EDITOR'S INTRODUCTION

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My task which I am trying to achieve is, by the power of the written word, to make you hear, to make you feel—it is, before all, to make you see.
—JOSEPH CONRAD[1]

Why would anyone bother to slow down an animated film and look at every frame?
—TOM SITO[2]

There is no subterfuge in what Hannah Frank intends to do with this book. Early on, she writes: "I thus inaugurate a study of the single frame, the single document, in which the tiniest of details—a brushstroke, a shadow, an errant speck of dust—is freighted with historical and, ultimately, political weight" (15). This is the crux of her ambition: to look at cartoons in a specific way—frame by frame—that will allow the process of their production to become visible within the finished films themselves. She wants to be able to see "the tiniest of details," ones that are ordinarily invisible. And then to grapple with the question of how all of this close looking, all of the emphasis on what lurks beneath the horizon of perception, can be used to reimagine or reconceive our understanding and experience of cartoons. This breathtaking book does not provide a new history of how cartoons were made; it does not uncover new patents or reconceive what we know about the logic of their mass production (a logic that involves both the division of labor and a gendered hierarchy of creative authority). Rather, Frank aims to show that these well-known features of the production of animated cartoons do not hide behind or beneath the cartoons in a separation of industrial history and aesthetic experience. Through her acts of looking, she trains our perception such that we can see how art and industry come back together, and so understand how each enriches the other. These are the criteria that Frank isolates for what she describes as "an art formed on the assembly line" (2). Frame-by-frame analysis is what makes it all happen.

Yet in this early declaration of intent there is something beyond a description of the book's central premise. We hear the voice of a young scholar looking toward her own future. Her "I thus inaugurate" heralds the pages that follow, but it also suggests all the works to come. The tone is ambitious and confident: she is aware that she has a program that no one else could imagine undertaking, much less be capable of achieving. The words announce the beginning of a career, and with it the promise of a unique and original voice within the field. It is the mark of a future star.

This was not to be. On August 28, 2017, Hannah Frank died of bacterial meningitis at the age of thirty-three. She had completed only a single year of teaching at the University of North Carolina Wilmington, where she had already become a cherished member of that community. The future she should have had remains a promise found in the memories of those who knew her, and in her own words.

Frank's voice shines throughout the pages of this book. You hear it in her accounts of the cartoons she discusses, and when she describes what happens to our understanding of them once we start looking at the individual frames. But her voice emerges most clearly in the discussions of method:

> The viewer of animated cartoons must work, too. . . . Looking at cartoons frame by frame is labor intensive—tiring, tedious. Yet her attention and her will must never waver. A single frame, so easily overlooked, might contain a pencil drawing that wasn't meant to be photographed, a profusion of feathery brushstrokes, a telling fingerprint. At the same time, she must also *play*. The monotony of frame-by-frame analysis leads one to daydream. . . . *What if?*, I ask again and again. What if we looked at works of cel animation like we do microform periodicals? What if we thought through cel animation's photographic basis in accordance with both realist and materialist theories of cinema? What if we treated each cel as a work of art in its own right? What if we compared inkers to secretaries? These questions, and the ones that emerge from them, are meant to test the limits of animation. (152)

This voice is after large questions, aimed at understanding the political economy of cartoons by way of the traces of their production left in the finished product. But it is also whimsical, aware of the vagaries of attention—not just as a flaw but as a model for an approach. One daydreams; one plays; one wonders.

In thinking about Frank's voice, and how to account for its power, I've sometimes turned for comparison to the early work of Stanley Cavell. This is less for the aspects of his philosophical method than for his critical voice, and the way that an act of looking—of looking very hard at something—can produce an explosion of what had always almost been in plain sight. Take this discussion of a phrase from *Romeo and Juliet*:

> Now suppose I am asked what someone means who says, "Juliet is the sun." . . . I shall *not* try to put the thought another way. . . . I may say something like: Romeo means that Juliet is the warmth of his world; that his day begins with her; that only

> in her nourishment can he grow. And his declaration suggests that the moon, which other lovers use as emblems of their love, is merely her reflected light, and dead in comparison; and so on. In a word, I paraphrase it.[3]

This is criticism of the highest order, combining eloquence with insight. Frank's writing shares the ability to transform our understanding, even our basic perception, of artworks with which we believe ourselves already intimate. The cartoons she discusses, and the characters who inhabit them, are utterly familiar: Mickey Mouse, Bugs Bunny, Woody Woodpecker, Popeye, Daffy Duck, Tom and Jerry, and so many more. We grew up with them—and perhaps for that reason we have never fully examined them. *Frame by Frame* trains us to see them anew, to grasp their freshness and depth.

There is, though, a crucial difference between Cavell and Frank, and it has to do with the perception of the labor of the critic. Cavell's analysis of *Romeo and Juliet* is certainly careful, thought through, studied; it took immense skill and effort to produce that reading. Yet his prose works hard to seem effortless: the casual "and so on" suggests that the reading was produced more or less off the cuff and could be continued at will.[4] This is not Frank's aim, nor her style. How could it be? "Imagine," she asks us in the opening words of the book, "studying a building not by walking its hallways or perusing its blueprints, but by examining each of its bricks: the pockmarks produced by air bubbles in the clay, the whorls of reds and browns, the trowel's impressions in the mortar. Imagine evaluating a mosaic not for the bigger picture but for the glint of individual tesserae. Or imagine not watching a film but looking at it frame by frame" (1). This is not just about a relation of part to whole, but about the work it takes to see—much less to examine—all these minutiae. *Frame by Frame* is built on an astonishing foundation of labor, a feat of viewing that required moving through somewhere in the vicinity of two million frames of animated cartoons.

Frank does not address her own work, the gargantuan yet mundane task of such a project of viewing, with the aim of garnering sympathy or favor. She regards this effort as one demanded by the very objects she is talking about. Repetitive work was crucial to the production of cartoons in studios, an unglamorous but necessary set of jobs—inking, in-betweening, et cetera—that were marked as uncreative but made what was called creative work a possibility. This work, moreover, was largely performed by women, who had little hope of advancing to more prestigious positions. In making the display of her own labor visible in her writing, Frank draws an affinity between her project and the uncredited work of the women who actually produced the images we see in the final cartoons. Part of the book's politics is thus enmeshed in its very method.

This method, the frame-by-frame approach, is what holds the book together. Over the course of its pages, Frank discusses an extraordinary range of topics, including the aesthetics of cel animation; the industrial organization of animation

studios; the technical history of animation; xerography; the relation between live-action and animated films; theories of montage; microfilm; Soviet cinema; abstract art; theories of authorship; the avant-garde; and deep-focus cinematography. In her hands, these topics turn out to bear directly on one another, but never in familiar ways. Every time you think you have an argument pinned down, the contours of a discussion mapped out, it becomes something else and leads not only into new sets of problems but into unexpected and surprisingly compelling ways of seeing and understanding the original one. If the ostensible topic of the book is cel animation in US studios, its insights range far beyond that—put differently, it shows how thinking about animation matters urgently to a range of debates and discourses.

Frame by Frame is basically the dissertation that Frank defended in August 2016. It is not the book that she would have published. In the months before her death, Frank had begun to think about how she might revise and change it. The part of *Frame by Frame* that dealt with Disney in the 1950s would be saved for its own book, while this book would incorporate much of the material from the dissertation but also expand to cover in more detail various techniques—whip pans, flicker effects, streaking effects—that bring cel animation into conversation with the strategies of experimental cinema. These books, surviving only in fragments and notes, will never be written. But what is contained here offers far more than testimony to the dream of what would have been; it is a powerful and original work, one that stands on its own as a significant piece of scholarship and intellectual inquiry.

There should have been more. More books, more essays, more reflections. Frank published only a few articles while she was alive. Two of these were on animation. One, drawn from the first two chapters of this manuscript and titled "Traces of the World: Cel Animation and Photography," won the 2017 Norman McLaren—Evelyn Lambart Award for Best Scholarly Article in Animation.[5] The other was a study of affinities—actual and potential—between US and Soviet animation over a period that mostly covered the 1930s and 1940s.[6] Frank also wrote on Sergei Eisenstein: an essay on his drawings of *Macbeth*, and an account of how he read other authors.[7] And she wrote on the under-studied practice of synthetic sound, the fantasy of creating sound without any referent in the world.[8] At the time of her death she was involved in a range of other writing projects, from a study of Disney's wildlife films of the 1950s—and the way special effects were used there—to an account of Paul Thomas Anderson's *The Master* (2012) that focused on the intersection between the film's use of a 70mm format and a reading of Scientology as a media theory. These projects, and the innumerable others that would have sprung from her, must remain incomplete or unrealized. We are the worse for that.

What we are left with is this extraordinary book. Its arguments are careful and nuanced, yet brim with a wild originality—not only Frank's knowledge that she

could find something hitherto unseen in the individual frames of cel animation, but her confidence that she could draw out vast and compelling consequences from those fragments. And there is of course her voice. It is utterly unique: at once sharp, critical, generous, and above all playful. To look at cartoons frame by frame, she says, is to undertake a method that functions as a form of play, a kind of game that one plays with the films being seen. What a pleasure it is to play this game with her. If, as she writes in the concluding lines, "Looking is laborious. But looking is also dreaming" (156)—well, that is where we are now, with the book we have and the dream of what could have been. We are fortunate to have this much.

FRAME BY FRAME

The book works by wondering about a question: What is it like to look at animation frame by frame? It's not, after all, even clear that one *should*. Buried in a footnote, Frank quotes the animator Tom Sito: "Why would anyone bother to slow down an animated film and look at every frame?" (176n15). It's a fair question: What is to be gained by undertaking this obsessive analysis? Why would you stop the movement of the film, and the play of the figures, in order to see what's in each frame? What do you think you'll see there that you couldn't see otherwise?

Answering these questions is the burden of Frank's project. One response follows the logic of discovery: "I am able to look past their immediate attractions—the plasmatic, free-form, potent movement of painted bodies—toward those elements of the image that are static (a newspaper insert, a background painting) or repeated (cycled motion) or fleeting (flicker) or imperceptible (a single frame)" (153). The extraordinary and unexpected things she finds there—and then what she does with them—are the deep pleasures and joys of this book.

We see the power of this logic throughout the manuscript. In one section, for example, Frank analyzes instances of what she calls "retinal bombardment": "brief 'flicker' sequences consisting of the rapid alternation of all-black and all-white frames or positive and negative images—sequences meant to evoke blinding pulsations of lightning or elicit the sort of somatic overload brought on by shock" (24). Thus, in Walter Lantz's *$21 a Day (Once a Month)* (Universal, 1941), a dog stuffs pillows into the holes in a sleeping turtle's shell; as the turtle breathes, the shell swells up and then explodes, leaving the turtle—in red pajamas—hanging on a hook. Frank remarks:

> Nearly every frame stands as the sole record of an ephemeral document: a stack of transparent celluloid sheets, each one uniquely painted and inked, set against a static background painting. Every other frame, however, records not a cel setup but a white sheet of paper. The alternation between colorful representations of the struggling turtle and white frames creates a flicker effect that serves to enhance the visual impact of the explosion. (25)

This is a familiar kind of comic gag, repeated so often that its significance as a formal technique can go unnoticed. Frank surfaces it to examine how the alternations of black and white frames create their stroboscopic effect. Even more, she sees in it an important affinity with flicker films by Peter Kubelka, Paul Sharits, and other members of the 1960s and 1970s avant-garde. The lesson is not least about how a technique thought to be the privileged terrain of the avant-garde shows up within the very texture, the material substrate, of seemingly innocuous cartoons.

That conclusion would be enough to justify attention, but as a method it wouldn't be entirely unusual. Looking at a film frame by frame, after all, is not a new idea. Vlada Petric broke down Dziga Vertov's *Man with a Movie Camera* (1929) into its constituent frames, and from there was able to see patterns and structures underlying its most virtuosic effects. Noting the frequency of sequences constructed out of shots of one and two frames—either of different subjects or of black frames—Petric argues that they work to "subliminally stimulate" the viewer toward a given end.[9] There are also important examples from scholarship on animation.[10] In each case, frame-by-frame analysis enables the discovery of how things actually work, a fine-grained study that shows exactly how and why viewers are being affected.

Frank is doing something else, and it is this shift in orientation that produces discoveries that can astonish a reader. In the case of *$21 a Day (Once a Month)*, as she works through the alternating white frames she notices something startling: "The particular white sheet of paper that has been photographed . . . is not blank, but rather bears a sketch of Woody Woodpecker, Walter Lantz's most famous cartoon star" (25). What a thing to suddenly see! And this sketch, Frank discovers after yet more viewing, is already from a frame in Alex Lovy's *Knock Knock* (Universal, 1940), made the previous year and (as it happens) the very first film to feature Woody Woodpecker. The camera operator, tasked with photographing a white sheet of paper, inserted—whether intentionally or not—a sheet that was not entirely blank. The light sketch in the white background, a frame that in the film alternates with frames showing the explosion of the turtle, only becomes visible when examined at the slow pace of frame-by-frame analysis. It challenges the very idea of what we thought we were seeing; it is the discovery of a world beneath the world.

What Frank realized is that she could find such phenomena throughout the history of US animated cartoons. She discovers, for example, a similar trace of a sketch in Bob Clampett's *A Gruesome Twosome* (Warner Bros., 1945), where a white frame is inserted at the moment a character is hit on the head by a club. Treating this frame as a photograph of a piece of paper, and isolating it from the flow of the film, Frank notices a "pencil drawing of a dog's head, which served as the basis for a cel painting that appears about twenty seconds earlier in the same film" (24). There are others. Frank finds frames in which mistakes were made in the

photographing (cels are flipped or even left out; the finger of the camera operator is still present); frames in which camera ephemera are preserved (traced characters from other cartoons); frames in which representation breaks down (smeared paint to depict fast movement; abstract patterns to represent explosions); frames in which the effects of the camera are visible (the presence of Newton's rings, or concentric circles on the image; the recording of dust motes attached to the cel). *Frame by Frame* catalogues these hidden moments.

These phenomena constitute the archive that the book mines for its insights, and which is the foundation of its originality. It is a unique kind of archive. Frank does not discover an archive that already exists—one that is, in a sense, out there in the world. The archive of *Frame by Frame* is the archive of frames, the archive of what she discovers by looking; it is the archive she creates.[11]

What Frank pulls out of this archive are the traces of the production process that allowed the Golden Age of cartoons to flourish, that made possible everything that came out of Disney, Warner Bros., Universal, and others. But Frank is not telling a conventional history; she is after something else. What traces of this production, she asks, can be seen in the films themselves? How does our perception of these traces change the way we see the films? These are questions, she says over and over again, that move between the epistemological and the aesthetic. Epistemological, because the actual objects that were produced—the cels themselves—are by and large no longer extant, either thrown away or washed and recycled for future use. Aesthetic, because there is a question of how this production process shaped the actual cartoons that we watch: "Even a mistake in a single frame can quake the world of the film. *Did I just see that?*" (57).

It is at the intersection of epistemology and aesthetics—about how "epistemological concerns . . . become a site of aesthetic inquiry" (47)—that Frank's frame-by-frame approach, and the archive she simultaneously discovers and creates, marks a distinct innovation within animation studies. That there is a divergence between the way we experience cartoons and the mode of production that makes them is a familiar claim about Hollywood animation. Eisenstein observed that the experience of freedom in Disney cartoons exists within the context of a social organization of labor that precludes the reality of that freedom.[12] Paul Wells makes the connection to Disney's own labor practice explicit,[13] while Scott Bukatman extends the argument to a condition of the medium itself:

> Labor and anima, then, might be regarded as the elemental forces creating a dialectical tension that informs the early history of animation, a dialectic that centers on the energy of onscreen animated characters. . . . Writers on animation continually circle around the tension between the anarchic polymorphous perversity that it presents and the hyperregulated mode of production that produces it. Animation as an *idea* speaks to life, autonomy, movement, freedom, while animation as a *mode of production* speaks to division of labor, precision of control, abundances of preplanning, the preclusion of the random.[14]

As Bukatman notes, much of this discussion is centered around the depiction of characters who seem to come to life, to gain *anima*, by virtue of the seemingly spontaneous way in which they move—despite the fact that they are drawn in static poses, shot frame by frame, and animated on the assembly line.

Frank incorporates this opposition, but reorients it through two perspectival shifts she effects in thinking about animation. The first is to take seriously the fact that cel animation is a photographic medium. If one regards every frame of an animated film as a unique photograph, one could subject each frame to a range of investigative questions that would move from the composition of the image itself to the history of its production. As a photograph, the frame becomes a document. The second pushes against the most prominent way of thinking about animation: as a medium that creates an impression of reality, of liveliness, from the perpetual motion of its forms. Frame-by-frame analysis stops that motion—in effect, taking the animation out of animation—allowing aspects of the animated image to become visible for the first time.

These shifts go together, generating a new way of conceiving the intersection between the form of the cartoons, their aesthetic organization, and the epistemological questions raised by historical investigations into documents. More precisely, to see the unseen industrial labor behind the cartoon in the finished film, we have to interrupt its flow. As she notes, once the cartoons start to move, we are helpless before their pleasure: "To *remember* that animation is photography is not enough, for memory cannot compete with the present tense of the animated cartoon" (49). Again, Frank is using a familiar trope for new purposes. In one of the key texts of film theory from the 1970s, Jean-Louis Baudry lamented how difficult it was to resist being pulled along by the movement of a film, the successive and inevitable appearance of images that draw the viewer along. Filmmakers, he argued, needed to create films that would disrupt that experience.[15] Frank wonders what the viewer, on their own, might be able to do. The frame-by-frame approach is her tool to prevent such immersion. Frame-by-frame looking forces us to stop the flow of the cartoons, and make the pause button and step-by-step playback regular parts of our viewing experience.[16] To draw on a different critical language, we could say that frame-by-frame analysis works for Frank as a kind of eidetic reduction, a bracketing of the world that allows for attention to a specific phenomenon.

This is why finding the errors matters for Frank. They are moments when we can see cartoons differently, when the work of the uncredited artists—men and women, though mostly women—whose art we actually see on-screen comes to the fore. When we learn to see in an accidentally flipped cel "Daffy Duck's gloppy underside, in which his bill lacks details like lips and nostrils and his hands distinct fingers" (60), we catch a glimpse of the work of the Paint Department and the traces of the women who labored there. Or when we can notice that Bugs's head disappears for a frame in *Hair-Raising Hare* (Warner Bros., 1946): "Just like

that, we realize he has been painted in sections, his head on one cel and his body on another, and we see both the total coherence of Bugs's graphic design (insofar as every part of him is reacting in some way to Gossamer's physical threat) and the completely fragmented labor process that necessitated dividing him across several cels" (58). Or when we can look at movement and explosions and see in them the constitutive smears, abstract patterns, and other visual forms in which the parameters of representation are stretched to their limits:

> The frame-by-frame examination of almost any animated cartoon will uncover at least one drawing, one cel, that seems out of place. It may, in the flow of the action, go unnoticed—but in isolation it is too puzzling, too wonderful, and often too abstract to be ignored. Perhaps it is the flurry of brushstrokes that seizes one's attention, or perhaps one is seduced by its radical minimalism or overwhelmed by its cacophonous colors. (90)

This is the wondrousness of the work of the assembly line, of the people whose job it was to translate the vision of the lead animators into the images that made it on-screen; it reveals what Frank describes as "the importance of noncreative labor, such as in-betweening" (78). These cels—really, these paintings—were all made by people who went uncredited in the cartoons but who produced images of stunning beauty. Watching the films at normal speed, the frames flow by under the guise of representational continuity; stilled in the frame-by-frame approach, they emerge as artworks in their own right.

Here we can come back to Frank's discovery of the sketch of Woody Woodpecker in the white frame from *$21 a Day (Once a Month)*. Once one sees it, Frank notes, "one is thus brought back to the sequence's creation." But how do we learn about this creation? Any actual information about the production of a specific frame no longer exists (if any record of it ever did). This is a familiar kind of gap in historical arguments, and Frank fills in all the details from what we know about how cartoons were typically made: "The camera operator, the technician assigned what is notoriously the most tedious of studio tasks, arranging first the cels against the static background, then taking a photograph, then removing the cels and the background and putting the sheet of paper in their place, then taking a photograph, then replacing the background and arranging a new stack of cels, and so on" (25). But her genius is to ask questions that center around the activity of speculation, the articulation of what Frank, quoting Thomas Elsaesser, labels "possibilist histories."[17] She wonders: "Did the camera operator know Woody would be visible in the final film? Is it only possible to see him because *$21 a Day (Once a Month)* can today be viewed via a 'restored' digital copy, one that perhaps brightened an image that the camera operator had intended to be obscure? These are facts that cannot be retrieved" (25). Her insight resides in the mapping of what we don't, or can't, know.

Frank frames this as a problem about the accessibility of evidence, though she is not quite clear on how to describe it. At times she says it as a matter of

"epistemological instability" (16); at other points it has to do with "epistemological uncertainty" (80). There is a difference in orientation between the terms, revolving around whether it is something inherent in the object itself or in our approach to it. Either way, Frank sees an epistemological dilemma as inevitable, and as irresolvable. As she put it elsewhere, "To deal with the image alone is to confront continual epistemological instability, only some of which can be satisfied by secondary sources. No matter how long one dwells on the material properties of the image—from the grain of the film stock to the fiber of the background watercolor paper—certain practical questions remain, which then open onto deeper epistemological and ontological debates."[18] What matters is the question of how one deals with the epistemological gap.

The speculative dimension of Frank's work cannot be overstated. Take this statement: "With *Little Nemo in Slumberland*, [Winsor] McCay set out to make 'four thousand drawings that will move,' and it is this movement we take to be its initial attraction—but no less astonishing is the filmstrip's frame-by-frame preservation of four thousand (give or take) individual drawings. Four thousand, coincidentally, is the number of photographs that Walter Benjamin, writing in 1931, attributed to Eugène Atget, while ten thousand is the number scholars now estimate him to have taken" (14). Obviously, there are factual truths and analytic insights here, about both McCay and Benjamin. But what about the "coincidentally" that Frank places in the midst of this? What kind of history is told like this? How are McCay and Benjamin related through matters such as numbers of images? These are real questions to ask of Frank's arguments, but it is important at such moments not to dismiss her historical claims. *Frame by Frame* is a meticulously researched book, based on exhaustive studies of industrial organization—both written and oral histories—visceral knowledge of the various production processes employed by the studios, and a full sense of historical context. The point for Frank, though, is to go beyond that. What matters are the speculations, the discovery of contingent affinities that allow her to develop her arguments. And these arguments, built out of but not limited to historical research, are what turn speculative questions into historical knowledge. The proof of the pudding will be in the eating.

Take her interest in the appearance of newspapers within cartoons. Frank realized that animators likely saved time and effort by using the template of an existing newspaper and inserting only a single new story. This allows her to look for the original newspapers, to read them against the images she finds, and from there to ask questions. Discussing a newspaper in Bob Clampett's *Tortoise Wins By a Hare* (Warner Bros., 1943), she notes a joke headline inserted into a copy of the *Chicago Sunday Tribune*: "Adolph [sic] Hitler Commits Suicide." And then wonders:

> Whose idea was it? Who wrote it? How could they possibly know that Hitler *would*, eventually, commit suicide? What is all the more fascinating is that Clampett would then reuse this mock newspaper at least two more times—first in *Fighting*

> *Tools* (Warner Bros.), released October 13, 1943, and again in *What's Cookin', Doc?* (Warner Bros.), released January 8, 1944—each time altering the name of the newspaper, as well as the major headline and accompanying illustration, but never removing the reference to Hitler's suicide. (38)

It is one thing to stop a film to look at a paper; another to catalogue all the examples of newspapers and to see that the same image of a paper is reused; and still another to speculate on the evidence. Frank does all of these, and then brings them together in a single vision that we can use to see within the cartoon. Through its reuse, the fake headline becomes a historical document in its own right.

This is a glorious aspect of Frank's work—what sets it apart. Immersed as the author is in materialist analysis, historical discoveries, and formal studies, she is equally a dreamer. The phenomena she finds allow her to postulate the existence of untold histories, to imagine what it would have been like to work on these images, and to dream of the possibility of errors as intentional acts—moments in which an anonymous inker created a mistake that she could point to as proof of her own agency. It gives Frank's project a utopian, even redemptive dimension, one that revolves around the work of the unheralded workers who produced the cartoons.[19] Their stories have been told, to be sure, but they are often situated on the margins: fleshing out context, filling in details, creating minor histories. Frank wants to make their work legible in the cartoons themselves, to demonstrate that it was never invisible. This is what she needs to train her readers to see, so that they can look past the names of characters and animators—and studios—and see in the image the traces of the work that went into production.

To make the study of the production of cartoons matter for aesthetic analysis, one doesn't have to return to the tension over the seen and the unseen—a divergence between art and labor. What Frank shows is that it's precisely in their gestures back to their own production (intentional or not) that cartoons reveal their hidden power. The speculative questions she poses articulate the object of study, create new historical and aesthetic insights, and provide a path for us as readers to change our modes of viewership—to begin to wonder what we're looking at, and where such thoughts might lead us.[20]

THROUGH AVANT-GARDE EYES

If the frame-by-frame method is motivated by the desire both to disrupt the flow of the animated world and to treat animation as a succession of photographs—that is, as a succession of documents—the insights Frank gains from that approach reverberate outward. Central to this shift is the intersection of her project with the formative influence of a history of avant-garde cinema—especially that of structural film and its aftermath. There is an echo in this of Tom Gunning's celebrated argument for the connection between early cinema and the energies of

the avant-garde, with overlooked aspects of a "cinema of attractions" reemerging decades later as the foundation of an alternative cinematic practice.[21] Frank's approach is less causal. In cartoons (seen frame by frame) and the avant-garde she finds a shared interest in the movement between aesthetics and epistemology, between art and document. It is a restless exchange that becomes productive for thinking.

There are some formal affinities. Frank was interested in recent work by Martin Arnold such as *Whistle Stop* (2014), in which a brief fragment of Daffy Duck is subjected to Arnold's familiar battery of halts, repetitions, extensions, and reversals. These effects show that Arnold, too, saw the work that goes into animation. He recognized that animation is not a continuous unfolding of movement but the accumulation of individual images, and that they can be manipulated like other photographic media. But where Arnold used this knowledge as a basis for visual play, Frank takes it as part of aesthetic experience and draws wild epistemological and ontological conclusions from it, conclusions that span formal analysis, labor history, and the very material of film—and film history—itself.

The connection to the avant-garde goes deeper. Frank's very understanding of the frame-by-frame method is based on similar forms of film production found in avant-garde films. This is one of the reasons for the importance of Robert Breer. *Blazes* (1961), which Frank takes as a model for her own work, is built out of the patterning of images on a hundred index cards. (She quotes Breer: "Those cards are frames. And so I am playing with a piece of film, really. I am editing with individual frames" [22].) The alternation of images in *Blazes* is often at the level of individual frames, shifting rapidly at the limits of perception—though also combined with longer pauses on individual images, as if inviting the viewer to contemplate a specific image before the rapid-fire montage resumes. Frank also finds attention to individual frames in the work of Stan Brakhage, Peter Kubelka, Martin Arnold, and other exemplary figures of the (largely) US avant-garde.

She derives two types of methodological orientation from the examples of Breer and others. The first is how such disruptive editing patterns produce new connections, a process she describes as a type of montage. As she puts it with respect to *Blazes*, "By overcoming the filmstrip's linear logic, these sequences invite us to treat them as if they were fragments of a montage—comparing them, linking them, interweaving them" (11); "Breer, in essence, re-sorts and cross-references his index cards, thereby allowing new connections to be forged between previously disparate documents" (20). Frank thus implies of her own method that by halting the movement of animated cartoons, and showing the details that can then be excavated, the individual frames become available to be placed into a combination that resembles the montage possibilities of Breer's films. The model here is

that of the creation of the archive as an act of montage, one that finds its inspiration in Walter Benjamin's *Arcades Project* and—though curiously undiscussed by Frank—Aby Warburg's *Mnemosyne Atlas*.[22] Warburg's project, strikingly similar to Frank's, was to create a form of art historical knowledge by isolating minor details (drapery, footwear, hair) from paintings and sculptures. Photocopying them, he could arrange and rearrange the images in various patterns on a large board, and their organization alone would teach the viewer about the development and transformation of visual style.[23]

Warburg's ambition exemplifies the second methodological orientation: the creation of the montage structure of fragments is designed to introduce a change in the viewer's perception of the images. For Warburg, this meant the ability to understand historical connections between disparate and fragmentary objects. For Breer, it is about the very perception of the film itself, which Jonas Mekas—quoted by Frank—describes: "Our eye has expanded, our eye reactions have quickened. We have learned to see a little bit better" (41). If Frank is a historian of the image in a way that Warburg would recognize, she is also attuned to the transformative power on our perceptual apparatus that Mekas indicates. In this vein, paying attention to the individual frame does not go against our experience of cartoons, but rather subtly yet profoundly changes it. What we learn by looking matters for how we watch, and for what we do with what we see: "Ultimately, the labor that shapes our aesthetic experience of animated cartoons is our own. . . . It is not only our attention and will that gives the film meaning, but also our imagination" (155). Knowing from the disappearance of Bugs Bunny's head in successive frames of *Hair-Raising Hare* that cels can be overlooked, we can start to wonder what the cartoon we're watching might look like—or might be imagined to be—were we think of its constituent cels as potential elements of a nonlinear montage. We can start to break apart the smoothness of the film as we watch it—in other words, to treat the animated cartoons as if they were bona fide members of the avant-garde.

It's in the context of Frank's investment in the avant-garde that we can understand one of the most peculiar aspects of *Frame by Frame*. To describe her method in the first chapter, she turns to books of ephemera from Emily Dickinson and Herman Melville that were produced by Jay Leyda.[24] Leyda is known largely as the first translator of Eisenstein's works, and his books *Film Sense* (1947) and *Film Form* (1949) were guides to aspiring filmmakers and film critics for decades.[25] He also wrote important early histories of Soviet and Chinese cinemas, and was a guiding presence at NYU for students in cinema studies. Yet what Frank focuses on are not his studies of cinema but the methodological questions he posed by creating accounts of major literary figures through careful juxtapositions of associated documents. This is a striking move on Frank's part. No one else has seen in these books a model for thinking about cinema, much

less animation, and no one has been so creative with such eccentric source materials. Again, Frank makes it work. She writes of Leyda's books on Dickinson and Melville:

> While chronology is the overall structuring principle, Leyda is most interested in what happens on a smaller scale, through juxtaposition. In his introduction to *The Melville Log*, for instance, he argues that "the relation *between* two documents, *among* a cluster of documents . . . tells us far more than we would ever have guessed by examining them singly," and that "these invisible relationships speak not only of Melville but of the historical climate in which he worked and died." (28)

If Warburg created a montage of fragments as a way to do art history, Leyda presents documents from the lives of Dickinson and Melville as a kind of speculative literary history. The fragments may or may not mean anything; they may or may not reveal secret histories; and the indeterminacy is what requires speculation to be a part of literary history. Yet this speculative history is at its core deeply materialist: "[Leyda] thought of books not as immaterial texts whose material is only incidental but rather as historical artifacts that exist as concrete objects capable of circulating through social networks, bearing notes in their margins, and surfacing in unexpected contexts" (30).

Leyda, then, provides a model for Frank that shows how to take the material context in which works are embedded—including, in the case of Dickinson, the details of the paper on which she wrote—and use the combinations of fragments to generate new questions. Equally important, however, is the figure of Leyda himself, who provides links among Frank's range of methodological interests, drawing into the orbit of his own practice the theorization of montage in Eisenstein and Benjamin.[26] Eisenstein's model could be emphatically determinate—"a tractor plowing over the audience's psyche," as he once put it[27]—but for Benjamin (as for Leyda) the result of the montage was not given in advance. Indeed, Benjamin's very idea of the dialectical image involves sudden theoretical insights that link together disparate phenomena through the illumination of juxtaposition.[28]

Frank aims to elicit this model of montage within animated cartoons. If much of this is what she discovers through frame-by-frame analysis, it is also simply there in the cartoons themselves:

> Many animated cartoons contain moments that serve to disrupt the linearity of the filmstrip, breaking the forward flow of the animation. These include flicker sequences that consist of the rapid alternation of distinct frames, which causes the animation to stutter and strobe, and expository inserts such as newspapers, which grind the animation to a halt. By overcoming the filmstrip's linear logic, these sequences invite us to treat them as if they were fragments of a montage—comparing them, linking them, interweaving them. (11)

This requires a shift in perception, almost a change in aspect, in which a work of art, whether a drawn image or a fragment of a film, suddenly becomes a document—a document that presents its own information, but also connects to a wider context, whether that is of the production process or of the historical moment to which it belongs. Frank remarks admiringly of Benjamin that he "reads not only documents as art, but art as documents" (35–6). This switching is itself part of the avant-garde: where Robert Breer's *Jamestown Baloos* (1957) treats the microfilm document as the subject for art, Ken Jacobs's *Tom, Tom, the Piper's Son* (1969) scrolls through the frames of a film as if it were placed on a microfilm machine (41–3).[29]

Frank seeks to harness these energies: "By straining our eyes, we can understand animated cartoons dialectically, as historical documents *and* aesthetic objects, not just one or the other" (43). Yet the path that Leyda takes—or that Eisenstein and Benjamin imagine—is not open to her. Leyda's books on Dickinson and Melville succeed precisely because he had access to an array of contextual material that could be used to create juxtapositions around the source object. Frank simply has the finished cartoons, the only surviving traces of the industrial production process that created them. The original cels, the material documents, were destroyed, discarded, or reused. They no longer exist, and so the montage of fragments cannot get going, cannot have meanings arise naturally from combinations of the objects themselves. Frank must produce the criticism that will allow the elements of montage to become legible in the way they require.

This is the role of the speculative questions Frank asks of the errors, smears, and contingencies she finds in the frames of cartoons. We can hear in her project an echo of a distinction drawn by Hollis Frampton:

> The historian of cinema faces an appalling problem. Seeking in his subject some principle of intelligibility, he is obliged to make himself responsible for every frame of film in existence. For the history of cinema consists precisely of every film that has ever been made, for any purpose whatever. . . . The historian dares neither select nor ignore, for if he does, the treasure will surely escape him. The metahistorian of cinema, on the other hand, is occupied with inventing a tradition, that is, a coherent, wieldy set of discrete monuments, meant to inseminate resonant constancy into the growing body of his art. . . . Such works may not exist, and then it is his duty to make them. Or they may exist already, somewhere outside the intentional precincts of art. . . . And then he must remake them.[30]

To be sure, Frank is not Frampton. She is not aiming to found a tradition, certainly not one based on a set of "discrete monuments." Indeed, part of the aim of looking at "art on the assembly line" is precisely to discourage a lineage of thinking that privileges the individual work and the singular artist. She even takes Eisenstein to task for succumbing to this tendency: "While Eisenstein did claim to 'believe

very strongly in the principle of collectivism in work,' his ultimate interest was in the singular genius, in the great man" (89); "creative visionaries like Leonardo da Vinci or Rockwell Kent (or Walt Disney) . . . are primarily responsible for great works of art, and the social context in which each of these figures worked is a secondary concern" (89). Not so for Frank. Though she admits fascination with "the fetishized signature" (89), the hallmarks of the Eliot-inspired modernism that Frampton embraces are missing. There is no privileging of high art; no lists of figures and artworks out of which a tradition might be built. There is only the mass of cartoons, the explosions of everyday pleasures that reveal mysteries in the minute details of their construction.

Still, we can see how Frank's work blurs the distinction between historian and metahistorian. If her approach comes close to invoking a "responsibility for every frame of film in existence," the speculations that result belong to the inventiveness that Frampton reserves for the metahistorian. For example, when Frank sees in *Meet John Doughboy* (Warner Bros., 1941) a newspaper with a headline, "Sitdown Starts Big Ford Strike at Dearborn Plant," she is able to weave a story about this fragment that goes outside the "intentional precincts of art." Part of this turns on the status of the frame as a document: Frank looks for the article in the *Los Angeles Examiner* archives and finds it, but with a different headline. She infers: "The altered version of the *Examiner* that made its way into the cartoon is from an edition—the '9 A.M. Extra,' presumably—that has not been preserved on microfilm" (39). Thus, the film frame presents a unique document; it may in fact be the only existing record of this edition of the newspaper. But Frank goes on. Thinking about the content of the headline, a wildcat strike lasting ten days, she suspects that the delay between production and release likely meant that the event had been forgotten. The fact of the strike itself, though, leads to a new history. In the months after the cartoon was made, Warner Bros. producer Leon Schlesinger locked out his animators, and then shortly thereafter (May 1941) the Disney animators went on strike (and Warner Bros. animators picketed in solidarity). This is not a mistake like an absent cel, nor an oversight like the appearance of a sketch on a blank piece of paper. But it contains historical puzzles as well, and it is the gaps—both historical and epistemological—that Frank finds in the newspapers that open space for her to speculate.

Certainly this is not a straightforward history; there is no claim of a direct relation between the cartoon's production and release and the labor unrest that was going on. But the headlines, Frank thinks, allow us fortuitous access to this historical moment, a way to bring events into new patterns and constellations. Alluding to Benjamin's *Arcades Project*, she writes: "The dialectic between art and labor, between the aesthetic object and the historical document, is articulated in this three-month interstice" (40). The metahistorical impulse finds a way to move forward. This is how speculative stories are themselves forms of historical knowledge—a lesson from and for the avant-garde.

PHOTOGRAPHY AND OTHER REPRODUCTIVE PRACTICES

Frank's use of the term "document" produces an interesting wrinkle in her account. One of the central ambitions of *Frame by Frame* is to take seriously the idea of animation as a photographic medium—not just to give an account of the technical practice but to use this fact to rethink animation's place within the history of film theory. The link between animation and photography has been a vexed topic. Of course scholars know that cartoons were photographed, that any frame in cel animation was made when the cels were placed on top of each other and positioned underneath a camera, and a photograph of them taken. But understanding how to draw consequences from this has proved difficult. For theories interested in cinema as a photographic medium, animation has no clear place. This view is found throughout classical film theory, and was put succinctly by Stanley Cavell: "Cartoons are not movies"—and therefore do not have to be treated in the way that films are.[31] But defenders of animation are no less fond of this binary opposition. Lev Manovich argues that animation is the key to understanding digital cinema against the history of photographic media. Esther Leslie seized on animation's freedom from photography's burden of verisimilitude to demonstrate the possibilities of a radical cinema. Even Karen Beckman's *Animating Film Theory* (2014) largely treats animation as a separate history from photographic cinema.[32] What this means is that, historically, animation has been defined as what cinema is not. The radical gesture Frank undertakes is to show that the two are inextricably intertwined, and to insist that we treat each cartoon seriously as a succession of photographic documents.

This move has, she thinks, a range of consequences. At a basic level, Frank wants to show that treating animation as a photographic practice means that you can see it as offering a view of the world. This is precisely what theorists such as Cavell denied, as they argued that the frame in photographic media demarcates a continuous space that extends into off-screen, whereas the ontology of drawn or painted media means that one could not reliably ask what lay beyond the border. Often this is framed in terms of the distinction between a photograph being of *the* world and a cartoon creating *a* world. When Frank argues that individual frames are recordings of the process of their own production, she is explicitly going against this distinction.

In this context, it is worth recalling one of the strongest criticisms of film theories that rely on the idea of photography. Noël Carroll argued that if we really held that to be true, that a film is about what was in front of the camera at the moment of recording, a range of startling consequences would follow. It would turn out, he says, that "*M* is about Peter Lorre rather than about a psychopathic child killer; *The Creature from the Black Lagoon* is not about a rivulet off the Amazon but about Wakulla Springs, Florida. Films you thought were representations of

castles, graveyards, and forests are really about studio sets."[33] (Frank refers to this passage in the conclusion.) Carroll means this to be ridiculous, and so to ridicule his opponents. It is a perverse pleasure of *Frame by Frame* that Frank happily accepts Carroll's conclusion: the photograph of the cels, the creation of an image of an animated film, is actually of the world of its production. Outside the border of a Bugs Bunny cartoon is the Warner Bros. studio; Mickey is separated from the Disney studios only by the line of the frame; Woody Woodpecker resides at Universal Studios. This is her direct challenge to the history of film theory, and at the heart of her project of looking at cartoons. Treating each frame as a photograph, a document of what it is of, allows her to move seamlessly from the errors she sees in the image to the production processes that generated them.

At the same time, Frank wants to use the idea of photography to stay with the image itself, to make sure that we do not escape what is within the frame of the cartoons. She describes this as an argument against the supposed transparency of the photographic image, an ambition "to find the world *within* the image, to study the windowpane as well as the view beyond it" (72–3). What we see is also part of the photographic record. Cartoons document "India ink, watercolor paints, paper, glass, and stacks of transparent cellulose nitrate or acetate sheets; particles of dust traverse half the screen and fleeting, spectral reflections are cast by the animation stand's overhead lights; Newton's rings knit together" (73). Thinking about photographs in these two ways, Frank joins a major trend of thinking about photography that eschews the idea of the index—or at least a thin account of it—as a way to capture a photograph's relation to the world.[34] This is not a topic she directly takes up, preferring to deal with it in footnotes. But it is a problem that she would have had to address eventually, whether through an extended discussion of Charles Sanders Peirce or a more sustained reflection on the dynamics of photographic reference within the animation process. Even without that work, we can tell that she embraces the idea that photographic reference is complex, multifaceted, and multidirectional. It includes the traces of the world being shown, but also the hidden components that gave rise to them. It also includes what Frank describes as the "graphic of the photographic": the ontological uncertainty of what it is one is seeing, and even whether it is anything at all.

This reconceptualization of animation as a photographic practice, and the different ways in which its referential dimension points, give Frank the materialist fragments she collects and archives and make possible the speculative histories she produces. Without being able to read individual frames as causally linked to the moment of their production, the connections that Frank draws between image and studio would have been significantly more tenuous. But it also gives Frank a way to examine and extend the long-standing view that, as she puts it, "Animation [is] . . . uniquely self-reflexive" (67). This is famously the case for cartoons like *Duck Amuck* (Chuck Jones / Warner Bros., 1953), with Bugs's address to the camera and his figuration within the film as the animator capable of tormenting Daffy.[35]

Echoing Dana Polan, Frank argues that "The world of *Duck Amuck* makes no allowances for *our* world. Its narrative elides the actual human labor that went into its making" (68).[36] This is the power of the frame-by-frame method, in which we see traces of production: the smears, the errors, the tricks. Even without deliberately staging this, the cartoon is inherently a document of—hence a film about—the fact of its own making.[37]

Finally, by treating animation as photography, Frank is more readily able to bring cartoons into dialogue with the aesthetics of live-action cinema. Discussing cartoons that use blurs or smears to depict motion—"those cels we know to be representations of bodies, but which, when taken on their own, operate on another aesthetic register altogether" (91)—Frank argues that their prevalence can be attributed to the interest of animators in motion studies, and in their own frame-by-frame analyses of fast-moving bodies in feature films (93ff). Perhaps the most compelling discussion of this interaction comes in the conclusion to the book, where Frank takes up critically disparaged animated films of the 1940s and 1950s. Critics claimed that these films "mimicked too closely" the aesthetics of live-action cinema, or "lost" the special qualities of motion—qualities that Eisenstein hailed under the name of the "plasmatic"—that animation alone could do. Manny Farber, for example, deplored what he saw as the "affectation of reality" in these cartoons.[38] Frank thinks something more complicated is going on. She discusses two examples, the animated short *Sniffles Bells the Cat* (Warner Bros., 1941) and the Disney feature *Cinderella* (1950), to show how they employ cinematic techniques. Frank acknowledges that they are explicitly *simulating* the effect of deep-focus cinematography of the kind that was popularized by Gregg Toland. However,

> I argue that *Sniffles Bells the Cat* is an animated cartoon not in spite of but indeed *because of* its reliance on cinematographic codes. Its simulation of the wide-angle lens in particular demonstrates not a slavish adherence to preexisting codes of representation but rather an imaginative expansion of the possibilities of cinema as a whole—not just animation. What it might lack in the plasmatic-ness of its figures, it makes up for in plasticity of the entire image. (149)

The answer, it turns out, has to do with color. Deep-focus cinematography was nothing new by the end of the 1940s, but it was done with black-and-white photography. It was impossible with the color technology of the moment, so much so that the creation of deep focus in Howard Hawks's *A Song Is Born* (1948) was done through special effects. What *Sniffles Bells the Cat* and *Cinderella* do, then, is to make a claim for the uniqueness of the medium of animation by doing what live-action cinema could not at the time do: they create an impossible image by following the *codes* of live-action cinema to the letter. As Frank puts it, "Even a cartoon that imitates cinematographic techniques must first deform the world in order to make it whole again. It dissolves *and* reinforces conventional reality" (151).[39]

As she does in all the other aspects of *Frame by Frame*, Frank finds a node of contention and pushes the debate in new directions. In chapter 4, she again takes up the debates over photographic media and the way they generate a reproduction of the world, this time in the context of an altogether different technology: the Xerox machine. The discussion of mechanical or technological reproduction in film and media studies is often, and rightly, focused around photography. Exploring how Xerox machines were taken up by animators, Frank shows that xerography needs to be considered as a major form of technological reproduction.[40] But xerography does not follow the same terms as photography. Drawing on marketing campaigns and their use for office work, Frank shows that xerography is based on the reproduction of only certain aspects of the image, most notably the line. Discussing an ad that demonstrates its reproductive qualities on a Pablo Picasso ink drawing, Frank writes:

> 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. . . . 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. (109)

Where André Bazin praised photography for its ability to compel belief that no matter how an image looked it was a document of the existence of the object, Frank sees in xerography an indiscriminate treatment of the identity of the source material. Text or image—it doesn't matter. What is reproduced best are lines.

Frank uses the reading of the aesthetics and epistemology of the Xerox machine to show how it transformed animation style. She provides a reading of Disney's *One Hundred and One Dalmatians* (1961) that demonstrates not only the use of xerography in the film's production, but how this changed its look, and how the qualities of xerographic reproduction are alluded to within the film itself. (Indeed, the title of the film already suggests photocopying.) Frank lays the foundations for the new form of production process that resulted, one in which inkers, in-betweeners, and painters had a different set of roles to play. With the Xerox machine, animators were now able to directly transfer their sketches onto cels without what they regarded as the intervening hands of others (who now filled in rather than re-created the original forms). As a result, the animation style of *One Hundred and One Dalmatians* appears decidedly more artisanal, the lines of its drawings more fluid and less polished than in earlier cel animation practices. This is, Frank observes, something of a paradox: a new technology of reproduction, one that positions a machine in the place of a human, makes the final product look more handmade:

> 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 . . . *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. (119)

The result is a more fluid, expansive line—a new aesthetic.

Xerography changes not only style but industrial practice and organization as well. It shifts emphasis away from the (female) uncredited workers and gives the (male) animators an even greater sense of authorship. The changes it makes to the feel of animation are one thing: "Xerography, in this context, offers viewers a tantalizing proximity to the original, inimitable trace of the artist, in all its imperfections and idiosyncrasies" (113). Frank's discussion is a reminder that new technologies are never simple, and that their introduction has unpredictable outcomes.

ROADS NOT (YET) TAKEN

The unwritten future of *Frame by Frame* is already articulated in the latter part of the book. When Frank turns to *One Hundred and One Dalmatians* and *Cinderella*, the topic of frame-by-frame analysis becomes less pressing—though certainly not absent—and an investigation into changes in the aesthetics of animated cartoons takes on an increased role. As she began to rethink this manuscript, Frank acknowledged this break, and decided to split it into two distinct projects.

One project would focus on Disney films from the 1950s. This was never developed beyond an initial sketch, but it would have extended the arguments about *One Hundred and One Dalmatians* and *Cinderella*: to reappraise Disney's critically maligned films of the 1950s; to show how they in fact accomplished "things only possible in animation"; and to reevaluate the relation between live-action cinema and animation. The book was to have six chapters:

1. On *Bambi*, its embrace by Eisenstein, and its relation to Soviet animation of the 1930s.
2. On deep-focus cinematography and *Cinderella*, an expanded version of what is contained in the conclusion of *Frame by Frame*.
3. On CinemaScope and *Lady and the Tramp* (1955), focusing on the relation between the new technological format and the depiction of space—especially of the home.

4. On special effects and *True-Life Adventures*, the nature documentaries produced between 1948 and 1960; this chapter would focus on "techniques of postproduction manipulation, which were achieved with the optical printer" and supervised by Ub Iwerks.[41] Reading against the grain, Frank proposed "an investigation into the ontology of the rephotographed image."
5. On 70mm and *Sleeping Beauty*: beyond a note that this would involve a discussion of "painting" and "magic," no description of this chapter exists.
6. On xerography and *One Hundred and One Dalmatians*, an expansion of chapter 4 of this manuscript.[42]

Some of the material that would have gone into these chapters had been presented at conferences, but the vast majority of the work remained to be done.

The second project involved the manuscript of *Frame by Frame* itself. Frank proposed a revised structure organized more explicitly around specific formal techniques. She described it as follows:

INTRODUCTION: LOOKING AT LABOR

The introduction defines the historical parameters and theoretical stakes of the book: its focus on theatrical shorts released between 1915 (the advent of cel animation) and 1965 (the decline of the studio system), the industrial labor practices in place during this period, and the problems assembly-line production poses for aesthetic analysis. After describing the tasks and technology involved in the manufacturing of animated cartoons, the introduction explains how *Frame by Frame* exploits digital editing software to resuscitate an obsolete form. Thousands of frames can be cross-referenced and their component parts disassembled; each individual frame can in turn be treated as both a primary historical document and a work of art in its own right. It also lays out the chapters to follow.

PART I: GLIMPSES

Each chapter in part I draws on a theory of photography in order to consider how the photographic process shapes the visual aesthetics of animated cartoons. Chapter 1 focuses on photography as a means of reproducing documents, while chapter 2 examines photographic theories of cinema.

Chapter One: Fragments of Daily Life

By and large, the primary visual components of cel animation—the transparent nitrate and acetate cellulose sheets that give the form its name and the painted backgrounds over which cels were laid—no longer exist. The cels and backgrounds that made their way to auction houses or found residence in archives are but a

minuscule sample of all of the cels and backgrounds created during the heyday of the theatrical shorts, the majority of which are lost to history. However, these physical objects survive in another form: *they have been preserved on film*. Each frame of an animated cartoon, in effect, doubles as the photographic record of ephemeral documents. Chapter 1 teases out the theoretical and historical implications of this observation by attending to a common expository device in animated cartoons: the use of pages from contemporary newspapers in which real headlines are combined with fictional ones to convey narrative information. In their collage practices, these inserts can thus be discussed alongside Rosalind Krauss's writing on Picasso's still lifes of 1912–13 and Walter Benjamin's comments on Dada ready-mades: "The tiniest authentic fragment of daily life says more than painting."

Chapter Two: A Glimpse of the World

Animation has long been excluded from film theory on the grounds that it is not a photographic practice. But cel animation was, in fact, produced photographically: a single-reel short could consist of as many as seven thousand individual photographs, each corresponding to a frame of film. What happens, then, when animated cartoons are understood in accordance with photographic theories of cinema? Chapter 2 attends to the visual evidence lurking within each frame that testifies to the image's photographic origins. By cataloguing the various visual imperfections—errant shadows, dust particles, fingerprints—that stand as traces of the physical reality of the world beyond the frame, and in particular the world of the animation studio, chapter 2 argues that thinking of cel animation as a photographic medium makes visible the hitherto invisible production process.

PART II. EYESTRAIN

Each chapter in part II highlights a stylistic convention in cel animation that evokes a specific cinematographic technique. Chapter 3 looks at the design of cartoon whip-pans and chapter 4 at the poetics and aesthetics of stroboscopic effects.

Chapter Three: Vertiginous Views

The rostrum camera used to photograph animated cartoons could only move up and down, in effect zooming in and out of the image. To simulate movement across a space—for instance tracking, crane, aerial, tilting, and panning shots—it was, in fact, the background painting that was moved, sliding under the fixed camera. The background paintings used in such shots often took the form of long, narrow scrolls, some as long as nine feet, only a small fraction of which was photographed at a time; the entirety of the painted space never appeared on-screen in a single frame, but would rather unfurl temporally, frame by frame. Using digital tools,

chapter 3 reconstructs several of these panoramic background paintings, in particular those that incorporate photographic effects, such as motion blur and barrel distortion, into their design. Whip pans make for particularly striking examples, as the middle sections of the painting (the "whip" portion of the simulated camera movement) are often quite abstract while the left and right sides (in which the simulated camera is at rest) conform to perspectival conventions. These paintings ultimately are sui generis, out of step with both contemporary art practices and the cinematographic construction space. Pulled between abstraction and representation, they warrant comparison to two alternative filmic modes: avant-garde films such as Robert Breer's *Jamestown Baloos* (1957), Ken Jacobs's *Tom Tom The Piper's Son* (1969), and Hollis Frampton's *Pan 698* (1974) on the one hand and microform periodicals on the other. The first reinvents the eyestrain engendered by scrolling through reels of microfilm and rapid whip pans alike into a vertiginous aesthetic experience, while the second illuminates the artistic labor that the rapid camera movement obscures.

Chapter Four: Arresting Animation

Cel animation and structural film would seem to have little in common. Popular animated cartoons use recognizable character types to tell stories; however much they may try to subvert the stylistic and narrative conventions of classical Hollywood, they can never fully escape the ideological and economic structures of the studio system. Structural films, by contrast, aim to test the thresholds of cinema's formal and material structures, often by pushing photographic representation into the realm of abstraction. Yet in spite of these differences, the two practices share an important feature: they were, by and large, produced frame by frame. Chapter 4 examines the aesthetic implications of this similarity through an investigation of the historical poetics of stroboscopic effects in popular animated cartoons. As early as the 1920s—decades before Peter Kubelka's *Arnulf Rainer* (1960) and Tony Conrad's *The Flicker* (1966)—films in Otto Messmer's *Felix the Cat* series routinely featured brief "flicker" sequences that consisted of the rapid alternation of either all-black and all-white frames or positive and negative images. By the 1930s, animators had begun integrating multiple colors into these sequences, producing unprecedented visual pulsations that disrupt the flow of the animation and arrest the eye of the viewer—if only for a few seconds at a time. Although cartoon flicker always possesses a clear narrative function (for instance to simulate lightning, explosions, and other violent shocks), its deployment nonetheless ruptures the very illusion of movement on which classical animation is predicated. At the same time, these sequences challenge much of the preexisting scholarship on flicker, which stresses that the technique is nonrepresentational, if not anti-representational. By looking at several animated cartoons frame by frame, chapter 4 reveals that even the most radical and abstract of filmmaking practices cannot

do away with representation altogether: what appears at first to be a blank frame, evacuated of all content, might in fact be the photographic reproduction of the verso side of a sheet of used sketch paper, its discarded drawing still faintly visible. General claims about the formal function of stroboscopic effects thus give way to detailed observations about the specific materials out of which these sequences were constructed, and the frame-by-frame model of production becomes a model of historical and aesthetic analysis.

PART III. SPECULATION

Both chapters in part III concern themselves with the painted cel in isolation. Chapter 5 uncovers the many abstract paintings that lurk within animated cartoons, and chapter 6 studies how thousands of distinct paintings culminate in a single cartoon character.

Chapter Five: The Limits of Representation

In numerous animated cartoons there exist moments—sometimes but a frame—in which famous characters are distorted beyond all recognition, becoming perhaps a mere streak of paint, or rendered unrecognizable by an extreme close-up. These abstract paintings were produced by the animation studio's painters, most of whom were women who went uncredited, their work considered noncreative and unskilled. In order to challenge the division between art and labor, chapter 5 first provides a genealogy of this particular mode of gendered labor, which has resonances with other industries traditionally dominated by women (from the coloration of postcards and early motion pictures to stenography and typewriting to sewing and quilting, as well as the pioneering textile work of both the Bauhaus Weaving Workshop and Soviet Constructivists like Varvara Stepanova and Lyubov Popova). Second, chapter 5 reviews specific examples of these unsung women's handiwork from films produced at a wide range of studios. A tornado of feathers whipping through the air in Disney's *Birds of a Feather* (Burt Gillett, 1931), removed from their context, becomes a dizzying swirl of jet-black droplets against a blank background, and a blustery blizzard in *Now That Summer Is Gone* (Frank Tashlin / Warner Bros., 1938) is depicted as a stream of dots and dashes, nonsense lines of Morse code. An overflowing bathtub in *Bathing Buddies* (Dick Lundy / Universal, 1946) is rendered in a milky, translucent wash of varying shades of turquoise, while in *Daddy Duck* (Jack Hannah / Disney, 1948) a jet of water gushes toward the putative camera, filling the entire frame with starbursts of blues, whites, and teals. In Disney's *Touchdown Mickey* (Wilfred Jackson, 1932), meanwhile, a cat's tail in close-up is the sole occupant of the frame: a black, jagged crescent that stands in sharp contrast to the background's white expanse. The image is meaningless on its own, yet it assumes new visual power when placed alongside another frame from

a later Disney film, *Donald's Camera* (Dick Lundy, 1941), in which Donald Duck, in a burst of anger, turns into a curved bolt of lightning. The two shapes, both bent, both serrated, echo and almost negate one another; the lightning bolt is smaller, black on white instead of black on gray.

Chapter Six: What Mickey Mouse Proves

In 1931, Walter Benjamin wrote, "Mickey Mouse proves that a creature can still survive even when it has thrown off all resemblance to a human being." That same year, Walt Disney successfully sued Van Beuren Studios, a rival animation company, for producing several cartoons featuring Mickey and Minnie lookalikes. In 1940, Sergei Eisenstein admiringly observed that the animation of Mickey Mouse tested "the limits of normal representation." In 1978, the United States Court of Appeals ruled that Mickey Mouse was "sufficiently delineated," and hence protected under copyright law. Through the frame-by-frame examination of numerous Disney cartoons from the 1920s to the 1940s, as well as the many parodies of Mickey Mouse that appeared in underground comix of the 1960s and 1970s, chapter 6 considers just what makes Mickey Mouse Mickey Mouse. What are the limits of his representation? Can he still survive if he has thrown off all resemblance to himself? What if "noncreative" workers were to exercise their creativity, such that Mickey Mouse looked different in every frame? To imagine what might result, the chapter turns first to examples of 1930s *Popeye* cartoons that were colorized in the 1970s, then to Robert Breer's *Rubber Cement* (1976), which features a crude rendering of Felix the Cat, and finally to the recent work of Martin Arnold, in which classic Disney, Warner Bros., and MGM cartoons are digitally taken apart and put back together again.

CONCLUSION: THE LABOR OF LOOKING

The conclusion takes as a final case study a single film, Hugh Harman and Rudolf Ising's *Bosko in Person* (Warner Bros., 1933), working—and playing—with it in multiple ways. *Bosko in Person* is a thoroughly unremarkable cartoon on its own terms, but it is noteworthy insofar as it has been repurposed several times—first by Harman and Ising themselves, as *Bosko's Parlor Pranks* (1934), then by Ken Boyer for an early episode of the children's television series *Tiny Toon Adventures* (1990–95), and finally by Ken Jacobs in the epic experimental film/video *Star-Spangled to Death* (1956–2004). Each of these variations comes with its own histories and aesthetics, and each solicits a new way of looking at *Bosko in Person*—to see what is missing, what has been hiding in plain sight, what went without saying, and all that might have been and might still be.

As is clear, the emphasis on the relation between frame-by-frame analysis and the avant-garde is more explicit, so that "the theorist of animation becomes

an experimental animator. . . . Ultimately, this mode of looking inaugurates its own experience."

All this is the future that was not to be. And it leaves open the question: What should we do with the book we have? There are reflections that could easily be built out of the manuscript. Some take on a heightened import in the contemporary media world. Frank's discussion of the relation between "creative" and "uncreative" work, both the way this distinction is gendered and the way its terms fluctuate over time, certainly has relevance for our current environment. So too does her reflection on how digital media made her project possible: Frank is attuned to the complexities of the relation between the analog originals and the digital copies through which they circulate. (Her attention to the Xerox machine as an intermediary between photography and digital media is evidence of this care.) Recall her discovery of the sketch of Woody Woodpecker: "Is it only possible to see him because *$21 a Day (Once a Month)* can today be viewed via a 'restored' digital copy, one that perhaps brightened an image that the camera operator had intended to be obscure?" Frank reminds us of the materiality of the digital image—not just the fact of its material existence, but the various ways in which that materiality can be used to manipulate (whether to obscure or to clarify) the image being presented.

Within animation studies, the most obvious and direct form of influence will be the method itself, the frame-by-frame approach. One could build off Frank's own work, the archive of stills she assembled in the course of her research; there are materials there that have not yet been addressed, ways of thinking about errors and documents that are yet to be uncovered. But if we want to extend into new areas, even just different kinds of animation, we must tread carefully. It would be a mistake to treat Frank's method as something that can be isolated, hypostasized, set in stone—or applied indiscriminately. Frank is clear that frame-by-frame analysis, one that looks at the material properties of the image for traces of the hand of the (usually unnamed) artist, is a *tool*. In particular, it is a tool for the analysis of animated cartoons made under the studio system, where the question of intentionality—the responsibility for the creation of the image—is obscured or unknown.[43] Frame-by-frame analysis is a way to break the industrially produced image apart, to create the archive necessary for more expansive historical and theoretical speculations. How should one apply it elsewhere? Would it be worth thinking about, for example, the films of Caroline Leaf, or Jim Trainor, or Jodie Mack—or even Faith and John Hubley—by looking at them frame by frame? If one did, what one was looking for would not be the same. Mistakes would be treated differently—indeed, they might not even be mistakes—and many of these independent artists often incorporate the chance effects, the contingencies, of production into the texture of the image itself.

Ryan Pierson and Alla Gadassik have proposed one way to resolve this question, seeing in Frank's work what they describe as the analytical concept of "the Frankish

frame." By this they mean "any frame that demands to be seen independently of its placement in a phase of motion."[44] This could be a glitch in a walk cycle from Disney's *The Skeleton Dance* (1929), or forms of gestural repetition in Len Lye's *Free Radicals* (1958). Pierson and Gadassik emphasize two key features: that looking takes work, and that the conclusions that one draws involve an intense form of imaginative play.

The idea of the Frankish frame leads to an additional set of questions: What should one do with computer-generated animation? Would it be worth using *Frame by Frame* to think about a film like *Toy Story* (1995), or *Moana* (2016), or *WALL-E* (2008)? Should one go through digitally animated films frame by frame looking for whatever contingencies might be in the algorithms? Would such intense looking reveal the seams in digitally generated images, moments that could generate the kind of nonlinear montage structure that could be used for Frank's speculative histories?

Perhaps. Or perhaps not. What is clear, though, is that we wouldn't be able to tell whether such an enterprise was worth it without undertaking it—without looking at the millions of frames it would entail. One would have to have confidence in oneself. This wouldn't be a project trying to tell a labor history of special effects artists, nor to provide a study of the constitutive algorithms that make up the images, nor even to produce a straightforward formal analysis. But one would bring all of these questions to bear. It's not entirely clear what this approach to digital animation would look like—and that uncertainty seems appropriate. Part of what it means for Frank to repeatedly describe her approach as "aesthetic" is that there are no fixed criteria by which it will succeed, no way to determine in advance what will work. We have to try, to test our judgments. We have to look and see.[45]

Taking a view of the whole, then, what defines Frank's work is three principles that work in counterpoint. The first is that what matters is less the "frame by frame" than the "materialist." Frank is interested in thinking about how something is made, about what that can show us, and about how we can get to production from the product. This is at once a method and a politics. The second is to take under-examined truths seriously—like the fact that all frames in cel animation are ultimately photographic documents—and see what happens to our theoretical presuppositions when we do. The third is to look carefully for instances where representation breaks down, and to experiment with what we can extract from those moments of crisis. Looking and playing; laboring and dreaming. These are the antinomies out of which Frank builds her method.

> *What if?*, I ask again and again. What if we looked at works of cel animation like we do microform periodicals? What if we thought through cel animation's photographic basis in accordance with both realist and materialist theories of cinema? What if we treated each cel as a work of art in its own right? What if we compared inkers to

> secretaries? These questions, and the ones that emerge from them, are meant to test the limits of animation. They are games, but that does not mean they are frivolous. The theoretical riddles they pose reveal buried histories. The counterfactual histories they write upend theoretical truisms. They introduce the possibility of ambiguity into film theory and history. (152–3)

A NOTE ON THE TEXT

As I mentioned above, what appears in *Frame by Frame* is essentially the text of Hannah Frank's dissertation, which she defended at the University of Chicago in August 2016. In the process of putting this manuscript together, I wanted to preserve her voice as much as possible, and so have kept a light editorial hand. Much of the work I did involved untangling some grammatical confusions, standardizing references in footnotes—though I have, following Frank's wishes, retained her citations from Benjamin's *Illuminations* rather than the more recent editions—and adding a few clarifying clauses. The only major change is the title. Frank's dissertation was entitled "Looking at Cartoons: The Art, Labor, and Technology of American Cel Animation." Yet within a couple of months she had already discarded that title, and begun to test alternatives. The title of this book, *Frame by Frame: A Materialist Aesthetics of Animated Cartoons*, was taken from the final version of the book proposal she wrote. It fits its topic well.

Many people helped to bring this book into existence. At the University of California Press, I am grateful to Elena Bellaart for overseeing its production, and especially for helping with the art. Lindsey Westbrook provided superb copy editing that improved the manuscript while preserving its unique style. Jordan Schonig created the final versions of the images in the book. We are all deeply indebted to Raina Polivka, who recognized the quality of the manuscript and made sure that it appeared in the world.

There have been tributes to Hannah, emotional and intellectual, at the University of Chicago, the University of North Carolina Wilmington, the 2018 Society for Cinema and Media Studies Conference, and elsewhere. A debt of gratitude is owed to everyone who organized and spoke at those events, who ensured that Hannah will be remembered.

Sam Frank, Hannah's brother, has been central to the preparation of this manuscript, and supported its publication throughout the process. Jacob Blecher, Hannah's husband, provided the material contained in this book, often searching through archives of files for the right document; this book is not least for him. I am also indebted immeasurably to Hannah Frank for her friendship, for what I learned from her, and for all that I never had the chance to put into words.

A last topic. Most dissertations, no matter their originality, suffer in the writing—the prose is flat, or too academic. One of the hallmarks of *Frame by*

Frame is that Frank's prose is so carefully and exquisitely composed. It bears analysis on its own. She begins, for example, with the evocation of construction: "Imagine studying a building not by walking its hallways or perusing its blueprints, but by examining each of its bricks" (1). The brick motif is not a throwaway. She will return to it twice. The first is to confirm her initial metaphor, quoting Robert Breer: "The single frame is the basic unit of film just as bricks are the basic unit of brick houses" (74). The second involves a character from Studs Terkel's *Working* (1974), a steelworker who longs to see the marks of his own labor in the buildings he makes. He dreams: "Let's say the whole building is nothing but red bricks. I'd like to have just the black one or the white one or the purple one" (80). And this sounds the larger topics of mistakes, and intentionality, that run throughout the book.

But then one might also wonder: Is Frank thinking as well of the debate between about the structure of montage between Vsevolod Pudovkin and Eisenstein, which turned on whether it should be thought of as bricks or collisions? And is she also thinking of Bazin's discussion of Roberto Rossellini's elliptical style, in which we come across reality like stones found in a stream that we use to cross rather than bricks made for the purpose of a bridge? And if these allusions are on her mind, what should we make of that?

These are speculative questions. That they are unfortunately unanswerable does not mean they should not be asked. To read Frank's prose is to entertain precisely the operation she undertakes with cel animation: one looks carefully, with effort, at the details of the writing itself, and then one dreams up new ways of thinking.