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The Multiplication of Traces

Xerographic Reproduction and One Hundred and One Dalmatians

The production processes of society disappear into a stream of paper—a stream of paper, moreover, which is processed in a continuous flow like that of the cannery, the meatpacking line, the car assembly conveyor.

—HARRY BRAVERMAN[1]

At rows of blank-looking counters sat rows of blank-looking girls, with blank, white folders in their blank hands, all blankly folding blank paper.

—HERMAN MELVILLE[2]

THE IDEA OF XEROGRAPHY

In 1963, *Business Week* ran a two-page advertisement for the Xerox 914, the first office photocopier. Earlier advertisements had touted the 914's versatility, automation, speed, and low price. This campaign took a different tack. Below a photograph of a pair of identical ink drawings of an eagle, each set in an ornate frame and occupying the top three-quarters of its respective page, stretches a banner of text:

> We bought a famous Picasso picture. We took it out of the frame. Made a copy of it on our Xerox 914. Then we put the original back in its frame and also framed the copy. We photographed both of them. And here they are. Can you tell which is which? Are you sure?[3]

The answer, of course, is no. We can make out the embossed wallpaper behind the picture on the left, the beveled matting within each frame, the density of Picasso's pen strokes, but the telltale signs of xerographic mediation are nowhere to be found. Even if we had the two pictures in front of us—not a photograph of the pictures, not a halftone screenprint of a photograph of the pictures, and certainly

not a digital scan of a halftone screenprint of a photograph of the pictures—the differences between the original and the copy would be nearly invisible. A thin curlicue is a bit thicker in one picture than it is in the other, as are two of Picasso's propulsive diagonal strokes, but these clues lead in no particular direction. Short of removing each picture from its frame and scrutinizing how the ink has or has not taken root in the paper, we could very well be duped by the duplicate.

"As you can see," the advertisement affirms, the Xerox 914 "copies line drawings and signatures flawlessly." A Xerox of *Guernica* (1937) could not fool us, even if it were able to approximate that painting's scale, nor could a black-and-white photocopier successfully render the subtle gradations of brown, tan, and maroon in *Gertrude Stein* (1905–6). The black calligraphy and white paper of Picasso's eagle drawing make it the perfect test case. If the original had been drawn in graphite or crayon, the copy would lose some of its finer textures. An all-black eagle would yield a mottled clone. But here the line is fine—but not *too* fine—and strong—but not *too* strong. We can read it as clearly as if it were written. Indeed, the looseness of Picasso's penmanship suggests that he drew the eagle, signed his name, and dated the picture all in one sitting, perhaps without even refreshing his brush. The loop in the "P" of "Picasso" is amplified in the eagle's feathers. Text abuts image, image abuts text, and the photocopier, which regards the entire field of the sheet of paper as a single unit, does not discriminate between text and image. It treats each squiggle and dash equally, as black marks on a blank field. Particles of pigment amass only where there is darkness.

Xerography, which literally means "dry writing," allowed for clean, crisp, and clear copies. Paper went in and paper came out. The first advertisements for the 914 listed the ways the new medium improved on older technologies of mechanical reproduction: unlike its predecessors the Rectigraph, Photostat, and Thermo-Fax, it did not "require expensive sensitized paper, or intermediate film negative, or liquid chemicals"; it was capable of copying "onto standard office paper (plain or colored), your own letterhead, or card stock," not just flimsy carbon paper; it forwent the perils of stenography.[4] These advertisements targeted businesses. Although it could do otherwise, the device was designed to reproduce text. Yet this 1963 advertisement holds out another possibility, in which the text might in fact be an image and images are treated as text. In addition to demonstrating the machine's technical capabilities and practical uses, the advertisement makes an implicit aesthetic claim: it says that, for its purposes, a Picasso is the same as a memorandum.

Simultaneously, the Xerox machine positions itself as a tool not just for the white-collar worker but also for the graphic designer, the photographer, the illustrator—as an artistic medium. That this particular technology underwent this kind of redefinition within just three short years is hardly remarkable. As media scholars like Lisa Gitelman, Rick Altman, James Lastra, and Jonathan Sterne have demonstrated, the identities of representational technologies are always contested.[5]

The parameters we have come to think of as defining and delimiting the telephone, the radio, the typewriter, et al. were "by no means historical inevitabilities, but rather the result of complex interactions between technical possibilities, economic incentives, representational norms, and cultural demands."[6] Objects originally intended for office use, such as the phonograph, are "reinvented" as household amusements; the projected motion picture proves more lucrative than the kinetoscope's peephole model. The cultural development of the Xerox follows a no less winding path, one with multiple beginnings and an indeterminate end.

A brief interlude into three years of xerography's history, from 1966 to 1968, reveals just how many "networks of assumptions, habits, practices, and modes of representation" could coalesce in a single technology.[7] In 1966, an estimated fourteen billion photocopies were made in the United States alone. That same year, Marshall McLuhan described Xerox's rapid ascent as a "reign of terror" that threatened the wholesale destruction of the publishing industry and copyright laws: "Anyone can take any book apart, insert parts of other books and other materials of his own interest, and make his own book in a relatively fast time."[8] In April 1968, Xerox Corporation served as the sole sponsor for ABC's airing of Emile de Antonio's *The Confrontation*, a condensed version of de Antonio's *Point of Order!* (1964), which consisted entirely of excerpts from the 188 hours of kinescope footage of the 1954 CBS broadcast of the Army-McCarthy hearings—McLuhan's fear had assumed televisual form.[9] The late 1960s also saw the first publication of Harry Zohn's English translation of "The Work of Art in the Age of Mechanical Reproduction," in which version Walter Benjamin observes, "Every day the urge grows stronger to get hold of an object at very close range by way of its image, or, rather, its copy."[10] As Yuriko Furuhata has shown, graphic designers in Japan drew heavily on Benjamin's essay in their construction of a xerographic imaginary. For instance one important design journal of the period published an article titled "Graphic Art in the Age of Electronics" in 1968, in which graphic art was defined as the "art of copy and reproduction."[11] Meanwhile, the conceptual artist Timm Ulrichs photocopied the cover of the German edition of the "Work of Art" essay, and then photocopied that photocopy, and then photocopied *that* photocopy—on and on one hundred times. The image so degrades over generations that the ridges upon ridges of cumulative visual noise accrue into pointed whorls; that which withers in the age of xerographic reproduction still leaves a fingerprint.[12]

Each of these examples expands what Gitelman calls "the idea of xerography."[13] Xerox is a corporation, a verb, a machine, a product, a promise, a threat. Ulrichs's photocopies may playfully tweak Benjamin, but the transformation of rigid text into something strange, amorphous, and unrecognizable recalls processes of decay and ruin. Xerox becomes an allegory. A sequence in Robert Taylor's animated feature *The Nine Lives of Fritz the Cat* (1974) uses xerography to similar effect. A black crow stands atop a fort, defending his home of New Africa from the bullets spitting out of a racist pig's machine gun. The people of New Africa,

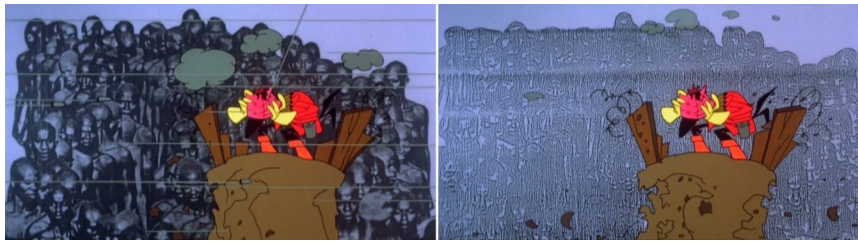

FIGURE 4.1. A photocopy and its great-great-great-great-great-great-grandchild in Robert Taylor, *The Nine Lives of Fritz the Cat* (1974).

a Black separatist nation formed in what used to be New Jersey, are depicted in the background by a xerographic collage of shirtless men. As the onslaught continues, the background changes eight times, each time replaced by a photocopy of the previous background. In a matter of seconds, the discrete human forms appear to have melted into a striated mass (fig. 4.1). The visual power of both Ulrichs's and Taylor's works derives from the Xerox machine's failure to reproduce its own reproductions.[14] (Perhaps the fastest way to determine which Picasso is the original and which Picasso is the copy would be to Xerox them.) Through the photocopy-by-photocopy or frame-by-frame study of each of these works, one can pinpoint the moment when the Xerox goes "wrong," when the represented content is not only unrecognizable but also wholly illegible. A "bad" photocopy makes apparent the machine's mediation. A "good" photocopy, on the other hand, maintains the uniformity of the original text—it is readable, dematerialized, and hence, tautologically, reproducible.

Lisa Gitelman's recent study of xerography considers the case of the Pentagon Papers, which were in fact photocopies made by Daniel Ellsberg of some seven thousand pages of the United States Department of Defense's classified history of the Vietnam War. "Nowhere in [the *New York Times*'s] publication of the Pentagon Papers did the newspaper report that its document/documents were xerographic copies," she writes. "The copies were assumed to be identical to the document/documents, and—because—the document/documents were assumed to be self-identical with their linguistic content."[15] By 1969 one would no more remark on the mediation of the Xerox machine than one would the linotype. It was, in other words, ubiquitous and yet (ideally) invisible. This is the same assumption that has allowed cel animation to be written out of photographic understandings of cinema: if animators had had their way, cartoons would have bypassed the camera altogether. But the camera was only *socially constructed* as invisible—it was, in fact, an economic, industrial, and ultimately aesthetic necessity. And just as structural filmmakers enable us to "question and interrupt the transparency of photographic representation," so an artist like Ulrichs upends the codes undergirding xerographic representation.[16] He invites us to consider the Xerox machine as an

artistic medium, whether used in the studio or the office, to look at even a copy indistinguishable from the original as having distinct material—and potentially aesthetic—properties.

Of course, this account of xerography, one that doesn't take the photocopy on a case-by-case basis but rather posits each and every one as ontologically identical, risks overdetermination. But such a teleological history can serve as a means of exploring the *limits* of technology. If an obsolete telephone can serve as a paperweight, a television as a television stand, a bicycle wheel as a readymade, what happens when we think of a paperweight as a telephone? Yes, one should not essentialize the telephone—"it is better," Gitelman argues, "to specify telephones in 1890 in the rural United States, broadcast telephones in Budapest in the 1920s, or cellular, satellite, corded, and cordless landline telephones in North America at the beginning of the twenty-first century"—but we can also think through what it would mean to consider one iteration of a technology in light of those that come before and after it.[17] A teleological history, if narrated provisionally or experimentally, becomes a mode of looking.

This chapter, in turn, considers what the advent of xerography means for the visual aesthetics of the animated cartoon. Its introduction to animation production, which I will describe at length in the pages that follow, represents the culmination of the stylistic shift inaugurated by the studio United Productions of America in the 1940s. Zachary Schwartz, an animator who left Disney following the strike and later cofounded UPA, told one interviewer, "Our camera is closer to being a *printing press*, in the way we use it, than it is to being a motion-picture camera."[18] Perhaps we can, following in the spirit of Schwartz, think of the animation camera as a Xerox machine. Such a move necessarily constricts our viewpoint. This chapter, however, takes that as a challenge, not in the sense of an obstacle to be overcome but rather of a test case for the promises and failures of mechanical reproduction.

One of the first businesses to adopt xerographic technology was Walt Disney Studios, not for the dissemination of in-house memoranda and business correspondence, but for art: to transfer drawings onto cels. Starting in 1957, before the Xerox 914 was commercially available, Disney's special-effects technician Ub Iwerks filed a series of patents for methods by which xerographic powder might be securely and consistently transferred onto sheets of cellulose acetate. These inventions allowed the studio to bypass the arduous and expensive inking process. Iwerks's patents positioned the technology as a labor-saving device with certain artistic benefits:

> Xerographic techniques could be employed to eliminate a substantial proportion of the skilled manual craftsmanship that was previously employed. Specifically, it was found xerocopies of the original artist sketches could be transferred directly to cels and fused thereon, thereby eliminating completely all of the manual tracing previously required. In addition, it was found that certain of the artist's shading

> effects, that were normally lost in the manual tracing operation, could be retained by the careful application of xerographic techniques to improve the quality of the finished cartoon.[19]

When Iwerks writes of "eliminating completely all of the manual tracing," he means that the predominantly female staff of the studio's Ink Department could be fired. The male head animators, meanwhile, were delighted to be able to see their own handiwork on-screen. Xerography, they believed, preserved the freshness and vitality of their lines. It also enabled them to shrink their designs when scenes called for extreme long shots—and hence extremely tiny characters and even finer brushwork—without sacrificing precision. (Another reduction technique, used as early as *Snow White and the Seven Dwarfs* [1937], had involved cels coated in a special wash-off relief emulsion, but the results were unpredictable.) What xerography promised, in short, was to maintain the integrity of the animator's hand—that is, to copy line drawings and signatures flawlessly, just as Xerox 914 advertisements would later boast. It gave Disney the chance to exploit a new technology to which rival studios did not yet have access and to stake out innovative (if not entirely new) artistic territory. After being tested in a few scenes in *Sleeping Beauty* (1959) and used throughout the animated short *Goliath II* (Wolfgang Reitherman, 1960), these promises were fulfilled by *One Hundred and One Dalmatians* (1961), directed by Clyde Geronimi, Hamilton Luske, and Wolfgang Reitherman. As this chapter will show, *One Hundred and One Dalmatians* could not have been made without xerography—indeed, as its title hints, it is a film *about* xerography.

Xerography, in this context, offers viewers a tantalizing proximity to the original, inimitable trace of the artist, in all its imperfections and idiosyncrasies. If before, a cartoon character's outline was clean and tight and controlled, the inker's strokes regulated by Taylorist methods of handwriting, now it could be loose and scratchy and spontaneous. Walt Disney himself prized such detailed hand-inking because it effectively concealed itself. Only with the Xerox machine does the viewer become aware of the line as *line*, the contour as *contour*, the drawing as *drawing*. Cruella de Vil's contours are brittle, marked by the sorts of hesitancies and jitters that would previously have been erased, while the lines that demarcate her flowing locks betray the materiality of the pencil Marc Davis used to draw them—some are thinner, some thicker, all are as asymmetrical in their stroke as Cruella's face is in its contortions. Earlier Disney films, such as *Cinderella* (1950), showcased rounded forms and multicolored ink work: pink flesh is bounded by a slighter darker pink ink, purple by purple, maroon by maroon. Cinderella's stepmother's teal earrings have a turquoise border, while Cruella's are encircled by black (fig. 4.2). The rough jottings that compose Cruella's face testify to how she was produced, and by whom, a process that multicolored ink covers over. Xerography copies the artist's signature flawlessly and introduces a new technology for the reproduction of artistic documents.

FIGURE 4.2. Cruella de Vil in *One Hundred and One Dalmatians* (Disney, 1961) (left) and Cinderella's stepmother in *Cinderella* (Disney, 1950) (right).

The use of xerographic technology in *One Hundred and One Dalmatians*, meanwhile, allows us to think of the film as the collation of another sort of document, the kind that would be photocopied in the office to which the Xerox 914 was marketed—*paperwork*. This is a narrow definition of xerography, of course, and one that ignores the admonitions of media theorists to consider the many social and historical contingencies that bear on a technology's meaning, but it is also a definition that speaks to both the organization of labor at Walt Disney Studios in particular and the broadening of white-collar work in the postwar United States in general. While the studio had long been compared to a manufacturing plant (whether by the striking animators, who likened their working conditions to those of steelworkers and machinists, or by Disney himself, who thought of himself as a Henry Ford), we could just as easily think of it as an *office*.[20] Consider all the paper that was used in the making of a single film: from storyboards to model sheets to transcripts of story meetings, from rough pencil sketches to publicity releases to idle doodles. "Drawing was everywhere; the walls were plastered with drawings," one employee recalled. "Instead of regarding an individual drawing as a sacred thing it was waste paper."[21] To be an animator was to work on an assembly line—or it was to work as a scrivener. It was with pen and ink that he (for he was invariably a man) toiled. Thus he joined the ranks of the clerical proletariat, who produces not "footwear, apparel, meat, wooden structures, metal shapes, or grain," but rather, as Harry Braverman notes, "markings on paper."[22] Recall the young interloper who accidentally spills hundreds of Winsor McCay's drawings in the live-action prologue to *Little Nemo in Slumberland* (1911). Fifty years later, Jerry Lewis's Morty S. Tashman wreaks similar havoc in the secretarial department of Paramutual Pictures in *The Errand Boy* (1961). These affinities allow us to conceive of the animation studio as a modern office, of in-betweeners and inkers as clerks and secretaries, of animating as paperwork. *One Hundred and One Dalmatians* becomes *One Hundred Thousand and One Documents*. The same

xerographic technique that presents a visible challenge to cartoon style also renders redundant highly skilled inkers, further mechanizes below-the-line labor, and contributes to the proletarianization of the animation industry.[23] It is this tension, arising from the deployment of Xerox technology, that gives form to *One Hundred and One Dalmatians*.

THE MARKS OF HAND LABOR

The technique of cel animation, introduced in the 1910s, enabled the mechanization of animation production and, consequently, the mass production of cartoons. But what was sacrificed in cel animation was the original artwork. Alternative techniques, while perhaps unsustainable as an industrial model, offered something cel animation could not: a view of the artist's hand. When the leaves of a tree in *Gertie the Dinosaur* (1914) flutter, we do not take the agent of their movement to be a gentle breeze. They move by *mistake*—the mistakes made by Winsor McCay's assistant, John Fitzsimmons, in his redrawing of tree after tree, leaf after leaf, from one frame to their next. The leaves' accidental sway conforms to Thorstein Veblen's description of "the honorific marks of hand labor," or the "imperfections and irregularities in the lines of the hand-wrought article [that show] where the workman has fallen short in the execution of the design." As Veblen explains, handicraft is afforded a "certain margin of crudeness," one that "must never be so wide as to show bungling workmanship, since that would be evidence of low cost, nor so narrow as to suggest the ideal precision attained only by the machine, for that would be evidence of low cost."[24] The exact dimensions of this margin, however, cannot be determined in advance; it is delimited in varying proportions by the stylistic conventions of the period, the larger economic pressures facing the industry, and the vagaries of material production. Moreover, we do not always know precisely *whose* handiwork it is we are seeing—but the point remains that the transmitted line stands as a one-to-one trace of the artist.

This is especially clear in the *Out of the Inkwell* series produced by Max Fleischer, whose studio used cel animation only sparingly well into the 1920s. As discussed in the second chapter, installments in this series routinely test the "hand-of-the-artist" trope of the period in unexpected ways. For instance, a sequence in *Koko Trains 'Em* (1925) begins with what we are led to believe is Fleischer's own hand rapidly drawing the contours of a dog perched on its hind legs, which then transforms (ostensibly of its own accord) into the eponymous Koko the Klown. The hand is in fact a cutout photograph that, thanks to stop-motion animation, appears to draw at lightning speed. Individual frames of the metamorphosis, however, reveal that another hand has previously alighted on these sheets of paper: the thick, dark contours of the dog-clown follow—but not always precisely—the path set by a lighter, thinner line of pencil. That these original sketches remain visible—an imperfection, an irregularity—perhaps indicates the film's low cost, but they

have an aesthetic effect, too: they serve as a penumbra to the figure's plasmatic body, giving what might otherwise be read as pure line a volumetric dimension.

Cel animation of the same period would permit no such access to the animator's initial sketch, and hence eliminated this particular possibility for formal play, however unintentional or crude. Inkers, of course, could still make mistakes—but the crucial aspect of their work was that it always obscured the artist's gesture. Ideally, this would not be the case: they were to function as amanuenses whose mediation was to have no bearing on the meaning of the final image. But the act of tracing necessarily intervened in the drawing's communicative power, for better or worse. Sometimes it made inconsistencies in the original drawing all too palpable, as when, in Disney's *Father Noah's Ark* (Wilfred Jackson, 1933), Noah's hair is a bramble of ever-changing squiggles and zigzags. It is not easy to prevent hair or leaves from being blown by the winds of drawing and redrawing, and tracing such contours is just as thankless. In a 1937 training session dedicated to the design of the Seven Dwarfs, the male animators at Disney Studios expressed anxiety about exactly this problem. One of them, Joe Magro, recalled how Noah had had "a beard that had a continuous buzz-saw all around it," and worried that such a flitting line would likewise plague Doc, Happy, Grumpy, Sneezy, Sleepy, and Bashful (though not the bald, baby-faced Dopey). The solution the animators arrived at was to have the inkers outline the dwarfs' white beards in gray paint instead of black—and then "to say a few prayers."[25]

The move away from dark contours—from black to light gray, for instance—pointed to a larger stylistic shift at Disney. Following *Snow White and the Seven Dwarfs*, inked contours were executed in a variety of shades in order to match more closely the paints used to opaque skin, hair, and clothing. A pink cheek might be offset ever so slightly by a peachy curve or a lavender sleeve wrinkled at the elbow in purple.[26] This move is most commonly seen as in keeping with Disney's pursuit of greater and greater "realism," insofar as it impedes our ability to read outlines as *line* and thus stanches the plasmatic potential of the cartoon figure: a dog can only ever be a dog, never a clown. As Sergei Eisenstein puts it, the comicality of Disney's *Silly Symphonies* and *Mickey Mouse* cartoons "stems from the fact that any representation exists in two ways: as a set of lines, and as the image that arises from them."[27] Their contours now nearly imperceptible, the characters populating Disney's feature films lack comic power. Yet there is a subtle irony here: while now less visible, the outline asserts itself as a constraining force, one that cannot be trespassed and deformed.

To define such an inviolable border required a controlled hand. The lines had to be delicate but not tentative, rigid in their adherence to the animator's pencil strokes but never static in their execution. Inking, while still classified as below-the-line labor, nonetheless required skilled craftsmanship. The refinement of the technique indicates another shift then under way at Disney. The growth of the animation industry over the previous decade had been concomitant with an increase

in the mechanization of the production process. Labor was segmented, jobs more strictly demarcated. A clear divide was articulated between inkers (responsible for tracing the animator's drawing with black paint onto the front of the cel) and painters (responsible for opaquing the back of the cel, that is, coloring within the lines). Demanding greater precision than painting, inking was compensated accordingly. In addition, although some studios employed assistant animators to erase stray and excessive markings on an animator's sketch, inkers were often trusted to work with sketches that hadn't been cleaned up—according to Phyllis Craig, who worked at Disney, "a good inker knew what lines to pick up."[28]

But this shift, in turn, contributed to rising labor costs. Unsurprisingly, then, by the mid-1930s, studios began looking for alternatives to inking. Herman Schultheis, who oversaw the special effects of Disney's *Pinocchio* and *Fantasia* (both 1940), experimented with using microphotography to transfer drawings directly to cels. This technique, which never came to fruition, was a refinement of the wash-off relief emulsion process, which had been used as early as 1937 in the production of *Snow White* for sequences in which Snow White and the Prince are framed in long shot. Drawing characters of such small size was exceedingly difficult, if not impossible, even for the most controlled of hands. As Snow White's animator, Grim Natwick, explained: "You could take a 6H pencil and draw as carefully as you want to, and there's a point beyond which you cannot do good work."[29] The use of a special photographic emulsion enabled Natwick to draw Snow White at regular size and then create a reduction print on the cel. This same technique was used in *Pinocchio* to transfer the detailed shading of Monstro the Whale from the animator's sketches to the final image and to animate vehicles and machinery (a scale model of Stromboli's wagon, for instance, was photographed in high contrast and then printed on a cel, where it could then be painted); the gurgling lava and earthquake of "The Rites of Spring" sequence in *Fantasia* were also printed via wash-off relief emulsion.[30] But the process had a serious downside. Because its elements were wet (hence "wash-off"), there was little technicians could do to ensure that they maintained their form from frame to frame: in long shot, Snow White and the Prince both look to be leaking kohl from their eyes. Xerography, as a dry reproductive process, would eventually solve this problem.

Given the pronounced economic competition between Disney and Fleischer Studios in the 1930s, it is not surprising that Max Fleischer was exploring similar techniques. In 1936 he filed a patent for a process of combining foreground and background elements through contact printing. The foreground element, which would typically have been traced from an animator's pencil sketch onto a cel, would first be drawn with what the patent specifies as "a substantially opaque line" and then photographed in high contrast onto positive film stock. By printing the resultant image on negative stock, the technician could produce a matte of the original image, which could then be combined via contact printing with a static background painting. The advantages of this technique, Fleischer's patent explains,

are twofold. First, transferring the original drawing (more or less) directly onto film would eliminate the inking stage and its attendant costs and hazards. Second, the outline thereby reproduced would be "of a superior and more artistic quality than that now appearing on such films." Into "superior and more artistic" Fleischer folds several claims: lines would no longer reflect "the different degrees of skill and individual characteristics of the artists making the tracings," and, moreover, would retain "the artistic quality of the lines in the original drawing."[31]

This last claim is essential, if ill defined. We should not, I argue, take its assumptions as a given. What about the original drawing is more "artistic" than the traced drawing? Why is mechanical (that is, photographic and, later, xerographic) reproduction capable of preserving this quality, but manual not? It matters not, it seems, that this manual reproduction was performed mechanistically: inkers were trained to pull, rather than push, their brushes in accordance with the Palmer Method, a Taylorist model of handwriting instruction. As the cultural historian Tamara Thornton has explained, the Palmer Method turned writing into an automatic act: "The thousands of ovals executed by penmanship pupils would one day translate into the thousands of bolt-tightenings executed by Henry Ford's workers."[32] But even mechanized manual reproduction falls short of fully mechanical reproduction. What's more, the copy is stripped of the original's alchemy, what Disney himself referred to as "the full inspiration and vitality in our animators' pencil drawings."[33] Disney and Fleischer both articulate the distinct sense that the original drawing possessed something special, something that was irrevocably lost when it was copied.

Even the most skilled inker was performing rote work. She had to stifle her creative energy in order to execute the tracing as cleanly and quickly as possible, and stifled, in turn, is the energy of the original line: a line should have *life*, a line should *move*. Paul Klee writes of lines that walk, Eisenstein of lines that serve as the graphic trace of an action.[34] Critics who were able to see animator's original sketches or to watch "pencil tests" (films of preliminary motion studies and scenes) remarked on the spontaneity and sensitivity of the lines. A reviewer for the *Chicago Daily News* held that the test version of the storm sequence in *Pinocchio* rivaled the work of Picasso and Georges Braque in its combination of abstraction and representation, two-dimensional line and three-dimensional volume; the animators had captured the storm's *essence*.[35] A traced line is impoverished in comparison—static, dead. This is in part attributable to the act of tracing, divorced as it is from the moment of creative genesis, and in part to the tracers, who are not themselves artists. Milt Kahl, one of Disney's "Nine Old Men," explained to an interviewer, "It's awfully hard to trace a drawing and get any vitality into it, especially when the tracing is being done by people who really don't have an appreciation for the mechanics of drawing."[36] Kahl is not alone in this belief. Ken Anderson, who spearheaded the overall design of *One Hundred and One*

Dalmatians, says, "I was very aware from having animated myself, that when you had an inker make a tracing of your drawing that it lost some of the life."[37] To have a drawing traced was to sacrifice its vivacity, its feeling, its expressiveness.

The discourse around this division of labor offers a multifaceted and sometimes contradictory theory of the line. A line is a trace of the human (namely, of the creative worker) *and* a line must be evacuated of the human touch (namely, of the noncreative worker). A line is a singular expression *and* a line is infinitely reproducible. A line is an index of physical contact *and* a line's life is not located in the original sheet of paper. These paradoxes are particularly pertinent for my discussion of *One Hundred and One Dalmatians*. If a line is not bound to the paper on which it was painted and the ink that constitutes its body, then it can circulate like text, extracted from its material origins. This is the logic of illustrations and comics, which are drawn in order to be reproduced. A lithograph of a line *is* the line, a photograph of a line *is* the line, and a Xerox of a line *is* the line.

These assumptions undergird head animator Marc Davis's description of watching the sequences he animated in *One Hundred and One Dalmatians*: "It was the first time we ever saw our drawings on the screen, literally. Before that, they'd always been watered down." Elsewhere, he recalls: "I did Cruella de Vil, and I had every scene of her. To see my own drawings up there was a very exciting experience."[38] Davis need not qualify "my own drawings" with "photographic reproductions of xerographic reproductions of my own drawings," for we understand exactly what he means. The medium is transparent. The presence of Davis's hand persists across multiple formats, both filmic and digital. It is perhaps most visible in Cruella's first appearance in the film, as she prances across her friends' sitting room, her oversize fur coat sweeping around her (fig. 4.3). The jaggedness of its outline, especially on the collar, varies in intensity and style from frame to frame, which produces a slight "buzz-saw" effect like that of Noah's beard in *Father Noah's Ark*. Viewing each frame in isolation, one can count the individual strokes that give the coat volume and texture. Longer, darker marks suggest a pencil handled deliberately and confidently, while the shorter, lighter lines suggest a no less confident impulsiveness. One can, indeed, find meaning in even the lines that seem like mistakes. They bristle with energy, and one takes this energy as an index of the human, of Davis. In addition, the lines were almost certainly committed in pencil, not pen, as their angularity testifies. That is, as much as the lines have a life of their own, they also seem bound to the particular instant of which they are but a trace.

But lost in the reproduction is the mediation of the drawing surface. One is not able to measure how deeply the pencil impressed the paper or hold the image up to the light to study the flow of the line in relation to the grain of the paper. Although pencil drawings and their xerographic reproductions might look the same to the

FIGURE 4.3. Cruella de Vil makes a grand entrance in *One Hundred and One Dalmatians* (Disney, 1961).

naked eye, when magnified at least thirty times the difference is clear. Bamber Gascoigne explains in his book *How to Identify Prints*:

> The black lines of a xerox image are made up of thousands of tiny dust-like grains of pigment which have rushed onto the charged areas of an electrostatic field before being fixed by heat to the paper. An exact analogy, at a rather large scale, is those photographs of letters formed on the ground by pigeons into the areas charged by the advertisers with corn. As with the pigeons, there will always be a few specks of pigment which are not quite in line and it is these deviants that give the method away.[39]

But not even a projection of the film on a theater screen provides a magnification large enough for these deviations to become visible. Davis's line, it seems, loses nothing when it is reproduced. Are we, then, *really* seeing Davis's own drawings? If a line is *text* (that is, if "its identity is not uniquely bound up in [its] physical form, nor in any one copy"), then yes.[40] If a line is *image* (that is, if its physical embodiment integral is to its form), then no. In *One Hundred and One Dalmatians*, as in all xerographic reproductions, it is both at once. The drawings might not exist "in two ways" in the plasmatic manner described by Eisenstein, but they do seem to pull between the "graphic" as drawn and the "graphic" as written. One almost expects the jagged edges of Cruella's collar to conceal the letters M-A-R-C, if only for a single frame, so close are their constitutive strokes to cursive. It lets us see, as Ken Anderson tell us, Davis's "thought process."[41] His hand and mind are one.

THINKING BY STROKES

"The separation of hand and brain," writes Harry Braverman, "is the most decisive single step in the division of labor taken by the capitalist mode of production."[42] One can perhaps attribute the deadness of the copied line to the deadening task of copying itself. The mechanization of the process meant the total separation of creative and manual labor, and, as a consequence, the ossification of the worker's brain. The narrator of Melville's 1853 short story "Bartleby the Scrivener" remarks that copying is a "very dull, wearisome, and lethargic affair," even "altogether intolerable"; for Balzac's Charles Rabourdin, it is nothing short of "idiot toil."[43] Similar rhetoric infuses animators' oral histories. In the early years of cel animation, men often got their start in the industry as inkers and painters. The cartoon director Chuck Jones, for instance, worked as an inker for a spell: "Most inking was not creative work, and I quickly decided that I did not want to be an inker. It was not for this that I had been to art school. The hypnosis of boredom forced me, in order to exist at all, to learn to ink while napping."[44] But male animators had the luxury of regarding inking and painting as a stepping-stone to above-the-line work, whereas with few exceptions, women in the animation industry could not expect to advance through the studio ranks. Of course, to believe that women somehow did not find this work taxing is specious. It took a real, physical toll. Inkers gave up coffee and cigarettes and did their best not to sneeze—or even talk—in order to preserve the integrity of their line. "Pushed a pen around for 16 years," one remarked in an interview. "No wonder I can't see today."[45]

The gendered division of labor of the animation studio strongly resembled that of the office. While for most of the nineteenth century clerical work was performed entirely by men, by the 1880s this began to change. The work became mechanized, deskilled, and, consequently, feminized. Coeval with the introduction of typewriters, addressographs, pneumatic tubes, and telephones was the introduction of women to helm them. By 1930, more than 95 percent of stenographers and typists were women.[46] (Consider, for instance, a shot of the newspaper "help wanted" section from Disney's *Lonesome Ghosts* of 1937, discussed in the first chapter [see fig. 1.3]: to the right of the advertisement for ghost exterminators is a collage element clipped from a preexisting source, a column seeking female stenographers, typists, and secretaries.) In his sociological study of white-collar workers in Weimar Germany, Siegfried Kracauer dryly explains the economic logic underpinning this shift:

> Thanks to the intellectual labor invested in [machine] equipment, its handmaidens are spared the possession of knowledge; if attendance at commercial college were not compulsory, they would need to know nothing at all. . . . The fact that they are so fond of placing girls in charge of machines is due, among other things, to the innate dexterity of the young creatures—which natural gift is, however, too widely distributed, alas, to warrant a high rate of pay.[47]

Kracauer's sarcasm is blistering, but ultimately not enough to damage the reified rhetoric of scientific management. Female office workers were regarded as transient employees who would leave as soon as they were married, a belief that was enforced by the so-called "marriage bar." High turnover among women employees benefited employers both by allowing them to keep salaries low and by impeding the possibility of unionization.

The same bar was in place at animation studios. According to a short 1941 article in *Glamour*, salaries for women at Disney ranged from "$18 to $75 per week, [but] would be higher if more girls didn't work a couple of years, marry and quit."[48] An interview with Walt Disney in 1943 reaffirmed this:

> This is the way it works: I hire a capable woman artist and put her to work. She turns out a nice job, and the men working around her begin to sit up and take notice. Soon they're taking too much notice . . . and before I know it I can hear wedding bells ringing in the offing. In due course there's a marriage . . . and then of course my able woman artist has her mind more on a home than on animated cartoons.[49]

Disney's monitoring of what his employees "have on their mind" is revealing. Male animators were allowed greater latitude to let their thoughts roam, as the many ribald doodles they made of Snow White demonstrate. Inkers and painters, meanwhile, were expected to keep their focus on their work, no matter how boring. One hears echoes of Kracauer's observation about female punch-card operators: "Just one thing is required of them: attention. It cannot wander free but is under the control of the apparatus it controls."[50] It would follow, then, that the lines they ink are as constrained.

Of course, it is ultimately impossible to speculate on an inker's state of mind. We could try to wring psychoanalytic insights from frequent errors and signature strokes, or we could take the inkers at their word: in interviews, women repeatedly affirm that their work was *work*. It required a certain level of mastery that could be attained only through extensive training. But here, again, many of the inkers fall back on a common refrain—their skills, particularly their patience, came naturally to them because they were women. The head of the Ink and Paint Departments at Disney, Grace Bailey, told Bob Thomas, "Inking and painting is precision work that requires neatness and patience. Women seem to have those qualities, plus a necessary feeling for their work."[51] And many of her employees agreed. One remarked, "You find very few men with that patience that a woman had to do that."[52] Theirs was a distinctly feminine touch. Is it this touch that animators were rejecting? Were the women *too* patient, and hence their lines too controlled?

But Antonio Gramsci and Walter Benjamin, writing contemporaneously with Kracauer and the industrialization of celluloid animation, offer alternative accounts of the relationship between mental labor and manual reproduction. Gramsci levels a critique of the assumption that has thus far guided my analysis, namely, that scientific management "produces a gap between manual labor and the

'human content' of the work." He acknowledges, however, that the mechanization of clerical and stenographic work is especially difficult, for the most skilled of these professionals must effectively *not think* in order to perform their work. A scribe must learn "to fix his attention exclusively on the calligraphic form of the single letters; or to be able to break down phrases into 'abstract' words and then words into characters, and rapidly select the pieces of lead in the cases; or to be able to break down not single words but groups of words, in the context of discourse, and group them mechanically into shorthand notation; or to acquire speed in typing, etc." Any mistakes are a measure of the scribe taking *too much interest* in what he is copying—intellectual curiosity is a liability. Yet Gramsci embraces mechanization. It does not stultify the mind, but frees it. For Gramsci, the apparatus controls only the copyist's physical gestures, and the brain is "unencumbered for other occupations."[53] Benjamin, meanwhile, wholly submits to the control of the copied text, but finds the act of copying a mode of self-exploration in of itself. He likens the experience of manual reproduction to walking a path previously seen from above: "Only he who walks the road on foot learns of the power it commands, and of how, from the very scenery that for the flier is only the unfurled plain, it calls forth distances, belvederes, clearings, prospects at each of its turns."[54] This is *flânerie*, a vision of travel that conforms to Benjamin's theory of historical materialism: the rejection of the universal, the eternal, and the dogmatic in favor of experience, possibility, and disorientation.

Of course, Gramsci and Benjamin are describing the act of copying text, not images. The difference between text and image becomes clear through the manner by which each can or cannot be copied. A text can be written by hand, dictated, impressed into carbon paper, typed; it can circulate on newsprint or microfilm or be projected twenty-feet high on a billboard or inscribed on a grain of rice. An image, by contrast, is bound to its materials. Roland Barthes says of the art of Cy Twombly that "everything happens in that infinitesimal moment in which the wax of his crayon approaches the grain of the paper." Thus in Twombly's line coalesces a set of physical processes (Twombly's presumed bodily gestures) and properties (the "leavened flight of bees" of the crayon's line). Barthes admits that there are categories of drawings that effectively function as text—architectural blueprints, for instance, which we value only insofar as they are intelligible, decipherable, readable. When we examine a piece of handwriting, however, "there are also other opaque and insignificant elements—or rather elements of a different significance—that capture our attention and what can already be called our desire: the nervous turn of the letters, the flow of the ink, the cast of the strokes, a whole series of accidents that are not necessary for the functioning of the graphic code." Twombly's art, for Barthes, exists at the threshold between writing and drawing. It is, above all, inimitable. To imitate it, to copy it, he says, produces *nothing*. Yet Barthes does find himself imitating it—not Twombly's exact marks, but rather the movements he takes them to be the trace of: "I am copying not the product by

rather the production. I try to place myself, if the expression is permissible, *into the stride of the hand*."[55] (It perhaps bears mentioning that Barthes was studying a printed catalogue—meaning, reproductions—of Twombly's drawings.) The pen pushers (or, rather, pen pullers) at animation studios, meanwhile, did not have the luxury to contemplate the drawing process, let alone the drawings they were copying. Their focus was on the product alone, their job to work as mechanically, mathematically, and unflaggingly as possible.

One wonders, then, what the difference is between *automatized* drawing and *automatic* drawing. The former is drawing under the sway of scientific management, every gesture determined in advance in order to maximize efficiency. The brain turns off and the body performs the same task for hours on end—as Chuck Jones recounts, one inks while napping. This is degraded, uncreative labor, a purely manual operation. But what about the adverb Barthes uses to describe how he imitates Twombly's penmanship? "I imitate the tracings that I infer, if not unconsciously, at least *dreamily*, from my reading."[56] As Barthes makes clear in many of his essays—including this one—the choice of modifier is no small matter.[57] Is the state Barthes enters different in kind from that to which Jones must succumb? The most salient difference, it seems, is that Jones's labor was alienated, while Barthes was performing his solely for himself as a playful exercise in artistic expression. It is this practice I am calling "automatic," as opposed to "automatized": one reveals the hidden recesses of the mind, the other shuts the mind down; one wanders free, the other is rigidly predetermined; one is "the trace of a dance," the other repetitive and uninspired.[58] This distinction is articulated in Stendhal's *The Red and the Black* (1830), wherein Julien Sorel's lover confronts him about a curiosity in the love letters he sent her, the words of which he in fact purloined from another author: "He had been copying line by line without thinking of what he was writing, and evidently had forgotten to substitute for the name London and Richmond in the original those of Paris and Saint-Cloud." But Julien doesn't confess. Instead, he offers this excuse: "Exalted by the discussion of the most sublime, the most lofty ideas of which the human soul is capable, my own spirit, as I wrote to you, must have suffered a momentary oblivion."[59] In fact, the thoughtlessness of Julien's copying births an obliviousness quite removed from that engendered by the sublimity of love. The first is a deadening of the spirit, the second its awakening.

Eisenstein's theory of the line, as well as his own drawing practice, clarifies what is at stake in the mechanization of manual production and reproduction. Eisenstein drew prolifically, obsessively. Drawing and writing were intimately connected in his practice. His notes are littered with schematic diagrams and quick sketches that illustrate or test the concepts he is working through, and he remarks in one diary entry from 1931 that he frequently would turn to drawing when he was too tired to articulate his ideas in prose. The scale of his output defies cataloging. He drew on napkins and calendar pages and envelopes and toilet paper. In this sense, the drawing surface both mattered, in that his line clearly responded to it,

and did not matter, in that he drew on whatever he had at the ready. His words flow into his images, and back again.

Perhaps the fullest expression of Eisenstein's approach to drawing appears in the scores of sketches he produced while in Mexico. It was there, inspired in part by the graphic purity of Mexican art, that he rekindled the hobby, which he had abandoned in the previous decade. Trapped indoors during the rainy season, Eisenstein devoted an entire week in early June 1931 to renditions of a single theme. This was a deliberate project, intended as an investigation into "drawing and the process of drawing," but he undertook it as if in a "trance," "blindly and automatically piling up material for research."[60] By the end of the week he had amassed more than one hundred drawings, including fifty-two done in a single day, all depicting the murder of King Duncan in *Macbeth*—which, incidentally, happens offstage in the Shakespeare play. Eisenstein was thus "think[ing] by strokes" in order to manifest what Shakespeare had left to the imagination.[61] Any given sketch in the series is meant to suggest an ongoing flow of action of which it is but one instant, while the entire series demonstrates how a single idea can give way to infinite possibilities. They are Eisenstein's rejoinder to Lady Macbeth's goading of her husband: "What cannot you and I perform upon / The unguarded Duncan?" Nothing, Eisenstein answers, and thus each extant sketch has Macbeth and Lady Macbeth tending to Duncan's body in some new (and novel) way: strangling the king with what appears to be Macbeth's belt or penis, fondling his disembodied head with their bare feet, feeding on his heart or toes, defecating on his crown—all while, of course, "the owl scream[s] and the crickets cry."[62]

Eisenstein numbered 127 of these drawings. If he had maintained that rate for a year he would have had enough for a split-reel animated cartoon. But he was only one man. He exhausted the theme: his drawings repeat certain stylistic flourishes, such as the ripples of Duncan's hair, and gags, such as Macbeth or Lady Macbeth wearing Duncan's head like a crown. His hand faltered; sometimes his line trembles. When drawn on paper too soft with ink too heavy, the line varies in thickness, coagulating when it is directed upward and thinning when pulled downward. Sometimes Eisenstein drew on both sides of the paper, sometimes on only one. In some reproductions one can see the verso image bleeding through to the front or the embossment of the paper stock, while other reproductions, rendered in high contrast, effectively wash out the materiality of the paper's surface—and thus the sense of the drawing's existence in endless space. Yet the space *was* delimited: his characters stretch to the paper's very bounds without ever exceeding them.

Can his images be treated as text? Certainly Eisenstein allows for that possibility. He aimed to achieve a near "mathematical abstraction and purity of line," which suggests that one could do away with his hand altogether, plug in a formula, and graph his figures geometrically. And their reproductions follow suit.[63] The hotel letterhead is cropped out, stains and tears in the paper are eliminated, and we are left only with a clarified image: a vast field of white crisscrossed by

black calligraphy. His Macbeth drawings appear in miniature, nine to a page, in the volume of *Metod* overseen by Naum Kleiman; some of these reappear in larger format in black and white in *The Body of the Line* and in full color in *A Mischievous Eisenstein*, both published in 2000; the reproductions in *The Eisenstein Collection* (2006) are pixelated.[64] Yet Eisenstein's style persists. It is there when tiny and it is there when nearly life-size, it is there when his blue pencil is printed as gray, it is there when the brown paper disappears. It *can* be mechanically reproduced. But it cannot be traced. He recycles tropes (contortions of limbs and spines, positions of heads, organizations of bodies) and reduces his forms to the cleanest, simplest line (an *S*, perhaps, or a *W*) and draws the same thing (heads upon heads upon heads) over and over again, but this does not mean that some other hand could ever imitate him.

Eisenstein presents a radical alternative to the industrial mode of film production. He is an individual artist, a singular genius. He fulfills the model of the craftsman detailed by the sociologist C. Wright Mills: his work is meaningful because it is not "detached" in his mind from the product of the work; he is free to control when and how he works; there are no motives for his work "other than the product being made and the processes of its creation"; his work is play.[65] Nonetheless, his theory of drawing and his drawing practice engage with many of the same questions as *One Hundred and One Dalmatians* and the idea of xerography. How do we evaluate mechanized art? To what extent is the mode of reproduction itself, whether manual or mechanical, an artistic intervention? Do we believe that the inkers, like Eisenstein, were "think[ing] by strokes"?

STYLISTIC RUPTURES

It is here useful to recall Veblen's argument about the "certain margin of crudeness," a margin that cannot be prescribed in advance. Popular animation, as a product of both industry and handicraft, is forever cognizant of this margin. Eisenstein holds out one possibility, commercial imperatives another. But when we consider the ways in which the animation process had to be rationalized—or, at least, rationalizable—and its results consistent, we should not forget what *might* have been. After all, xerography was by no means the only method of bringing the animator's handiwork directly to the screen. One need look no further than the Disney Studios' own pencil tests, which were photographed directly from animation sketches and screened for animators in what was dubbed the "sweatbox." Lacking backgrounds and sound and often riddled with stray lines, extant and reconstructed tests nonetheless manage to convey the full emotion of the characters and dynamism of the staging. They are truly drawings come to life—drawings as *drawings*. Ken Anderson looked to the pencil tests for inspiration for the aesthetic of *One Hundred and One Dalmatians*. "The tracing looks dead," he explained, "but the one underneath it somehow or other has the spark of life, because it was conceived

because of an idea or an emotion. I always thought that was true when we would run tests in black and white; the animation had more life to it."[66] But the pencil tests were ultimately too loose, too unmoored from the world of sounds and colors, to be commercially viable.

Thus Disney eschewed the methods that independent and experimental animators used to bypass tracing. For *A Man and His Dog Out for Air* (1957), Robert Breer produced around a thousand individual ink drawings directly on eight-by-twelve-inch sheets of paper. Over the course of the film's two-minute running time, Breer's line worms, fractures, and swivels into a series of abstract shapes before congealing into a pair of makeshift forms that almost resemble a man walking a dog and then, finally, spelling the word "End." The animation is deliberately crude, but also spontaneous and vital, and the revelation of recognizable shapes at its conclusion fulfills Eisenstein's theory of the line's comicality. John and Faith Hubley's *Moonbird* (1959), a more traditional work of character animation than Breer's, likewise plays with the line's duality. Instead of tracing animators' drawings, the crew cut out the original artwork and pasted it onto sheets of celluloid. Visible throughout the film are the pentimenti demarcating the ovoid forms that structure each character, as are thin slivers of paper that exceed characters' outlines because, we assume, they resisted even the sharpest scissor. Such imperfections are in keeping with the film's exploration of childhood and imagination. The characters come to life not in spite of but because of their origins in everyday craft materials (paper, pencil, paint, glue).

One Hundred and One Dalmatians, by contrast, must ultimately conform to the conventions of commercial filmmaking. And, when considered alongside theatrical shorts and television spots of the same period, its xerographic technique hardly represents a radical stylistic break. Instead, its form suggests Disney's efforts to keep pace with the rapid changes in the animation industry over the previous decade. The release of *One Hundred and One Dalmatians* coincided roughly with the close of the Golden Age of animation in the United States, which was precipitated by a number of factors, including but not limited to the unionization of the labor force and the resultant rise in employee salaries, the steady dismantling of the Hollywood studio system in the wake of the 1948 Paramount case, and the growth of television in the postwar years. By the end of the 1950s, most studios had shuttered their in-house animation units. But while the era of theatrical shorts was drawing to a close, this did not mean that animated cartoons were no longer being produced. It was only the exhibition format that changed, from cinema to television: in 1958, trade papers reported that more than half of all television commercials were animated.[67] The studios that remained open were making more cartoons than ever, and independent houses flourished. William Hanna told *Variety* that he and Joseph Barbera could churn out as many as five cartoons a week—thirty times the rate at which they had produced theatrical shorts two decades earlier. To meet such demand, offices devised new ways to reduce below-the-line expenditures:

Hanna-Barbera sped up production by eliminating in-betweening; Jay Ward's *Rocky and His Friends*, which premiered in 1959, was animated in the United States but inked and painted in Mexico; other producers began outsourcing noncreative work to studios in cities like Prague and Tokyo.[68]

Television shows and commercials had significantly lower production costs than theatrical shorts. A television screen might be as small as or smaller than a cel, and the broadcasted image was, even with perfect reception, of lower resolution than 16mm film. Details of character design and movement were thus superfluous, and indeed often amounted to distracting noise. Animators no longer agonized about drapery or bone structure. The modernist style of limited animation most strongly associated with UPA became the industry norm, albeit without its political or artistic bite.[69] Reemerging in this economic context were the thick, black contours of slash-and-tear and early cel animation. Now, however, the characters they defined were not plasmatic, not prone even to squashing or stretching, utterly incapable of multiplying or smearing. But, much like Felix the Cat and Mickey Mouse, they had a strong iconographic presence, which allowed them to be identified from far away or in miniature. Their movements, simple and repetitive, could be read even through TV static. Animated commercials frequently incorporated into their mise-en-scène collage elements such as product labels and boxes, which both reinforced the flatness and inflexibility of the character design and heightened the legibility of the image as a whole. Backgrounds, too, were simplified, often radically so, if not discarded altogether in favor of monochromatic fields of color.

This aesthetic permeates *One Hundred and One Dalmatians*. The film still subscribes to the tenets of full character animation (for instance "squash and stretch") outlined in Ollie Johnston and Frank Thomas's "Principles of Animation," but the design of characters, props, and settings are all clearly influenced by UPA and limited animation: in addition to their black outlines, the human characters have thin limbs and pointed features, a graphic starkness that belies their richly rendered movements; the newspapers they read are xerographic reductions of actual newspapers (including the *Daily Mail* and the *Reynolds News and Sunday Citizen*); the backgrounds consist of abstract patches of color and busy black lines.[70]

That last tendency, overseen by Walt Peregoy, is particularly noteworthy, in that it marked a deliberate attempt to wed foreground and background. The background illustrations, done in pencil, were Xeroxed onto cels, giving them a line quality identical to the characters. These cels were then overlaid on paintings based only loosely on the original illustrations—thus the drawing of a cylindrical lampshade might be set against a triangular patch of color, or the upper edges of a curtain might be of the same shade of brown as the lintel from which it hangs. The layout artist Ray Aragon likened Peregoy's style to that of the Fauvist painter Raoul Dufy, calling it a "style where you paint beyond the line. Where you just ignore the lines and paint over and beyond. It looks like nothing. But when you put the line on

the thing, there it is."[71] Look again, however, and the representation dissolves into abstraction. Look once more, and the representation reasserts itself. Color plays against line, line against color. Although by no means unique to *One Hundred and One Dalmatians*—UPA tested it out in their early sponsored film *Brotherhood of Man* (Robert Cannon, 1945), and even made a short for television called *The Invisible Mustache of Raoul Dufy* (Aurelius Battaglia, 1955)—this style was nonetheless a first for a Disney feature film. The studio's previous features had all fallen prey to what Eisenstein called a "total stylistic rupture" between foreground and background, a direct consequence of the cel animation technique—the "crucial aspect" of which is, as Kristin Thompson has detailed, the separation of these layers.[72] In *One Hundred and One Dalmatians*, however, foreground and background are stylistically unified. The bold colors of the background match the opaque cel paintings, and the black xerographic lines tie them together. Most importantly, line and color seem to have independent existences. Neither is determined by the other, and their moments of coincidence appear almost unintentional.[73] This, again, is color as color and line as line. But the two also need each other in order to make sense. Without color, the figures would be weightless, disembodied; without line, the backgrounds would be flat and impenetrable.

But these compositions are *crowded*. The large cast of characters is swallowed up by the background's black lines and off-register colors. UPA and its imitators, meanwhile, were praised for their abstract treatment of space, in which, as a critic for the *New York Times* describes, "emptiness becomes a positive value against which are drawn a few architectural motifs or a single, telling prop."[74] Compare Big Ben as it appears in the title card for Chuck Jones's *Deduce, You Say!* (Warner Bros., 1956) and the opening credits for *One Hundred and One Dalmatians* (fig. 4.4). Only five colors are used in the earlier film: two shades of green to indicate an adjacent structure and three purplish blues for the sky, Big Ben, and the rest of the Palace of Westminster. In *One Hundred and One Dalmatians*, by contrast, Big Ben competes for attention not only with the surrounding skyline but also with the very lines used to give its colors a skeleton. Nonetheless, in both films, line and color are engaged in a careful pas de deux that dynamizes an otherwise flattened composition. *One Hundred and One Dalmatians* vacillates between three dimensions and two, between representation and abstraction, between image and text. Disney had learned from UPA how to treat the camera as a printing press.

Ultimately, however, the xerographic technique could only supplement—not entirely supplant—the cel animation technique. It was not enough merely to photocopy an animator's drawing, for then the pencil tests alone would have proven sufficient for commercial release. The drawings had to be painted and then overlaid on backgrounds. Television commercials and animated shorts had greater freedom to test the limits of representation, but feature-length animated films still needed to place full-bodied characters in fully rendered spaces in order to anchor their stories. Xerography, then, was a shortcut, a way of making the animation

FIGURE 4.4. Big Ben's appearance in *Deduce, You Say!* (Warner Bros., 1956) (left) and *One Hundred and One Dalmatians* (Disney, 1961) (right).

process cheaper and faster without appearing too cheap or too fast—and, thanks to changing stylistic trends, its black lines were no longer viewed as markers of crudeness. Thus, obscured by the account of xerography that privileges the artist's hand was the primary function of the technology: to reduce labor costs. Xerography rendered the Ink Department redundant. The line may index Marc Davis, but it symbolizes shifts in the animation industry (and, by extension, the US economy) at large.

LEGIBLE IMAGES

What makes *One Hundred and One Dalmatians* remarkable is how it reflects in both its style and its narrative the formal and industrial changes of the previous decade. It was the first Disney feature film to be set in a recognizable location—London—in the present day, and the jazz-inflected score by George Bruns firmly grounds it in contemporary idioms.[75] The story it tells is simple: Pongo, a Dalmatian, and his owner, Roger, meet and fall in love with Perdita, another Dalmatian, and her owner, Anita. Perdita gives birth to fifteen puppies, and Anita's friend Cruella steals the puppies in order to make a Dalmatian fur coat. Pongo and Perdita, aided by a motley crew of other beasts, rescue their children along with eighty-four additional Dalmatian puppies. It is not insignificant that these titular animals are black and white. The dogs themselves figure the central components of the xerographic process, namely, black ink and white paper. Publicity materials for the film at once downplayed this fact ("All 101 of us are in black and white [like all Dalmatians], but *everything* else is in gorgeous Technicolor," read the cover of one press kit), while also noting the range of whites and grays devised just for the film in order to handle a variety of lighting schemes.[76] In the daytime the dogs are a bright, clean white; indoors they are a creamy off-white; marching through a blizzard they are a light blue-gray. But they do not have the light contours or the

subtle shading of the dogs in Disney's *Lady and the Tramp* (1955). In color and line they are flat, like the sheets of paper on which they originated.

That the dogs are *spotted* is also not incidental, for it suggests a fundamental element of the xerographic process, whereby dots of ink amass into a line. The very first xerographic image ever made, by Chester Carlson and Otto Kornei in Queens in 1938, is speckled with excess lycopodium powder, and, as we have seen with Timm Ulrichs and *The Nine Lives of Fritz the Cat*, photocopies of photocopies soon dissolve back into these constitutive dots. In *One Hundred and One Dalmatians*, spots serve as a narrative leitmotif: they are playfully invoked by pipe ash patterns, splattered ink, dirty paw prints, and when drips from a melting icicle slowly expose a disguise of coal dust. And, importantly, the spots represent the sheer impossibility of making the film without xerographic technology. As Chuck Jones told an interviewer, "If I had suggested doing *One Hundred and One Dalmatians* [at Warner Bros.], everyone would have thought I was crazy. Even a dog named Spot, with one spot, would have been out of the question."[77] Such patterns were notoriously difficult to animate. In Dave Fleischer's *Ding Dong Doggie* (Paramount, 1937), Betty Boop's pup, Pudgy, dons dots in order to join a Dalmatian-helmed fire brigade, but they disappear and reappear throughout the cartoon; the dots on the ermine trim of a robe worn by Bugs Bunny in *Rabbit Hood* (Chuck Jones / Warner Bros., 1949), meanwhile, elongate and slide of their own accord. For *One Hundred and One Dalmatians*, the animators learned to treat the dots as if they were a fixed constellation of stars, which allowed them to preserve their relative size and position. David Michener, who worked under Milt Kahl, explained that his primary task was putting spots on Pongo: "That was a terrifying job. I knew if one of those spots ever jumped or jittered or jerked, there would be hell to pay."[78] The Xerox machine did not eliminate Michener's position, but it did mean that no spot would go overlooked in transferring the drawing from paper to cel. Ultimately it enabled the film's final budget to come in at "half of what it would have cost if they'd had to animate all those dogs and all those spots."[79]

Xerography offered the ability to control what the human hand couldn't—not just the inimitable flourish of an animator's line and the countless dots that even the most diligent of inkers would miss, but also the especially fine and precise lines animators themselves could not achieve. Here xerography picked up where Disney's wash-off relief emulsion had left off. As a dry process, xerography did not suffer from the sorts of irregularities to which wet processes were prone—shriveled, warped, and watery lines. It could thus be used to shrink or enlarge a drawing, perhaps to suggest camera movement relative to the character or character movement relative to the camera, without any degradation. Xerography was used in this way to animate a miniature elephant in *Goliath II* (1960) and a battle sequence staged in long shot in *Sleeping Beauty* (1959). The title sequence of *One Hundred and One Dalmatians* also teases this application of the xerographic process: a single drawing of Pongo goes from being framed in extreme long shot to

extreme close-up in six successive enlargements. The final shot is, in fact, so close as to be nearly defamiliarized: visible only are a half-dozen of Pongo's spots and three sharp lines delimiting his back and upper leg. Thus magnified, and further magnified in the act of projection on-screen, the shifting texture and varying pressure of pencil against paper are palpable. The line's pockmarks and protrusions, now as large as the entirety of Pongo once was, give it flesh. Short of examining the original drawing under a microscope or subjecting the reproduction to the analytic procedures suggested by Bamber Gascoigne, we are as close to the trace of the artist as we will ever be.

Xerography faithfully reproduces even those aspects of the line that aren't visible to the naked eye. Its results are consistent, predictable, trustworthy. It was thereby well suited to the reproduction of diagrams and maps, the kinds of drawings Barthes explicitly likened to text. In this regard, it could improve on the wash-off relief emulsion as well as on another animation technology, Max Fleischer's rotoscope, both of which had been used to animate machinery. Fleischer initially developed the rotoscope, a device that enabled animators to trace live-action footage frame by frame in order to achieve more realistic movement with little artistic training, for instructional films on the operation of heavy artillery. The assemblage of a gun could thus be filmed with a regular motion-picture camera and then its most salient features copied manually, so as to schematize an otherwise complicated process without sacrificing the accuracy of its depiction. The wash-off relief emulsion process was used to similar effect in Disney feature films for the turning of gears and wheels, which, if animated by hand, risked eccentricity. The cars and trucks in *One Hundred and One Dalmatians* posed the same problem. As they had done for the wagons in *Pinocchio*, the animators crafted scale models of the vehicles, which they then photographed frame by frame. These frames could then be enlarged and transferred xerographically onto cels. But there was an intervening step. The models constructed for *One Hundred and One Dalmatians* were entirely white, save for the black lines demarcating their windows, sides, wheels, headlights, and grills. When photographed before a black backdrop, the resultant image was nearly indistinguishable from a drawing: the white flattened into paper, the black details into inky lines, and the backdrop could be treated as a matte (to be used to combine images). In motion, however, it is apparent that the vehicles were not drawn, for they maintain their exact dimensionality and proportions even as they rotate through space.

Disney was not the only production company of the period to experiment with this kind of technique. In 1955, a pair of independent producers, the brothers Norman and Leon Maurer, devised a similar method for producing animated cartoons that purported to do away with drawing altogether. Their process was promoted as fully automated, the fastest and cheapest way to animate human motion. The performances of human actors, dressed in black and white (including black-and-white makeup), were shot on high-contrast stock in front of a black backdrop,

their bodies fully illuminated by the studio lights so as to "appear as a 'flat object' free from shadow." The film was then chemically treated to separate the figures from the background, as in a matte, and to remove the white portion of the image. The result was the outline of the figure, including details like eyebrows, nostrils, cheek lines, face wrinkles, belts, coat buttons, ties, et cetera. After another round of processing, the outline was photographically transferred to a transparent sheet, which in turn functioned much like an inked cel—it need only be opaqued, overlaid on a background of one's choosing, and finally rephotographed in order to produce a frame of the animated cartoon. Although these last steps had to be done by hand, the Maurers promoted their process as a radical alternative to the manual techniques of animating and inking: animation without animators. One of their early patents declared, "Manual techniques impose literally an insurmountable burden on the draftsmen or cartoon illustrators in order to produce an acceptable end product."[80]

A 1957 demonstration of the process, then called Artiscope, showcased animated ballerinas and sea pirates. (Later versions of the process had names like AnimaScope, Colormation, and Dynatoons. A related technique called CineMagic, which involved tinting and solarizing the image, was used for Mars scenes in the low-budget science-fiction film *The Angry Red Planet* (1959).[81] Related by marriage to Moe Howard, the Maurers collaborated frequently with the Three Stooges. Artiscope was even integrated into the narrative of *The Three Stooges in Orbit* (1962). Disappointed with their current cartoon series, their television sponsor, "N'yuk N'yuks Cereal," threatens to drop the Stooges unless they can come up with something better. Thankfully, their friend Professor Danforth has a plan: "Electronic cartoons," he tells them. "The most startling new process since the magic lantern!" Later, the Professor holds up a painting of an owl for Moe, Larry, and Curly-Joe to scrutinize. "No artist ever touched this," he informs them. "The whole thing was drawn by a machine." He then removes a paintbrush from a bucket of white paint, slaps it across each of their faces, and instructs them to get into costume—white suits with black detailing, including lapels and buttons, as well as black panels on the sides that will presumably function as attached shadows in the animated image. A subsequent shot reveals the Stooges in full getup as they boogie for the Professor's special camera. Their faces have been completely slathered in thick white paint, their features (including cleft and double chins) rimmed in black, and their eyebrows and lips darkened. We get only a few glimpses of the final "electronic cartoon" in which the animated Stooges shimmy on TV exactly as we saw them shimmy in their black-and-white costumes earlier in the film (fig. 4.5). What makes them distinctly cartoonish is not their animation per se, which is indistinguishable from what was captured by the motion-picture camera, but rather the movement of the opaque blocks of gray-toned paint that fill each figure. The application of paint to what was once a photographic image flattens it by eliminating the visual cues for volume and texture. Simultaneously it produces

FIGURE 4.5. The "before" and "after" of Norman and Leon Maurer's Artiscope process, as fictionalized in *The Three Stooges in Orbit* (1962).

a parallel layer of movement, one that slides alongside the photographically determined black outline. The result is uncanny—and, moreover, is evidence that a human hand *has* touched it. Its cartoonishness arises specifically from manual intervention into the mechanically produced image.

The Maurers' process pushes at the relationship between the photographic and the graphic just as the rotoscope had before it. Enabling the frame-by-frame projection of live-action footage onto an animator's drawing board, from which it could then be traced, the rotoscope yielded cartoons that operated in a liminal space between animation and photography. What both processes prioritize is the line—not its relative vitality, spontaneity, or plasticity, but rather its legibility, its ability to simplify the noisiness of the photographic image. The costuming and makeup worn by the Three Stooges likewise eliminate unnecessary details (pores, flab, stubble) and underscore the body's borders. Of course, the use of black-and-white costumes in motion analysis has its source in the chronophotography of Étienne-Jules Marey, and was taken up by the Fleischers early in the development of the rotoscope: Dave Fleischer dressed in a black clown costume with oversize white buttons when he performed as Koko for his brother. At Disney, meanwhile, animators worked with both rotoscoped footage and individual photostats (enlarged film frames printed on photographic paper) of actors in performance.[82] For the role of Snow White, Marjorie Champion wore a white dress with black piping, so as to facilitate the tracing of the fabric as it moved with and around her.[83] But whether built into the subject of the photograph or drawn over it, the line functions to turn the photograph, in all its plenitude and inexhaustibility, into a diagram—to make an image readable.

The Maurers' invention thus followed the broader stylistic shifts inaugurated by the advent of television and the rise of the UPA aesthetic. Like limited animation, Artiscope and its offshoots prioritized the legibility of the image. And, like limited animation, its primary appeal was that it saved labor. Where character animation had been highly labor intensive, requiring both the close study of human and animal locomotion and the subsequent step-by-step, frame-by-frame re-creation of movements small and large, animation of the 1950s focused on

graphic boldness. Sacrificed were the subtleties of gesture and facial expression, in favor of striking visual design. While *One Hundred and One Dalmatians* does not deviate radically from the principles of character animation (we learn as much about Cruella de Vil from the way she stubs out her cigarettes as from her name or her demonic features), it nonetheless articulates a tension between its characters' movements and their design. This is a rehearsal of the tension from which emerges the comicality of the animated cartoon (between "a set of lines," here understood as design, and "the image that arises from them," here understood as character), but it also further complicates xerography's negotiation between the original and the copy.

MULTIPLYING TRACES

On the one hand, xerography was uniquely capable of reproducing the trace of the artist in all its idiosyncrasies and particularities. Marc Davis, for the first time, saw his own handiwork moving on-screen. But the very same process could be used to produce a plurality of copies, each identical to the original and to one another. The same drawing of Cruella appears at least three times in the film (fig. 4.6). She sneers behind the wheel of her car, her gaze directed downward and her shoulders hunched. Her fingers are slender, her eyebrows arched, her cheekbones sharp. There are variations in the way she is painted—in one, the red of the lining of her coat is applied to a section that in the others is flesh-colored—but there is no question that the three drawings have a common origin. In one, however, Cruella is driving her car from the right to the left; the image is a mirror reversal of the other two, in which she is driving in the opposite direction. And there is a variation in shot scale: whereas Cruella is framed roughly in medium shot in two of the three frames, in the third she is in medium close-up. Xerography, here employed to save time and money, must treat the drawing as a design element, one that can be flipped or enlarged as the narrative demands.

Can we really expect Davis to have had the same reaction to each of these reproductions? Which is the original? Which is the copy? These questions recur throughout *One Hundred and One Dalmatians*—and throughout the one hundred and one Dalmatians. As Chuck Jones told Michael Barrier, it was xerography that facilitated the animation of the "acres and acres of puppies." All they had to do was animate "eight or nine cycles of action, of dogs running in different ways, then [make] them larger or smaller, using Xerox, knowing that if there are a hundred and one dogs, and if there are eight or nine distinct cycles, and they're placed at random in this rabble of dogs, no one will know that they all haven't been animated individually."[84] Staggered just right, one puppy can hop over the same obstacle again and again without being noticed (fig. 4.7). The singularity of the drawing (the line as an index of an inimitable gesture, the fleeting moment when graphite first makes contact with paper) gives way to a multiplicity of copies.

FIGURE 4.6. The same drawing of Cruella de Vil, three times, in *One Hundred and One Dalmatians* (Disney, 1961).

FIGURE 4.7. The same puppy jumps to safety again and again in *One Hundred and One Dalmatians* (Disney, 1961).

FIGURE 4.8. From top: "Kanine Krunchies," *Springtime*, and *What's My Crime?* play on the television in *One Hundred and One Dalmatians* (Disney, 1961).

Significantly, several sequences in the film are organized around a television set, and it is through these scenes that the film broaches the problem of how to animate a mass of nearly identical characters (fig. 4.8). The Dalmatian family gathers around the cathode hearth to watch their favorite television star, a collie named Thunderbolt, foil his human heavy, and at a pivotal moment, the program cuts to a commercial for the pet food Kanine Krunchies. (When Pongo turns off the TV, the spokesman for Kanine Krunchies is xerographically reduced over several frames in order to suggest the television tube going out.) Later, kidnapped and trapped in Cruella's hideout, the puppies and their scores of companions watch an early *Silly Symphonies* short, *Springtime* (Disney, 1929). Cruella's henchmen then take control of the set to watch an episode of a game show called *What's My Crime?*. The style and content of these programs recall earlier (that is, pre-Xerox) solutions by the animation industry to problem of depicting similar-looking characters—a problem not all that dissimilar to the one posed by *One Hundred and One Dalmatians* itself. In *Springtime*, three flowers dance in perfect unison, their limbs moving fluidly in the manner of "rubber hose" animation. Donald Crafton explains how this synchronization was achieved:

> Once a figure has been sketched out in its component motions, an assistant simply retraces the drawings to make another identical character to position next to the original. Repeat as needed to make more clones. If the drawings are flipped left to right before tracing, then mirror-image figures dance with each other in the same steps. But they move in the opposite direction. . . . By retracing and cycling the drawings, a complicated dance sequence with several characters could be done, all based on a single original sketch series.[85]

So which flower exactly, we might wonder, is the original? The same question can also be asked of the advertisement for Kanine Krunchies, which is pitched by a row of dogs drawn in the UPA style. Their stereotyped movements and highly simplified character design, white contours set against a black background, meant considerably less work for the Ink Department and perhaps none at all for the Paint Department, and hence made rendering a large number of figures economically viable. The human figures in *Thunderbolt* and *What's My Crime?*, meanwhile, are distinguished from one another through both their design and their movement—they are emblems of labor-intensive character animation, which offers yet another solution to the problem of animating multiple characters. After all, it was with *Three Little Pigs* (1933) that Disney pioneered the technique. Chuck Jones cites it as "the first picture with three characters that looked alike and were differentiated by the way they moved and the way they spoke."[86] The television programs thus figure three styles of animation, each with its own labor process.

Before Xerox, then, one hundred and one—or even just two or three—Dalmatians might have been brought to life through a process of manual tracing

(as with the flowers in *Springtime*), or by radically simplifying their designs so as to reduce the amount of tracing necessary (as with the dogs in the Kanine Krunchies commercial), or through the painstaking process of giving each Dalmatian its own unique manner of walking and talking (as with the human figures in *What's My Crime?*). The first two options are in keeping with an idea of xerography that values the medium's capacity for multiplication; the third, meanwhile, follows the desire to come closer to the vitality synonymous with the virtuosity of the individual artist.

And, at its very beginning, *One Hundred and One Dalmatians* strongly implies that each of the one hundred and one Dalmatians will have a distinctive, signature movement: xerography will be harnessed for its ability to copy line drawings flawlessly, but not for its ability to multiply them. In the first post-credit scene, Pongo stares out his master Roger's window and contemplates the dogs (and their walkers) passing by. Based on their gait and design alone, he makes snap judgments: "Unusual breed." "A little too short coupled." "Much too fancy." "Too old." "Too young." What we witness, through Pongo's discriminating gaze, is character animation at its finest: the pug waddles, the afghan hound lopes, the poodle prances. Watching it, we might entertain the thought that this sort of rich, detailed attention will be given to every last one of the Dalmatians: all will be original, and we will be able to tell one from the other just by the way they strut. And yet—and this is a big yet—this same sequence has built into it another possibility. However vibrant and comical the animation of these woman-dog pairs may seem, none would have been realized without the shortcut known as a walk cycle. The characters are walking on a loop, just as they would in a phenakistoscope or zoetrope or a Marey or Eadweard Muybridge motion study. The same drawing is reused with each renewal of the cycle (fig. 4.9). (Which, then, is the original? Which is the copy?) As it turns out, *One Hundred and One Dalmatians* is a film filled with walk cycles—walk cycles multiplied with a little help from the Xerox machine.

Xerography, as deployed within *One Hundred and One Dalmatians*, differed from its use elsewhere. What mattered most to animators was the machine's capacity for reproduction, less so its capacity to produce *multiple* copies that made it so popular in other contexts. But, in fact, both ideas are at work in Disney's film, and, ultimately, Ub Iwerks's Xerox machine is not all that different from the Xerox 914. We can see in the film, then, proof of Benjamin's claim that "technological reproduction can place the copy of the original in situations which the original itself cannot attain."[87] And we might feel, even in this sequence, that we are being brought closer to the inimitable trace of the animator. But there emerges a paradox. Somehow mechanical reproduction brings us closer to the artist's hand than manual reproduction ever could—for manual reproduction, we understand, was not performed by *the* artist, and not even by *an* artist. And yet the manually reproduced line, the line traced by the female inker, the noncreative worker, is *unique*, an irreducible impression left by the anonymous laborer. The xerographically reproduced line, however, is not unique. The very same process that let Marc Davis

FIGURE 4.9. The same drawing of the Afghan hound is reused with each renewal of the walk cycle in *One Hundred and One Dalmatians* (Disney, 1961).

see his "own drawings" on-screen for the first time could also be used to produce a multiplicity of copies, each identical to the original and to one another.

In the *Arcades Project*, Benjamin coins the term "the multiplication of traces" to refer to the necessary outgrowth of the "modern administrative apparatus"—the bureaucratic networks of documentation and paperwork, of identity cards and fingerprints, of filing cabinet after filing cabinet after filing cabinet.[88] He quotes Balzac's early diagnosis of the surveillance state:

> Do your utmost, hapless Frenchwomen, to remain unknown, to weave the very least little romance in the midst of a civilization which takes note on public squares of the hour when every hackney cab comes and goes, which counts every letter and stamps them twice at the exact hours when they are posted and when they are delivered, which numbers the houses, which registers each floor on the schedule of taxes, after making a list of the windows and doors, which ere long will have every acre of land, down to the smallest holdings and its most trifling details, laid down on the broad sheets of a survey—a giant's task, by command of a giant![89]

But he could just as easily have been describing the animation industry, with its interchangeable parts, its rigid division of labor, its cost-cutting measures, its systems of managerial control, its piles of paper, its monotonous regularity—of which *One Hundred and One Dalmatians* is the culmination.

MASS REPRODUCTION

Pages proliferate. Paper piles up. Cels are inked and painted and then photographed and then washed clean. After four or five passes through the assembly line, they are incinerated. Drawings and gags are recycled within films and from film to film. For the animator, Scott Curtis remarks, "the number and ubiquity of images is mind-boggling and inescapable."[90] Promotional materials for *One*

Hundred and One Dalmatians tout these numbers: 6,469,952 spots scattered across 113,760 frames of film, requiring, all told, the consumption of 1,218,750 pencils, any one of which we might submit to the "act of attention" described by Vladimir Nabokov in his 1972 novel *Transparent Things*. We follow the graphite back to its excavation from the earth and the wood back to its tree. We finger the pencil, "we hear the whine of a newly invented power saw, we see logs being dried and planed." Nabokov regards the lead with Dziga Vertov's Kino-Eye, which can bring slaughtered livestock back to life: "See it baked, see it boiled in fat (here a shot of the fleecy fat-giver being butchered, a shot of the butcher, a shot of the shepherd, a shot of the shepherd's father, a Mexican) and fitted into the wood."[91] But the sheep is gone, the saw is gone, the pencil is gone. We are left only with its trace, the trace of its trace, a copy of a copy of a copy, a screen grab of a digital file of a scan of a print of a photograph of a palimpsest of glass, celluloid acetate, and paper—thousands of them. Where do we even begin? The accumulation threatens to overwhelm.

Throughout this book, I have argued that we should start with one frame at a time. To stop the film and to study the individual image—the photographically reproduced document, the photograph as such, the painting as such—is to remember that the image is not, in the words of Lisa Gitelman, "self-apprehending." Gitelman insists that the material histories of technological reproduction should not be relegated to footnotes, that research must not forget "the real human agents involved, like the typesetters and printers of 1854, the microfilm camera operators and film processors of the twentieth century, and the scanner technicians and data handlers employed today by ProQuest's offshore contractor."[92] At the animation studios, the human agents were inkers and painters, assistant animators and in-betweeners, camera operators and cel washers. Their history is also the history of secretaries, textile workers, and machinists, of Adam Smith's pin manufacturers and Upton Sinclair's meatpackers. It is an anonymous history. It is a history of drudgery.

Ben Kafka's recent intellectual history of paperwork thus doubles as a history of cel work: "The manual labor required to transform [its] raw materials into files, registers, and finally power itself was slow, hard, and prone to error."[93] Paperwork, he explains, is defined by the frustration it engenders. We hear echoes of this frustration in the exasperation expressed by inkers and painters, and it is palpable, too, in Walt Peregoy's lament that in-betweening was "absolutely the epitome of factory work" and Jack Kirby's comparison of Fleischer Studios to a garment plant.[94] It lurks within Benjamin's cryptic pronouncement that "the route taken by a file in an office is more like that taken by Mickey Mouse than that taken by a marathon runner."[95] And it determines the plot of Disney's *Pigs Is Pigs* (Jack Kinney, 1954), in which a hapless railway agent wrangles doggedly with bureaucratic red tape. Unsure if a shipment of guinea pigs should be classified as "pigs" or "pets," he sends a telegraph missive to upper management. The guinea pigs, in the

meantime, breed and multiply exponentially, their numbers matched only by the carbon-copied files and memoranda the railway produces to keep track of them. The voice-over jauntily recounts the reproductive process:

> They examined the wire and immediately dated it
> Then stamped the receipts and communicated it
> To the department that quadruplicated it.
> Copies were sent out to all of the staff.
> Each copy received was filed and related
> To copies of copies that checked and notated.
> Nine copies of each were validated . . .

The final line of Friz Freleng's *By Word of Mouse* (Warner Bros.), released the same year, hinges on an identical pun. A German mouse, having related to his family the details of his trip to the United States, where he received a tour of a department store and a quick lesson in capitalist industry, concludes his story by asking them, "Und now do you all understand mass consumption und mass production?" "*Understand mass production?*" cries a harried female mouse, at whose feet swarm a flock of children. "I'm a victim of it!" Her offspring's movements cycle over and over again. Can you tell which is which? Are you sure? The traces multiply before our eyes.