of the Lena image, as well as its position within the history of test images, are marked by the prototypical encoding of whiteness as a default skin tone, the instrumentalization of women's bodies as measurable surfaces, and the collapse of bodies, faces, territories, and enemy Others under a regime of optical control.

In this chapter, we fast-forward to the 1990s, to a moment when the Lena image had hardened into a material proxy for a growing field and an artifact of the trained professional vision of image engineers (figure 4.1).² Here, we find new institutional and professional contexts, and through key moments when the Lena image was challenged, we glimpse the activist responses to the unjust settings of computer science and image engineering. Finally, we gather some of the many afterlives of the Lena image, which in recent years has transcended its status as a proxy to become an emblem for the field of image processing and a persistent target of critique.

Although the Lena image is easier to track in the 1990s than before, there are evident traces of its movement, storage, and transmission as early as the mid-1970s. By 1977, SIPI had established and distributed its first version of the USC-SIPI Image Database, a database of test images that functioned as a storehouse of potential commensurability for the growing field of digital image processing (and is still available today).³ The USC-SIPI Image Database worked to establish common references for the field because it could be shared, reused, and cited—it provided the network of traceable fixed points, through which a growing field could make new connections. The institute often distributed batches of test images to other research centers, in person, using data stored on magnetic tape. Alexander Sawchuk (the engineer who originally digitized the centerfold and a future SIPI director) recalls: “Visitors asked us for copies, and we gave it to them

so they could compare their image processing and compression algorithms with ours on the same test image.”⁴ In other words, the media of digital image processing began with the circulation of privately collected images that were exchanged by hand.

A similar story is told about the origins of the computerized Bulletin Board System (BBS) in 1978. The architects of BBS, Ward Christensen and Randy Suess, exchanged programs with each other by recording them on cassettes and then mailing them. When a snowstorm stranded the two men at home, as Christensen recalls, BBS was born “of the necessity of transferring files mostly between Randy and myself, at some means faster than mailing cassettes (if we’d lived less than the 30 miles apart we did, XMODEM might not have been born).”⁵ These stories of manual exchange, which follow personal networks and precede digital ones, capture two common aspects of the history of standards and proxies: at key moments, the work of building and maintaining a standard is done by hand; and the tools of standards work are assembled ad hoc, but always with the aim of establishing conditions of commensurability across space and time between like-minded researchers and workers.⁶

In 1975, the same year that the Lena image first appeared in the institute’s reports, SIPI engineers transmitted test images over ARPANET.⁷ While we don’t have evidence of which images were transmitted at this time, the Lena image was among SIPI’s most frequent test objects. Therefore, the image was spreading through two networks concurrently: by hand through the social networks of engineers whose colleagues visited the lab, and through a novel computer network that would one day come to reshape the visual culture of everyday life. The first appearances of the Lena image do not announce its use by naming or labeling it in any consistent fashion. However, by the mid-1980s, the image was sometimes labeled as “Lena” or “Lenna” in articles outside of USC.⁸ It was rare for the image to be consistently labeled during this period, and it often appeared with other images of women’s faces, tagged as “girl,” “woman in hat,” or sometimes just “womanhat.” It is only when the image became the source of conflict that it transformed from a taken-for-granted piece of a knowledge infrastructure into a named object with a contestable history and politics.

CONFLICTS

A few months after *Optical Engineering* included the Lena image on its cover and in two published studies within its pages, Playboy Enterprises sent a letter demanding that the journal cease its use of the Lena image on the grounds that it was the intellectual property of *Playboy* (Playboy Enterprises is the umbrella company, launched by Hugh Hefner, that publishes *Playboy* magazine). The letter reads (*sic*):

It has come to our attention that you have used a portion of the center-fold photograph of our November 1972 PLAYBOY PLAYMATE OF THE MONTH Lenna Sjööblom, in your July 1991 issue of *Optical Engineering* magazine. . . . Playboy Enterprises, Inc., the publisher of PLAYBOY magazine, owns the copyright in and to this photograph.

As fellow publishers, we're sure you understand the need for us to protect our proprietary rights. We assume you did not intentionally make unauthorized use of our material and we ask that you contact us for authorization before using any of our copyrighted material in the future.⁹

Optical Engineering is the flagship journal of SPIE, the International Society for Optics and Photonics. The issue in question, from July 1991 (figure 4.1), advertised a special section devoted to “visual communications and image processing.” A few months after receiving *Playboy*'s cease-and-desist letter, the journal's editor, Brian Thompson, had to deliver a somber message about the meaning of copyright. He wrote in an editorial:

The image in question is used a great deal by workers in image processing and is often referred to as the “Lena” image. As SPIE noted in its response to Playboy Enterprises, “*The image is widely used in the worldwide optics and electronics community. It is digitized and its common use permits comparison of different image processing techniques and algorithms coming out of different research laboratories.*”¹⁰

As one of the few indications about the negotiations between Playboy Enterprises and *Optical Engineering*, this passage is highly suggestive. In its appeal for leniency, *Optical Engineering* made the case to *Playboy* that the use of the Lena image is not trifling. Instead, Thompson justifies the

image's use by highlighting it as an object of honed, professional vision. He qualifies the use of the Lena image by noting both that engineers have transformed the image through digitization and that its popularity, its "common use," provides the conditions of commensurability for digital image processing as a field of practice. In this pithy response, Thompson neatly explicated the role of proxies in creating coherence within domains of practice, across space, and through time. The professional vision of image engineers relies on a continuity of technical experimentation that hinges on the conventional use of a circumscribed set of images.

Thompson was also speaking for a new field that was increasingly distinct from his own. *Optical Engineering* was not primarily a journal that concerned itself with digital image processing, but rather with other optical applications like holography, x-ray lithography, and three-dimensional (3D) sensing. But in the years leading up to 1991, the journal often devoted a special issue to the burgeoning field of image processing. But what Thompson either didn't know or didn't confess was that the Lena image ran *frequently* on the journal's cover and throughout the pages of the journal.¹¹ In fact, the presence of the Lena image on the cover was often what marked those special issues on image processing—and marked image processing as a distinct discipline, with its own test images and reference points.

Despite Thompson's equivocating, he finished the editorial by placing the onus on researchers to manage their own copyright permissions:

With regard to the "Lena" image, we reached an understanding with Playboy and appreciate their cooperation. However, because publishers do not know whether or not material is borrowed, adapted, etc., from other sources, be advised that *it is each author's responsibility to make sure that materials in their articles are either free of copyright or that permission from the copyright holder has been obtained.*¹²

Ultimately, in Thompson's piece, individual responsibility took the place of collective responsibility to control and manage the selection of test images. Furthermore, he does not suggest that Playboy Enterprises could be wrong. It is questionable whether the use of the Lena image as a test image, without permission, is legitimate under fair use provisions in the United States: the

Lena image is cropped and does not reproduce the entire centerfold, which conforms to the protection of the use of excerpts; it was also only ever used for research and scholarly purposes, again conforming to a use that is (in theory) protected; fair use exemptions often hinge on the use of the original being transformative and in many cases, the Lena image is, strictly speaking, transformed through various signal processing techniques. On the other hand, though, in fair use cases transformation usually refers to a creative appropriation of an original text. The fact that engineers treat the Lena image as test data, not as the grounds for creative expression or critique, might make it less likely that it would pass a fair use test. Finally, a fair use exemption would require that the Lena image plays a role that *only* the Lena image could do—for instance, in this book, only showing the Lena image could serve a discussion of the Lena image. Thompson’s appeal to *Playboy* made the case for its permitted use on two grounds: it was for research purposes, and the Lena image *did* serve a unique purpose due to its common, widespread, and regular use. Its uniqueness was directly tied to its cultural role as a disciplinary proxy for the world of images, as well as the ways that it was used to foster and maintain communal connections in the field.

He did not give any details about the agreement that he reached with *Playboy* in his editorial, and he stopped short of telling *Optical Engineering* authors to cease using the image. *Playboy*, for their part, later claimed that their agreement to permit use of the image grew out of their opportunism and that they worked with the Society for Imaging Science in Technology to track down Lena Forsén so the society could invite her to its fiftieth annual conference, in 1997—the event captured in the opening passage of this chapter. *Playboy*’s vice president of new media said, “We decided we should exploit this, because it is a phenomenon.”¹³

>>>

Playboy Enterprise’s letter to *Optical Engineering* was the first challenge to the viability of the Lena image as a professional proxy. This controversy erupted because the image had circulated unobstructed in digital image processing for nearly twenty years, throughout which time it was used by a global community of researchers. In contrast to the image’s origins, when engineers

lauded it for its formal properties (its glossy paper, its dynamic range) and disavowed its content (a cropped nude woman), the first impediment to its use came from *Playboy's* assertion that the image was their private property.

A second challenge came a few years later, in 1996, and again it emerged on the editorial page of a professional journal: *IEEE Transactions on Image Processing*, where the editor responded to accusations that the Lena image's origins in a porn magazine should preclude it from further use on sexist grounds.¹⁴ *IEEE Transactions on Image Processing* was established in 1992, when it splintered off from *IEEE Transactions on Signal Processing* because that journal's backlog of paper submissions grew too large and the digital image processing community feared "the exodus of image processing expertise from our society to other professional groups."¹⁵ This is a key moment in that it signals an attempt to consolidate digital image processing as a discipline: the journal materialized its separation from other disciplines to keep members within its specialization. It is noteworthy, then, that at this important point in the history of the discipline, the Lena image appears 205 times in the first volume (the first four issues) of the journal (table 4.1).¹⁶

For context, while other common test images appear in the journal, the Lena image is by far the most used. There are, in the same volume, six reproductions of an image of Walter Cronkite and one image of Ronald Reagan. There are virtually no traces of anyone who reads as nonwhite; even by the early 1990s, digital image processing operated through a visual culture of prototypical whiteness.¹⁷ This meant that mastery of the tools of representation and reproduction was equated with a visual culture dominated by the oversampling of whiteness in test images (discussed at length in chapter 3). Representational equity was clearly not on the minds of engineers, even while the Lena image was used to fulfill other representational desires. As Jamie Hutchinson proclaimed in 2001, "If the criterion is frequency of Lena, then the *IEEE Transactions on Image Processing* is by far the sexiest journal out there."¹⁸ A process of proxification began at SIPI in the 1970s, when a group of men instrumentalized the detritus of their pop culture surroundings to turn the nude body of a woman into processable data and so-called extractable features. In the pages of journals like *Optical Engineering* and *Image Processing*, we see the culmination of this process.

<i>IEEE Transactions on Image Processing</i> (Volume 1)	Appearances of the Lena image
Issue 1	62
Issue 2	61
Issue 3	45
Issue 4	37
Total	205

The Lena image was now part of the canon of test images and the chosen stand-in for a new discipline.

Citation patterns expose the unspoken politics that shape a discipline's own narrative.¹⁹ Citation sutures and divides: it builds canons, defines boundaries for insiders and outsiders, and confers legitimacy. It first confers legitimacy on the source (e.g., an image, a text, an author), but through the networks of repeated use, it confers legitimacy on those doing the citing by signaling their awareness of a community's common ties. At moments of genesis, like the first volume of *Image Processing*, citation was a way of highlighting a shared set of referential materials that demonstrated the coherence of a newly formed field. Readers of *Transactions on Image Processing* in the 1990s witnessed how different people transformed the Lena image, and technical scrutiny of the Lena test image became an occupational obligation. Being literate in image processing meant sharing a set of professional vision practices that made one conversant in the transformations of the Lena image.

In 1996, four years into the publication of *Transactions on Image Processing*, the journal's inaugural editor, David Munson, was nearing the end of his tenure. Volume 5, Issue 1, contains a letter from the editor, in which Munson reflected on the journal's first four years and its future. On the subsequent page, however, there is a second, exceptional, editorial, "A Note on Lena." Munson began:

During my term as Editor-in-Chief, I was approached a number of times with the suggestion that the *IEEE Transactions on Image Processing* should consider banning the use of the image of Lena.

Munson established a vague controversy but made it clear that this had been an issue throughout his tenure as editor.²⁰ Then he continued:

I think it is safe to assume that the Lena image became a standard in our “industry” for two reasons. First, the image contains a nice mixture of detail, flat regions, shading, and texture that do a good job of testing various image processing algorithms. It is a good test image! Second, the Lena image is a picture of an attractive woman. It is not surprising that the (mostly male) image processing research community gravitated toward an image that they found attractive.²¹

Munson, like many before and after him, was determined to fold the Lena image into the professional practices of image engineering: he highlighted the image’s formal usefulness in the specialized terms of his discipline. And he also appealed to the Lena image’s value as a tool for perpetuating a chain of iteration that maintained the profession’s standards. But unlike Thompson with his editorial in *Optical Engineering*, he also acknowledged that the image was popular for reasons beyond its formal features and professional history—that it was an image of a desirable subject—and in doing so, he confessed to the heterosexist logic of the image’s use.

The language here is telling, as he described a nearly inexorable attraction (“gravitated”) of the community toward their object of desire. Unlike the accounts of the Lena image’s original digitization, this passage affirmed the sexualization of the test image; but like those earlier accounts, it disclaimed the agency and responsibility that individual researchers held for choosing their proxies. It’s a rare but telling moment that undermines a common refrain in image engineering, where there is often a presumed objectivity in selecting a natural image as a proxy, because one’s techniques—if properly tuned—will work similarly across the world of potential images. Munson stepped out from behind a shield of presumed objectivity to excuse his colleagues’ image selection on the basis of the image’s “attractiveness.” Here, it was the image that had power (pull) instead of the engineers making a conscious choice.

Having stipulated the scientific and affective qualities of the image, Munson recapped the controversies surrounding its continued use. He summarized

the earlier conflict between *Playboy* and *Optical Engineering* but noted that it was essentially resolved. Munson concluded:

So what is the problem? Well, quite understandably, some members of our community are unhappy with the source of the Lena image. I am sympathetic to their argument, which states that we should not use material from any publication that is seen (by some) as being degrading to women. I must tell you, though, that within any single segment of our community (e.g., men, women, feminists), there is a complete diversity of opinion on the Lena issue. You may be surprised to know that most persons who have approached me on this issue are male. On the other hand, some informal polling on my part suggests that most males are not even aware of the origin of the Lena image! I have heard feminists argue that the image should be retired. However, I just recently corresponded with a feminist who had a different point of view. She was familiar with the Lena image, but she had not imagined that there could be any controversy. When I offered an explanation of why some persons are offended by the use of the image, she responded tartly. A watered-down version of her reply is, "There isn't much of Lena showing in the Lena image. This political correctness stuff infuriates me!"²²

Munson was perhaps receptive to the complaints of some colleagues but took great pains to make it clear that the issue was more complicated than some may have thought. The unnamed interlocutor here played the discursive role of severing the demand for different test images from one kind of feminist politics, claiming that such demands are emblematic of a lesser brand of censorious feminist.²³ Ultimately, Munson decided that the perceived ambiguity of the issue (even the feminists can't agree!) merited a recommendation that was similarly compromised:

As Editor-in-Chief, I did not feel that this issue warranted the imposition of censorship, which, in my view, should be applied in only the most extreme circumstances. In addition, in establishing the precedent, I was not sure where this might lead. Should we ban the Cheerleader video sequence? Should we establish an oversight panel to rule on acceptable imagery? Instead, I opted to wait and see how the situation might develop. I suspected that the use of Lena would decline naturally, as diverse imagery became more widely available and as the field of image processing broadened in scope.²⁴

His equivocating speaks to a fear of shared governance as a potential curb on one's academic freedom. The fear of a "precedent" that Munson cited is a fear of shifting power dynamics and it's a testament to the fear that an explicitly political standard could supersede the power of elite scientists to choose their own test media. Munson's concluding suggestions come down on the side of the complainants, if only passively:

In cases where another image will serve your purpose equally well, why not use that other image? After all, why needlessly upset colleagues? And who knows? *We may even devise image compression schemes that work well across a broader class of images, instead of being tuned to Lena!*²⁵

His final response, then, was not to censor the image but to plead that fellow researchers might be more considerate when selecting test images. It's the final sentence, however, that makes the use of the Lena image seem inescapable. There is a hint of irony, but the notion that existing image compression schemes are "tuned to Lena!" is a clear indication of the image's power as a proxy and an adhesive that binds the profession of image engineers.

And here is the problem: Munson is drawing attention to the fact that test images do not function ahistorically. Rather, they operate through chains of iteration that maintain standards and norms. Most important, they operate through the labor of the people doing the image processing—a kind of work that is already calibrated (tuned) to this one particular image. It was not just "compression schemes" that are tuned to the Lena image; the people doing the compression calibrated their vision practices to the image. The cultural work of using and reusing the Lena image as a proxy requires this attunement. This feeling was echoed in 2001 by a Carnegie Mellon University engineer, Chuck Rosenberg, who said that "many researchers know the Lena image so well that they can easily evaluate any algorithm run on her."²⁶ Participation in the image engineering community of the 1990s meant putting the Lena image under scrutiny as a matter of professional necessity.

These two letters from journal editors (Thompson in *Optical Engineering* and Munson in *Image Processing*) present two ways that the politics of images, computer science, and the internet were being renegotiated in the

1990s. Thompson's letter foreshadows how the management of images as private property, and porn in particular, would shape the internet as a communication medium; and Munson's letter shows how gendered mistreatment and gendered violence were the sources of long-standing conflicts within the larger communities of computer science and engineering. These letters provide us with two pathways to studying the labor and politics of visual media and proxies, first through tracing the history of porn and property, and second through the contestation of university classrooms and computer science workplaces by feminist activists. Each of these histories, which played out in the late 1980s and through the 1990s, discloses the contested uses of emerging network technologies and the gendering of computing.

PORN AND PROPERTY

Pornography is often credited as a driving force and a shadow influence over the ways that new media and technologies are used, adopted, appropriated, and controlled. As Wendy Hui Kyong Chun states, the perception of porn's primacy was crucial to the discourse surrounding the internet in the 1990s:

In terms of technology development, sex allegedly popularizes new devices: pornography is the “killer application” that convinces consumers to invest in new hardware. New technology is a “carrier”—a new Trojan horse—for pornography; sex is “a virus that almost always infects new technology first.” Sexuality is the linchpin for strategies as diverse as entrepreneurial capitalism, censorship, and surveillance.²⁷

The production, circulation, and consumption of porn helped shape the ways in which both regulation and commerce took form through the internet and the legal framework for the internet's infrastructure in the United States and elsewhere.²⁸ This meant that internet porn received outsized attention as a phenomenon, often crystallizing sensationalized fears about the dangers of cyberspace, cybersex, communicating with unknown others over a computer network, and the threat of children being exposed to explicit images.

The largest and most conspicuous attempts at regulating the internet were often based on efforts to sanitize a new communication medium that was both newly privatized and potentially global—to make the data of the internet more hygienic. Hence, the Communications Decency Act (CDA) of 1996 was prompted by a politicized desire to redefine obscenity and to curtail access to sexual information and sexualized media.²⁹ Fears of the internet in this time were not only infantilizing, they were also deeply gendered. Amy Hasinoff argues:

In the heady rhetoric of the early 1990s, the internet is naturally democratic, anticensorship, and virtually impossible to regulate . . . Metaphors positioning the early internet as a “wild west” frontier space justified the idea that it was an unsafe place that women should avoid. The key idea is that the internet could not (and should not) be governed.³⁰

The CDA was opposed by civil libertarians and many of the internet’s earliest and most vociferous proponents, many of whom argued that the legislation ran counter to the free-speech principles of a flat, open, and horizontally structured network. The fact that misogyny and bigotry were endemic in many of those open communities was dismissed as an unfortunate side effect. In retrospect, misogyny and hatred have thrived online and through the architecture and affordances of the web, and white supremacist and misogynist communities continue to frequently innovate new exploits of network technologies to find new audiences, expand their reach, and evade censorship.³¹ Although most of the CDA was struck down by the US Supreme Court in 1997³²—thanks in large part to the advocacy of sexual health experts—section 230 of the Act, which shields most content-hosting companies from many kinds of liability, still structures how the internet is commercialized and used today.³³

The Lena image is woven into the internet as a key instrument in the standardization of digital images, and it is a signal example of how the internet could be used for sending and analyzing porn. But it does more than mark yet another case where porn played a vanguard role in the development of technology. As a proxy used in the preconditioning of visual standards, it connects the visual culture of engineers and their sociotechnical

practices with the visual technologies that they were building. It is not a mere token of pornographic media fought over by stakeholders in technological development; it is meant to leverage its relationship to a larger cultural context, to be used in the building of a visual internet, and to be used to determine which images would look *good enough* for a potential world of users. If the Lena image at SIPI was a stand-in for a particular kind of male desire and a world of measurable images of women's bodies, by the 1990s it had become a stand-in for the heteropatriarchal relationships that structure the spaces and institutions of engineering and computer science.

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Playboy Enterprises is infamous for enforcing its copyright and going to great lengths to sue perceived violators. In the 1990s, several high-profile legal decisions followed from companies hosting *Playboy* content on digital networks (both prior to the World Wide Web and afterward). These cases include *Playboy v. Frena* (1993); *Playboy Enterprises, Inc. v. Russ Hardenburgh* (1997); *Playboy Enterprises, Inc. v. Webworld Inc* (1997); and *Playboy Enterprises, Inc. v. Netscape Communications Corp* (2004), which went all the way to the Ninth Circuit Court of Appeal. Both *Hardenburgh* and *Webbworld* are still cited by the Recording Industry Association of America on their website's section on copyright infringement with regard to digital images.³⁴ In both *Hardenburgh* and *Webbworld*, *Playboy* sued because online aggregators had reproduced *Playboy's* copyrighted images in a nonpassive way (at the time, a host that acted as a conduit had a much easier defense than one that undertook any kind of curation or control over the selection of images). In *Webbworld*, the defendants argued that they were ignorant about what their users were doing and thus couldn't be held responsible for users uploading or sharing copyrighted images. The court found in favor of *Playboy*, ruling that ignorance was not an acceptable defense in this case, as *Webbworld* had targeted adult websites and concertedly built what amounted to a database of secondhand images.³⁵

Hardenburgh offers a more intricate case to consider the kinds of infrastructural and cultural labor that shape technologies and standards—including legal ones—through the management of porn. In *Hardenburgh*, a

popular, preweb bulletin board system called Rusty-N-Edie's (RNE) issued tokens to users who uploaded images—the tokens became a kind of voucher for downloading other users' images. Of the approximately 50,000 images on RNE, an estimated 40,000 were porn, a portion of which were proved to be Playboy Enterprise's property. The Federal Bureau of Investigation (FBI) raided RNE's servers in 1993—which were located in the Ohio home of Rusty and Edie Hardenburgh—seizing hundreds of computers. The case became a cause célèbre for the American Civil Liberties Union, but the judge in the case used *Playboy's* display rights to find in the magazine's favor.

In building their case *Playboy* paid an employee, a woman named Anne Steinfeldt, to join Rusty-N-Edie's and spend her workdays downloading images from their servers, finding and tagging images that were potentially owned by Playboy Enterprises. The judge describes at length the manual process of finding, tagging, downloading, and examining the pictures:

In the early 1990s, PEI [Playboy Enterprises] employee Anne Steinfeldt was given the job of scanning on-line systems to determine whether [copyright infringing] photographs were available to subscribers via their home computers. In November of 1992, Ms. Steinfeldt subscribed to Rusty-N-Edie's BBS under the pseudonym "Bob Campbell." She conducted key word searches in the files available on the BBS, and claims to have downloaded approximately 100 GIFs from the BBS which contained reproductions of PEI's photographs. She transferred these files to floppy disks, and then delivered the disks to PEI photo-librarian Timothy Hawkins. Mr. Hawkins states that he examined the files by displaying the images on his computer monitor and comparing those images with photographs from *Playboy Magazine*.³⁶

The work that Steinfeldt performed on behalf of Playboy Enterprises, under the name "Bob Campbell," is infrastructural labor. Just as thousands of people are now employed to moderate content on commercial social media platforms like Facebook and Instagram and to check that images uploaded to these platforms meet standards of decency (including that they are not sexually explicit), *Playboy* contracted an employee to scan the databases of a bulletin board system to locate private property.³⁷ Steinfeldt was already performing the manual labor of image classification on a nascent platform. She went an extra step, though, by downloading images, copying them to

disks, and providing them to a librarian, Timothy Hawkins. The librarian in turn performed a final act of commensuration by comparing the images side by side with *Playboy's* archive of images.

This analysis and memory work, all performed without the help of automation, became the basis of a precedent-setting legal decision regarding the knowing curation of copyrighted porn. While legal precedents shape the contexts in which images can legally appear and circulate over the internet, it is too easy to ignore the actual labor that it takes to create a testable batch of possibly infringing images. Unfortunately, it is impossible to know if the November 1972 *Playboy* centerfold was among the images Steinfeldt found on the RNE servers (the company identified ninety-nine images and submitted ten to the court, although they are kept sealed at an Akron courthouse). Nonetheless, it is in this context of sounding out the limits of free expression and free circulation in networked communication that Playboy Enterprises became aware of the use of the Lena image by the image processing community. The very techniques that were used by users of RNE to digitize, compress, and transmit images, as well as those used by Steinfeldt on behalf of Playboy Enterprises to build its case against the bulletin board system, were built in the same laboratories that used the Lena image as the basis of technoaesthetic benchmarking.

The Lena image is remarkable because of the way that it persisted over time, well beyond its original use. But it hasn't lasted as long as it has by accident; at each phase of its existence, it needed the intervention of its users to shore up its viability. In its original digitization, the act of erasure (tearing or folding) that cropped the image of its illicit content also cleansed it of *Playboy's* trademark, printed in the bottom-right corner ("Playboy's Playmate of the Month"). And in the negotiated agreement between Playboy Enterprises and *Optical Engineering*, the image was once again saved, its use repaired, as the intervention by Brian Thompson rescued it from illegitimacy due to its being a popular proxy. The self-policing that image engineers tacitly agreed to was meant to secure the permission of Playboy Enterprises (and not of, say, Lena Forsén herself), and that permission concerned only the status of the image as *property*.³⁸ We can imagine another history in which image engineers voluntarily quit using the image before or

immediately after *Playboy's* copyright claim. This was the first moment that the professional community could no longer claim ignorance of the image's origins or ownership. It would then stand as a powerful counterexample to the uncontrolled distribution of pornographic images on the internet instead of the original model of the form. Instead, the image only grew more famous, while the community of image engineers was given special dispensation from *Playboy* to keep using it.

Until recently, outright banning of the Lena image was always a last resort. The only legitimate claim against the image's unfettered use that found quarter with the engineering community was *Playboy's* legal claim that the image was private property. Like others working at the beginning of the computer projects of the Cold War period funded by the Advanced Research Projects Agency (ARPA), the engineers at SIPI couldn't have predicted the outcome of digitizing any one particular image in the 1970s—or how the primary act of cleansing the image would code its use.³⁹ However, by the time the image made its way onto the cover of *Optical Engineering*, there was a strong incentive to retain the Lena image as a shared reference point and a material articulation of the professional vision of digital imaging researchers.

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As Judith Butler argues, our understandings and embodiment of gender norms must be iterable to persist: “The historicity of norms (the ‘chains’ of iteration invoked and dissimulated in the imperative utterance) constitute the power of discourse to enact what it names.”⁴⁰ But chains of iteration do not simply exist as static connections; they are animated in practices of performance, citation, and memory. The use of test images as proxies is—but need not be—a powerful means of reiterating a gendered, heterosexist, and racially twisted norm within the foundations of image technologies. Standards—as technologized norms—also work as a means of shaping the representational capacities of media infrastructures and rely on proxy samples of the world *out there* as the basis for their norming logics.⁴¹ Because the Lena image is both a *de facto* standard and a tool for constructing other standards, it plays a double role in perpetuating the chains of iteration and

the representational norms of visual culture. But just as a norm has to reiterate to persist, breaking the chain of iteration can strain the norm. This is the political potential of refusal and willfulness. As Sara Ahmed argues, willfulness also requires a chain of action in order to break the relations of injustice: “Willfulness becomes what travels, as a relation to others, those who come before, those who come after.”⁴² No one mandated the use of the Lena image, and anyone could stop using it at any time. But refusal requires a system of support and reinforcement to counter the pull of normative habit.

For instance, other than its copyright status, a person could refuse to use the Lena image for any or all of the following reasons: they think that the image is sexist; the use of the image seems overly arbitrary; the image is formally insufficient; there isn’t enough information about the image’s production to make it a truly useful proxy; the image is too old and its aesthetics are out of date; the image, like many before it, overemphasizes white skin; and the image is not a born-digital image. Any of these may suffice as a reason to stop using the image or even to ban its use. Instead, in a final twist to this story, one engineer, concerned that *Playboy* might one day stop allowing academic uses of its image, had his wife pose for a new version of the Lena image (figure 4.2), calling it the “iLena image.” The image is licensed to Creative Commons Attribution-Share Alike.

He was neither the first nor the last image engineer to invoke his wife’s image. William Pratt, the first and longtime director of SIPI, released four editions of his *Digital Image Processing* textbook over a forty-year period. Each one begins with the same dedication:

To my wife, Shelly,
whose image needs no enhancement⁴³

This constant enfolding of male engineers’ wives into the image production system underscores the constant reiteration of women’s images as tools of masculine mastery. While Pratt’s dedication draws a distinction between the images of women whom he works on professionally (those needing enhancement) and his wife, the iLena image exposes another flawed argument: that simply removing the private copyright status of the Lena image



Figure 4.2

The iLena image is a Creative Commons reenactment of the original Lena image. (CC BY-SA 2.5 BR) Photo by Roberto Bittencourt; the model is Ila Fox.

would eliminate any danger that it poses to the coherence of the discipline's practices of professional vision. The Lena image's liminal status as private property and communal instrument provoked the first cease-and-desist complaint from Playboy Enterprises, but prizing the image from the structures of private property by negotiating its use or reformatting it using a new stand-in model does nothing to change the contexts of its creation and continued use. As activists, workers, and students have made clear, these contexts were persistently abusive and objectifying.

RESISTANCE

There is a cost to the repetitive use of women as test objects and the regular presence of porn in computer science environments. A process of objectification that played out in test materials drew an implicit connection between the day-to-day routines of knowledge production and the many forms of abuse, violence, and mistreatment surrounding computer science and engineering in the late twentieth century. It connected the violence of campuses and workplaces to the compulsory objects of professionalization.

In the late 1980s, women scientists, computer scientists, and engineers started publishing accounts of their experiences of gendered violence, isolation, and mistreatment in their laboratories, offices, and classrooms. These accounts took the form of official and unofficial reports published by universities or circulated online, among women, and through backchannels. The objections that they voiced were tied to the same social contexts that enabled the Lena image's use: the Lena image would not have made its way onto ARPANET if the November 1972 issue of *Playboy* hadn't made its way into the USC lab, and if the USC lab had not been the kind of place in which shared consumption of porn was an unremarkable social practice. As these objections collided with the growing cultural and political power of computer science, a shift to digital and networked methods of visual representation, and a drop-off in women's enrollment in computer science programs, the Lena image received public criticism as an emblem of sexist exclusion, misrepresentation, and mistreatment.

In recent years, several popular and academic researchers have reinscribed the fundamental role that women have played in the history of computing and engineering. This work documents the concerted efforts to remove women from engineering professions at moments of increasing prestige, as well as the widespread (and often intentional) failure to account properly for the constitutive labor of women, trans and nonbinary researchers, and queer actors.⁴⁴ As Mar Hicks argues, this research can revive forgotten and erased stories that are regularly concealed by an overemphasis on heroic tales of masculine dominance of technology. Beyond the recuperation of marginalized history, work still must be done to understand "how gender is a formative category for postindustrial labor markets and how gendered analyses alter the main contentions of the historiography of computing."⁴⁵ The history of proxies and the history of digital test images are avenues for talking about the role of gendering within knowledge systems and computing professions.

Learning to look at pictures of women, teaching computers to look at pictures of women, and using pictures of women (often taken from *Playboy*), all of which show white skin, have historically been compulsory parts of learning to be an image engineer. As Munson's editorial in *Transactions*

notes, this is an inescapable facet of tuning one's perceptual apparatus to the technoaesthetic benchmarks of image engineering. All computing professionals experience life through gendering systems and institutions. It's necessary, then, to understand the ways that gender—as an intersectional system of representation, identity, performance, labor, and social categorization—shapes computing sciences and the work that people are asked or permitted to do.

In the early-to-mid 1990s, enrollment in science, technology, engineering, and math (STEM) programs in Canadian and American universities was dominated by men and trending away from a period of moderately increasing gender parity. Many people in these programs often found the settings alienating, inhospitable, and abusive. Particular attention was focused on the ways that gender was expressed, policed, and weaponized. In one of the most vicious examples, a man shot and killed fourteen women—mostly engineering students—and injured another fourteen people in 1989 at the University of Montreal's École Polytechnique. The gunman's motivations were explicitly misogynist; he is quoted as saying to his victims, "You're women, you're going to be engineers. You're all a bunch of fucking feminists. I hate feminists."⁴⁶ The Montreal Massacre irrevocably marked the context for women in STEM fields in Canada and forced a confrontation with the misogynistic surroundings of engineering programs more broadly.⁴⁷

The killings and the response to them also took place during a period of increased sensitivity to the structural inequalities that produce, reinforce, and perpetuate discrimination. The 1980s and 1990s were marked by a series of very public social justice struggles that are often erroneously lumped together under the heading of "political correctness." During this period, American and Canadian campuses were often prominent sites of confrontation between those who demanded fair treatment, affirmative action, equal pay, and reparations for historical wrongs and those who rejected these claims, resisted transformative change, and treated these demands as an attack on tradition. As Joan Wallach Scott wrote in 1992, "If there were any doubt that the production of knowledge is a political enterprise that involves a contest among conflicting interests, the raging debates of the last few years should have dispelled them."⁴⁸

Within the larger context of campus politics and social justice campaigning, a series of reports were published in this period that documented the difficulties that women were experiencing in computer science and engineering departments. These include the Spertus report from the Massachusetts Institute of Technology (MIT 1991), the Cottrell report from the University of Vermont (1992), the Winslett report from the University of Illinois at Urbana-Champaign (1993), and a cover story in *Communications of the ACM* by Karen Frenkel (1990). There were other related reports as well, including a Harvard report on *Women in the Sciences* (1991) and a second MIT report on *Family and Work* (1990).⁴⁹ Although this was a bumper crop of reports in this area, similar texts have continued to be produced since this time. There is also a collection of gray literature from this period that includes reports that are cited but not published. Where some documents were officially released by universities, many others circulated through online message boards and early social networks. This body of literature offered evidence and support for young academics and engineers looking to address the institutionalized sexism and gendered inequalities of the scientific fields in which they worked.⁵⁰

One of the most widely cited of these reports came from Ellen Spertus, titled “Why Are There So Few Female Computer Scientists?” At the time, she was a graduate student in electrical engineering and computer science. Spertus notes that in 1990, only 13 percent of computer science PhDs went to women, only 7.8 percent of computer science faculty were women, and only 2.7 percent of the tenured computer science faculty were women.⁵¹ Spertus’s wide-ranging report documents a variety of possible factors that could contribute to the lack of female computer scientists, including social factors like stereotyping, subtle biases, gendered language, and the tyranny of low expectations.⁵² Among Spertus’s contributions in this report is an exhaustive bibliography, which later circulated on message boards, was added to, and became a hyperlinked web resource.⁵³

The larger group of research on women in STEM fields from this period describes university computer science departments as hostile workplaces and classrooms. The reports often emphasize the pervasive display and circulation of pornography. For instance, as Spertus states, “Some computer

science graduate students and staff at Carnegie Mellon were sufficiently disturbed by the display of nude pictures as backgrounds on computer terminals that they got together and tried to change the situation by publicly appealing to the community.”⁵⁴ She draws on an unpublished report written by Carnegie Mellon University (CMU) students and staff called “Dealing with Pornography in Academia: Report on a Grassroots Action.” After challenging the presence of porn in computer labs and appealing for change, the students and staff of CMU were met with outrage:

The appeal closed by making clear that they were not advocating banning such displays but were requesting that people voluntarily remove them out of sensitivity to others. Responses about the appropriateness of the displays and of the appeal were mixed and are categorized in the report. Negative reactions included the position that the writers were advocating censorship “like the Nazis or the Ayatollah Khomeini,” that people should not be asked to change their behavior merely because of what others might think, and that a public appeal was inappropriate but instead should have been made by individuals to individuals. . . . In response to the criticism that individuals should complain personally, several women wrote that “[w]omen asking for changes in behavior individually are exposed to ridicule and abuse.”⁵⁵

This account highlights that the requests from women at CMU recognized both collective responsibilities (creating a workplace that is comfortable for everyone) and the importance of having the power to shape one’s workspace (asking for voluntary compliance instead of a policy banning porn). In response, the requests were transformed into fuel for further abuse, ridicule, and alienation, with the moderate demands for equitable and nonviolent workplaces being equated to authoritarianism. It’s a textbook example of what Sarah Banet-Weiser calls the “funhouse mirror” of gendered politics, through which social justice demands are twisted and mutated to portray men as the “real” victims of inequality.⁵⁶

At the time, MIT had a reputation for innovation, often ascribed to its valuation of unorthodox thinkers and loose surveillance of social norms. The school remains among the most influential sites of academic research into computing and artificial intelligence (AI). Among the most

often credited reasons for this reputation is Marvin Minsky, who founded the school's AI Lab (now the Computer Science and Artificial Intelligence Laboratory [CSAIL]) with John McCarthy and was a member of the Media Lab from its founding in 1985. As Meredith Broussard says, "Look behind the scenes at the creation of virtually any high-profile tech project between 1945 and 2016, and you'll find Minsky (or his work) somewhere in the cast of characters."⁵⁷ As famous as MIT was for its research, it equally prided itself on its self-perceived iconoclasm. As Broussard writes, Minsky's lab was "where hackers were born. It was terribly informal."⁵⁸ It was vital to the reputation of many researchers within the AI Lab, and the Media Lab after it, that their work appear unconventional—a countercultural and counterinstitutional ethos that bolstered the claims of revolutionary potential connected with innovations in computing.⁵⁹ In recent years, both CSAIL and the Media Lab have been tarnished by their long-standing association with the convicted sex offender Jeffrey Epstein, who provided both institutional funding and personal funding and organized fundraising for institutional research. Minsky also accepted funding from Epstein and organized academic symposia on his private island after his conviction in 2008.⁶⁰

But these institutions were already accustomed to controversy. Even in the 1980s and 1990s, MIT, CSAIL, and the Media Lab had been cited for the mistreatment of women. In Karen Frenkel's 1990 cover article for *Communications of the ACM*, titled "Women and Computing," she included anonymous quotes gathered from women computer scientists around the United States that detail experiences of harassment, abuse, and alienation. In one passage, a woman detailed her experience of choosing a proxy, a video test sequence, at MIT's Media Lab:

"[In] The Garden [at MIT's Media Lab] . . . some faculty, students, and staff [chose] a test sequence from the film clip of the TV program 'Moonlighting'. They were looking for a sequence of a few frames that had a variety of colors, textures, and camera motions, and that probably had human figures on it. On these strictly technical considerations, they chose a sequence in which, at the beginning, the camera focuses closely on the legs of Cybil Shepherd

as she walks away from the camera in a torn skirt. Subsequent frames show her walking flirtatiously past Bruce Willis, pretending to be angry at him but with a small, triumphant smile on her face. . . . Women must deal with these pictures of women as test objects, as pictures to be used over and over again, long after their anger has worn off.”⁶¹

It is remarkable how well this person’s description foreshadows Munson’s description of the Lena image from six years later—the way that it speaks to the repetitive injuries of using compulsory test images and the way that it captures the effects of one’s embodied labor being tuned to an unwanted proxy. As much as it foreshadows Munson’s comments, however, it is the twisted mirror image of the origins of the Lena image; while the man who digitized the Lena image, Sawchuk, claimed that the selection of the centerfold grew out of boredom with his existing batch of test images, this woman at MIT must deal with the tedious repetition and the perennial objectification of women’s bodies. As image proxies have to be seen as typical representations of the world of images, the selection of an image that carries the signifiers of sexualized and gendered violence echoes the banality of such texts in the larger domain of popular cinema and television—as a proxy, it doesn’t just index the world of pop culture media, but also the taken-for-grantedness of images of abuse.

The correspondent’s description of her work in the Media Lab expresses the anger of being forced to select a sexist video clip. But it also describes the routinized violence of using the clip repeatedly as a necessary and assumed practice on the job. Such accounts are important testimonies that expose the nonspectacular ways that shared injustice must be mediated. Here too, the politics of standing-in are activated, as witnesses can speak to and speak for absent others. “Witnessing,” following Carrie Rentschler, is a form of participation in others’ suffering.⁶² In “The Aptness of Anger,” Amia Srinivasan describes “affective injustices” as a special kind of injury “where victims of oppression must choose between getting aptly angry and acting prudentially.”⁶³ These affective injustices, where one must curb one’s anger out of a fear of appearing too “emotional,” constitute a form of doubled, unrecognized harm. The testimony of the researcher at MIT, like those of other contemporaneous accounts, speaks directly to the felt

experience of affective injustice: the injustice of lacking control over one's working environment or the knowledge infrastructures of one's discipline, *and* the felt incapacity to do anything about it.

The concluding statement, that this labor will continue "long after their anger has worn off," demonstrates the untimeliness of unrecognized injustice: if your work has always been tuned to the stuff of prototypical whiteness and sexualized objectification, when would it be timely to be angry? Affective injustice is not evenly felt; it is more likely to be felt by those whose anger is seen as unreasonable or inapt. Affective injustices are more likely to be treated as legitimate complaints if they are voiced by people whose subjectivity is associated with rationality, not by "the sort of person who is not already stereotyped as rageful, violent, or shrill."⁶⁴ In the context of the campus politics of the 1980s and 1990s and the reactionary politics of those in positions of power, who often refused even minor demands for change, we can see how the labor of working with unjust proxies for the world *out there* persists long after the moment of acute anger.

Chapter 3 documented the institutional, cultural, and technical context of the digitization of the Lena image, and the role that human actors like Lena Forsén play in embodying proxiness; meanwhile, the discussion here has marked another crucial period in the image's history by placing it within the larger context of computer science and engineering in the 1990s. This period was marked by its attention to the structures of inequality that perpetuate discrimination and abuse within institutions, and also by the resistance to these structures undertaken by activists, students, teachers, and those simply fed up with the status quo.

Accounts like this one from MIT speak to the embodied labor of working with proxies within a larger institutional context of mistreatment and misrecognition. How is a researcher, a student, or a fellow teacher to understand their role in the workplace in such moments? It is also worth remembering that when controversies and scandals erupt, there is often an attempt to claim that things used to be different, the culture of the time was less enlightened, and things have changed now. This is usually an attempt to disavow the political demands of minoritized and marginalized people. But

these scandals erupt because of the bonds of culture, the chains of iteration and reiteration that perpetuate norms. It is true (but not an excuse) that the problem is cultural—that certain thoughts are used to think others—but it is the power to create those connections, to insist on particular forms of culture that is so firmly entrenched. It's the inescapability of the network of cultural connections that makes it nearly impossible for the powerful to imagine a different way of doing things.

As Kenneth Burke writes, in an appropriately visual metaphor, “A way of seeing is also a way of not seeing—a focus upon object A involves a neglect of object B.”⁶⁵ For him, ways of seeing and not seeing are learned, trained, and practiced. They come to seem natural, even valorized, as professional ways of enframing the world. Building on a term first coined by Thorstein Veblen, Burke calls these ways of seeing/not seeing, “trained incapacities.”⁶⁶ He adds that “one adopts measures in keeping with his past training—and the very soundness of this training may lead him to adopt the wrong measures.”⁶⁷ In other words, trained incapacity is not an unwanted side effect of proper training; rather, it is a way of understanding properly trained actions from a different perspective. This is precisely the problem that David Munson diagnosed in 1996 when he wrote, “We may even devise image compression schemes that work well across a broader class of images, instead of being tuned to Lena!” The Lena image is an instrument that tuned the professional vision of image researchers to a circumscribed world of digital images, and it also changed the ways that engineers experienced their profession.

The other story here is one of historical exclusion, a story where women had little capacity to shape computer science as a discipline, were limited in shaping the media environment of their workplaces and classrooms, and were excluded when men repaired the instrumental value of the Lena centerfold by rejecting claims of its unjust use. The Lena image was what Luce Irigaray calls the “*target, object, and stake*” of a masculinist discourse.⁶⁸

The routines of professionalization in digital image processing required workers to choose images as proxies, to potentially favor certain kinds of images, and to reproduce those images with as much regularity as possible—building up the known catalog of possible image transformations. Through

this process of constant reproduction, the image hardened as both a shared reference point and a useful set of test data. Understanding this repetitive labor as a manifestation of trained incapacity is one way of accounting for the selection and maintenance of the Lena image as a stand-in for the objectification and sexualization that suffused lab environments.

AFTERLIVES

Something changed in 2018, when scientific and technical journals finally started to ban the use of the Lena/Lenna image. We return to the pages of *Optical Engineering*, where the journal's editor stated, "As of 1 July 2019, SPIE journals and books will no longer consider new submissions containing the Lena image without convincing scientific justification for its use."⁶⁹ In *Nature Nanotechnology*, a similar note said, "We no longer consider submissions containing the Lena (sometimes 'Lenna') image."⁷⁰ The Optical Society and the Society for Industrial and Applied Mathematics also banned the image's use. Each of these statements claimed that this was a collective and deliberative decision and noted that the image had served as a standard for forty-five years. They also tied their decisions to a desire to create more hospitable environments for women to become computer scientists and engineers. Like other proxies, which gained coherence and usefulness through reuse, the Lena image persisted for decades as a shared reference point. But ultimately, it was political demands, not formal ones, that sunk it. Beyond just a winking reference to insiders, the image accrued a wider reputation as an icon of misogyny and misrepresentation within the world of computer science and its allied fields. What began as a campaign to end the use of the image in the 1990s culminated in a documentary, *Losing Lena* (2019), featuring Lena Forsén herself and supported by the "Code Like a Girl" campaign.

The image lives on, however. In the HBO comedy series *Silicon Valley*, the protagonists, a start-up with an enviable compression algorithm, compete against their main antagonists, a powerful Silicon Valley firm called Hooli. Hooli has both bottomless funds and an abiding grudge against the start-up. The two sides meet in the finals of a Valley competition, pitting their compression algorithms against one another. Hooli's chief executive

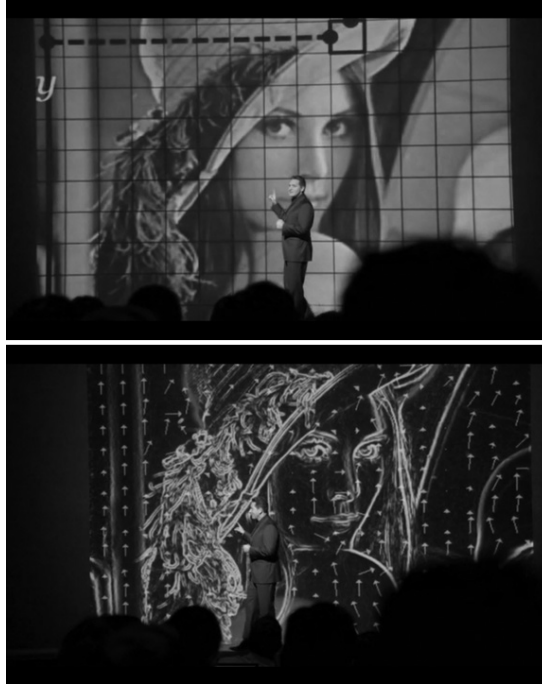


Figure 4.3

In this scene from the HBO series *Silicon Valley* (2014), the fictional Hooli CEO demonstrates how the company's compression algorithm would take the original Lena image (top panel) and convert it into more compressed data (bottom panel). Photos: Dylan Mulvin.

officer (CEO) stands in front of the crowd, and in the familiar bravado of the Valley's product showcases, proceeds to compress an image more efficiently than ever before (figure 4.3). That image is the Lena image.

Earlier in the series, the start-up's leader sits at his desk, trying to think his way out of a stymying compression problem. Deep in thought, his head is framed facing a now-familiar sight: the Lena image is pinned to the wall next to his desk. The image is there when the young, aspiring engineer needs inspiration, and it is there when the behemoth corporation needs to assert its unrivaled mastery: in the visual culture of Silicon Valley (and *Silicon Valley*), the Lena image is both muse and model.

Its status as an icon of the image processing profession has prompted a range of responses. In addition to appearing on *Silicon Valley* and in

poetry,⁷¹ the Lena image appears in art works, reenactments, 3D renderings, icons in Apple's App Store, and video art pieces.⁷² This is not surprising. As recurs frequently with proxies, people will often find and use these common reference points as the basis of artistic creation (see chapter 6). A video artwork by Jamie Allen with the unfortunate name of *Killing Lena* shows the image undergoing repeated compression. Like a photocopy of a photocopy, the image slowly disappears in a cloud of pixelated noise while Roberta Flack's "The First Time I Ever Saw Your Face" plays.⁷³

The history of the Lena image shows how the process of proxification—the transformation of a centerfold into a test image—is porous, as the test image carries the traces of its institutional and cultural milieu. It also shows how these traces leave indelible marks. Throughout the 1990s, the image's origins and continued use were liabilities that brought it into focus as an artifact of the field's larger structures of discrimination and objectification. The work of animating proxies—from their production to their continued use—is inescapably embodied. Test images capture the cultural work of models who perform as stand-ins. In being coopted into the history of test images, Lena Forsén's labor became the labor of vicarity—standing in for a world of images, faces, and skin. But the cultural work surrounding proxies also extends to the moment that this labor is leveraged, like the moment when image engineers walked into the SIPI laboratory and either tore or folded a *Playboy* centerfold to fit it with a scanner; the conditions of proxy labor also extend to the malaise of using a staid set of test images, as well as to the alienation of compulsory engagement with sexist and objectifying instruments. Proxies live through the bodies of their users.

Proxies for the world *out there* don't just form the foundation of a discipline, but also themselves are in need of maintenance and repair and are susceptible to contestation. For it to stay usable, someone had to crop the Lena centerfold to cleanse it of its soft-core origins, someone else had to circulate the image to turn it into a commonplace object, and someone (indeed, many someones) had to use and cite it. In the making of standards, cropping, circulation, and citation all become kinds of repair and maintenance. These social acts shape and maintain proxies in ways that lend them credibility and allow them to retain legitimacy.

Our media technologies are built on standards, and our standards in turn are built of the materials that standard makers use. The history of proxies like the Lena image, however, tells us that our standards are made to work in the world, but they are made to work for only some people in some ways. Objects do not simply appear and centerfolds do not simply appear on analog-to-digital scanners. To appear, an object needs time, circumstance, and purpose.⁷⁴ Test images appear because their users want to forecast what they think their publics and their machines will see. They imagine *how* we will see—whether it's the automated detection of tanks, nontanks, or centerfolds, test images foresee one version of things to come. We know that our ways of seeing are learned, that human vision is trained.⁷⁵ We also know that computer vision is trained. The Lena image, as an early digital test image and a product of the material life of hetero desire, serves as a familiar icon of both these processes.

There is a difference between what we know and what we see. The myth of computer vision and digital image processing is that they are the same thing—that a computer or an algorithm might “see” in an objective way, unalloyed by human perception and prejudice. Yet these techniques function through specifically chosen and programmed preconditions. The history of the Lena image tells a story about humans caught up in data. It's an entangled tale of gender, sexuality, race, and power: the power to choose test media, to inscribe new techniques of vision, and to dictate a new vocabulary of seeing. But it also tells a history of resistance to that structure of vision, and it demonstrates that the meaning of a standard is never fully determined.