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Digital Surrealism: Visualizing Walt Disney Animation Studios

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Abstract

There are a number of fruitful digital humanities approaches to cinema and media studies, but most of them only pursue traditional forms of scholarship by extracting a single variable from the audiovisual text that is already legible to scholars. As an alternative, cinema and media studies should pursue a mostly-ignored "digital surrealism" that uses computer-based methods to transform film texts in radical ways not previously possible. This article describes one such method using the z-projection function of the scientific image analysis software ImageJ to sum film frames in order to create new composite images. Working with the fifty-five feature-length films from Walt Disney Animation Studios, I describe how this method allows for a unique understanding of a film corpus not otherwise available to cinema and media studies scholars.

There are quite a number of fruitful digital humanities approaches to cinema and media studies, which vary widely from aesthetic techniques of visualizing color and form within shots to data-driven metrics approaches analyzing editing patterns. Despite their methodological differences, what all these approaches have in common is the reduction of the complex film or television text — image, sound, editing, production history, reception, paratext — to a more limited set of manageable variables: color palette, scripted dialogue, average shot length, budgets, box office results, or social media presence. While any digital humanities project requires the reduction of a complex set of textual elements to a smaller set of abstracted variables, cinema and media studies poses a special challenge to the digital humanist since film and television objects are composed of disparate elements that are as challenging to reconcile as they are to pull apart. That is, it is relatively easy to separate an image from its soundtrack and then do something like time the length of shots, but such a method obscures for the digital humanist the otherwise intractable complexities of film and television texts. While projects that perform textual analysis of a set of screenplays, or that map the relationships between actors and industrial figures, or that compare cutting rates across time periods all acknowledge the limitations of their approaches, they nonetheless reinforce the sense of film and television as a dis-integrated medium whose constituent parts can be analyzed discretely. 1

Before readers imagine that I have discovered a solution to this difficult problem, I admit that the film studies work which I describe here is subject to the same criticism, for the same reason I began with: that the digital humanist must make an initial decision about which components to abstract and represent, and in doing so must by necessity omit others. There is not yet something like a "principal components analysis"[1] for the media text which can account for the inherent diversity of the physical object. But rather than only pursue digital forms of traditional methods that are already legible to the cinema and media studies scholar (like projects that simply use computers to more efficiently analyze screenplays or editing patterns or industrial business histories),[2] what I propose instead is something weirder. To borrow from Stephen Ramsay's call for a "hermeneutics of screwing around," [Ramsay 2014] I propose a digital humanities project that is more aleatory and aesthetic than it is formal and constrained. This fits within the framework of "deformative criticism," which has emerged as an innovative site of critical practice within media studies and digital humanities, revealing new insights into media texts by "breaking" them in controlled or chaotic ways. Deformance includes a wide range of digital experiments that generate heretical and non-normative readings of media texts; because the results of these experiments are impossible to know in advance, they shift the boundaries of critical scholarship [Samuels and McGann 1999]. Thus, deformative criticism offers a crucial venue for defining not only 2

contemporary scholarly practice, but also media studies' growing relationship to digital humanities. So, rather than reduce the film or television text to one of a well-established list of "components" such as the shot or the cut or the soundtrack in order to extract individual "elements," how might we abstract the film or television text so that it is presented to us in a radically new way? How can we transform the object of study into something which retains the organic features of the original, but which is freed from the burdening over-recognition of form? How can we create something from cinema which is familiar but unrecognizable?

Here, I describe my method and theory for creating and interpreting "summed frame z-projections" of films. In this process, I compress the visual field of a film into a single image in order to compare a corpus of summed frames and create new avenues of scholarly research. I call this technique "digital surrealism," since it creates images by means of an automatic process which reveals otherwise unconscious information about film texts. While the resulting images on their own are aesthetically pleasing, a comparative analysis of a corpus of summed images can generate new analytical modes for digital humanists who work with image analysis, raising new, comparative, second-order questions that come out of this digitally-aided abstraction. 3

Figure 1. A summed z-projection of *Sleeping Beauty*, dir. Clyde Geronimi, 1959

Texts

I took for my corpus the fifty-five animated feature films produced between 1937 and 2016 by what is now known as Walt Disney Animation Studios.[3] These include well-known, wildly successful "classics" such as the first feature-length cel animation *Snow White and the Seven Dwarfs*, Disney's first original story *The Lion King*, and Disney's most successful film *Frozen*, as well as relatively unexamined films like the Latin American compilation *Saludos Amigos*, the commercial and critical failure of *The Black Cauldron*, and Disney's first full computer-animation *Chicken Little*. One might expect digital manipulations of animated films to look different from live-action films, but I was surprised that my digital surrealist research strategy revealed very little difference between these two modes of narrative cinema. I have done similar research on a corpus of fifty-four live-action films from the western genre (1993–2007), forty-two gialli (1956–2013), and the twenty-six Japanese *Zatoichi* films (1962–89), and observed remarkably similar tendencies to those I found in the Disney corpus [Ferguson 2016]. The fifty-five Disney films offer a particularly rich corpus for digital surrealist investigation: despite the often rocky history of the studio's management, Disney is and has been the most important, innovative animation studio ever, releasing a film on average every seventeen months over the last eight decades and pioneering many significant, groundbreaking, and influential animation techniques like fully synchronized sound, three-strip Technicolor, the multiplane camera, multi-channel sound, CinemaScope, and numerous software engineering techniques. As a part of the larger Walt Disney Company media conglomerate (after Comcast, Disney is the second largest media conglomerate in the world by revenue), Walt Disney Animation Studios also plays a significant role in a global marketing juggernaut that continues to shape both multinational industrial media practices and the proliferation of American cultural exports. Indeed, as early as 1934, Walt Disney worked with the United States government to promote cultural exchange with Latin America through feature animation and "by 1943, 94 percent of all 4

the footage produced by the Disney Studio was done under government contract" [Shale 1982, 24]. We can thus reasonably expect the corpus of Walt Disney Animation Studios to represent both a broad range of historical innovation in animation as well as a consistent, calculated, family-oriented production strategy.

	Film	Year	Directed by
1	*Snow White and the Seven Dwarfs*	1937	Larry Morey, David Hand, Wilfred Jackson, Ben Sharpsteen, Perce Pearce, William Cottrell
2	*Pinocchio*	1940	Ben Sharpsteen, Hamilton Luske, Bill Roberts, Norman Ferguson, Jack Kinney, Wilfred Jackson, T. Hee
3	*Fantasia*	1940	Norm Ferguson, James Algar, Samuel Armstrong, Ford Beebe Jr., Jim Handley, T. Hee, Wilfred Jackson, Hamilton Luske, Bill Roberts, Paul Satterfield, Ben Sharpsteen
4	*Dumbo*	1941	Ben Sharpsteen, Norm Ferguson, Wilfred Jackson, Bill Roberts, Jack Kinney, Samuel Armstrong
5	*Bambi*	1942	David Hand, James Algar, Bill Roberts, Norman Wright, Samuel Armstrong, Paul Satterfield, Graham Heid
6	*Saludos Amigos*	1943	Norm Ferguson, Wilfred Jackson, Jack Kinney, Hamilton Luske, Bill Roberts
7	*The Three Caballeros*	1945	Norm Ferguson, Clyde Geronimi, Jack Kinney, Bill Roberts, Harold Young
8	*Make Mine Music*	1946	Jack Kinney, Clyde Geronimi, Hamilton Luske, Joshua Meador, Robert Cormack
9	*Fun and Fancy Free*	1947	Jack Kinney, Bill Roberts, Hamilton Luske
10	*Melody Time*	1948	Clyde Geronimi, Wilfred Jackson, Hamilton Luske, Jack Kinney
11	*The Adventures of Ichabod and Mr. Toad*	1948	Jack Kinney, Clyde Geronimi, James Algar
12	*Cinderella*	1950	Wilfred Jackson, Hamilton Luske, Clyde Geronimi
13	*Alice in Wonderland*	1951	Clyde Geronimi, Hamilton Luske, Wilfred Jackson
14	*Peter Pan*	1953	Hamilton Luske, Clyde Geronimi, Wilfred Jackson
15	*Lady and the Tramp*	1955	Hamilton Luske, Clyde Geronimi, Wilfred Jackson
16	*Sleeping Beauty*	1959	Clyde Geronimi
17	*One Hundred and One Dalmatians*	1961	Wolfgang Reitherman, Hamilton Luske, Clyde Geronimi
18	*The Sword in the Stone*	1963	Wolfgang Reitherman
19	*The Jungle Book*	1967	Wolfgang Reitherman
20	*The Aristocats*	1970	Wolfgang Reitherman
21	*Robin Hood*	1973	Wolfgang Reitherman
22	*The Many Adventures of Winnie the Pooh*	1977	Wolfgang Reitherman, John Lounsbery
23	*The Rescuers*	1977	Wolfgang Reitherman, John Lounsbery, Art Stevens
24	*The Fox and the Hound*	1981	Art Stevens, Ted Berman, Richard Rich
25	*The Black Cauldron*	1985	Ted Berman, Richard Rich
26	*The Great Mouse*	1986	Ron Clements, John Musker, David Michener, Burny Mattinson

	Detective		
27	*Oliver & Company*	1988	George Scribner
28	*The Little Mermaid*	1989	Ron Clements, John Musker
29	*The Rescuers Down Under*	1990	Hendel Butoy, Mike Gabriel
30	*Beauty and the Beast*	1991	Gary Trousdale, Kirk Wise
31	*Aladdin*	1992	Ron Clements, John Musker
32	*The Lion King*	1994	Roger Allers, Rob Minkoff
33	*Pocahontas*	1995	Mike Gabriel, Eric Goldberg
34	*The Hunchback of Notre Dame*	1996	Gary Trousdale, Kirk Wise
35	*Hercules*	1997	Ron Clements, John Musker
36	*Mulan*	1998	Barry Cook, Tony Bancroft
37	*Tarzan*	1999	Chris Buck, Kevin Lima
38	*Fantasia 2000*	1999	James Algar, Gaëtan Brizzi, Paul Brizzi, Hendel Butoy, Francis Glebas, Eric Goldberg, Don Hahn, Pixote Hunt
39	*Dinosaur*	2000	Ralph Zondag, Eric Leighton
40	*The Emperor's New Groove*	2000	Mark Dindal
41	*Atlantis: The Lost Empire*	2001	Gary Trousdale, Kirk Wise
42	*Lilo & Stitch*	2002	Chris Sanders, Dean DeBlois
43	*Treasure Planet*	2002	Ron Clements, John Musker
44	*Brother Bear*	2003	Aaron Blaise, Robert Walker
45	*Home on the Range*	2004	Will Finn, John Sanford
46	*Chicken Little*	2005	Mark Dindal
47	*Meet the Robinsons*	2007	Stephen J. Anderson
48	*Bolt*	2008	Chris Williams, Byron Howard
49	*The Princess and the Frog*	2009	Ron Clements, John Musker
50	*Tangled*	2010	Nathan Greno, Byron Howard
51	*Winnie the Pooh*	2011	Stephen J. Anderson, Don Hall
52	*Wreck-It Ralph*	2012	Rich Moore, Phil Johnston, Jim Reardon
53	*Frozen*	2013	Chris Buck, Jennifer Lee
54	*Big Hero 6*	2014	Don Hall, Chris Williams
55	*Zootopia*	2016	Byron Howard, Rich Moore, Jared Bush

Table 1. The Walt Disney Animation Studios corpus

Method

Inspired by Lev Manovich's Software Studies Initiative, I use as my primary tool ImageJ, a public domain scientific image analysis software program developed by the National Institute of Health that works with an increasing library of

user-created plugins. ImageJ can process a variety of image types, facilitating simple tasks like scaling, rotation, and contrast adjustments as well as much more highly technical operations such as “morphological data mining,” “trabecular geometry and whole bone shape analysis,” and “comparison of intensity ratios between nuclei and cytoplasm” [Ferreira and Rasband 2010–2012]. ImageJ is customizable with any number of plugins and macros, and like other advanced image processing programs such as Photoshop, even its basic menu can be bewildering. For the purpose of analyzing moving images, ImageJ’s most useful functions are found in its Stacks menu; stacks are “multiple spatially or temporally related images,” called “slices,” that are displayed in a single window [Ferreira and Rasband 2010–2012, 12]. Imagine neatly cutting out each frame from a brief filmstrip and stacking them up in sequential order so that you are left with a three-dimensional volume. In effect, ImageJ does this digitally, but it can also analyze each slice as it relates to the entire stack: “in stacks, a pixel (which represents 2D image data in a bitmap image) becomes a voxel (volumetric pixel), i.e., an intensity value on a regular grid in a three dimensional space” [Ferreira and Rasband 2010–2012, 12]. That is, with stacks, ImageJ can not only analyze the two dimensions of an individual film frame, but can also analyze any slice or line through the third dimension of the stacked film frames. One typical application of ImageJ is with spatially related images, like those produced by confocal microscopy, where a complete in-focus image of an object is built up from a stack of partially in-focus slices, or for various forms of medical tomography like PET or CAT scans, where successive scans of slices of the interior of the body are stacked to model a hidden structure. In these examples, it is desirable for the captured object to remain as still as possible to get an accurate rendering. So, applying these methods to large stacks of temporally related but spatially unrelated film slices, which not only have moving objects but also numerous scene transitions and framings, leads to unpredictable results. In effect, we are converting the dimension of time that we experience while watching a two-dimensional motion picture into a third spatial dimension that can also be analyzed.[4]

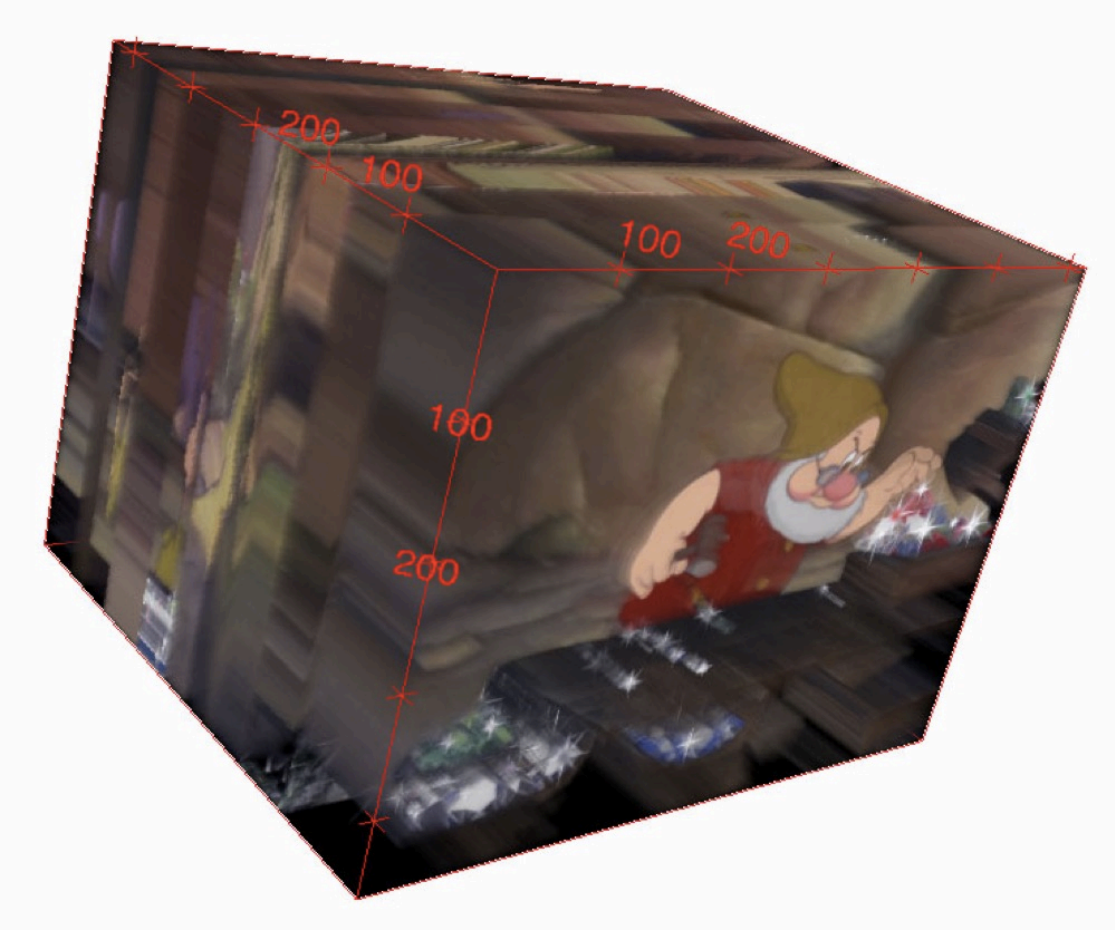

Figure 2. Visualizing a stack of slices as a cube in ImageJ

To create a stack in ImageJ, users can import in a number of ways: a video file, an animated gif, or an image sequence. Due to processor memory limitations, most users will find the simplest strategy is to create a folder of “stills” to import; I

use Quicktime Player 7's Export feature, selecting the option "movie to image sequence" to generate a folder of sequential jpegs. For this project, I created image sequences at 0.5 frames per second, or one frame every two seconds.[5] For a 90-minute film, this results in an evenly-distributed sampling of 2,700 frames. I removed errant black frames from the beginning and end of the stack as well as distributor and production logos that were later added for home video release (but kept production or studio logos that are integrated into the opening or closing credits). For example, here is a chronological montage of the 2,832 frames generated for *Frozen*.

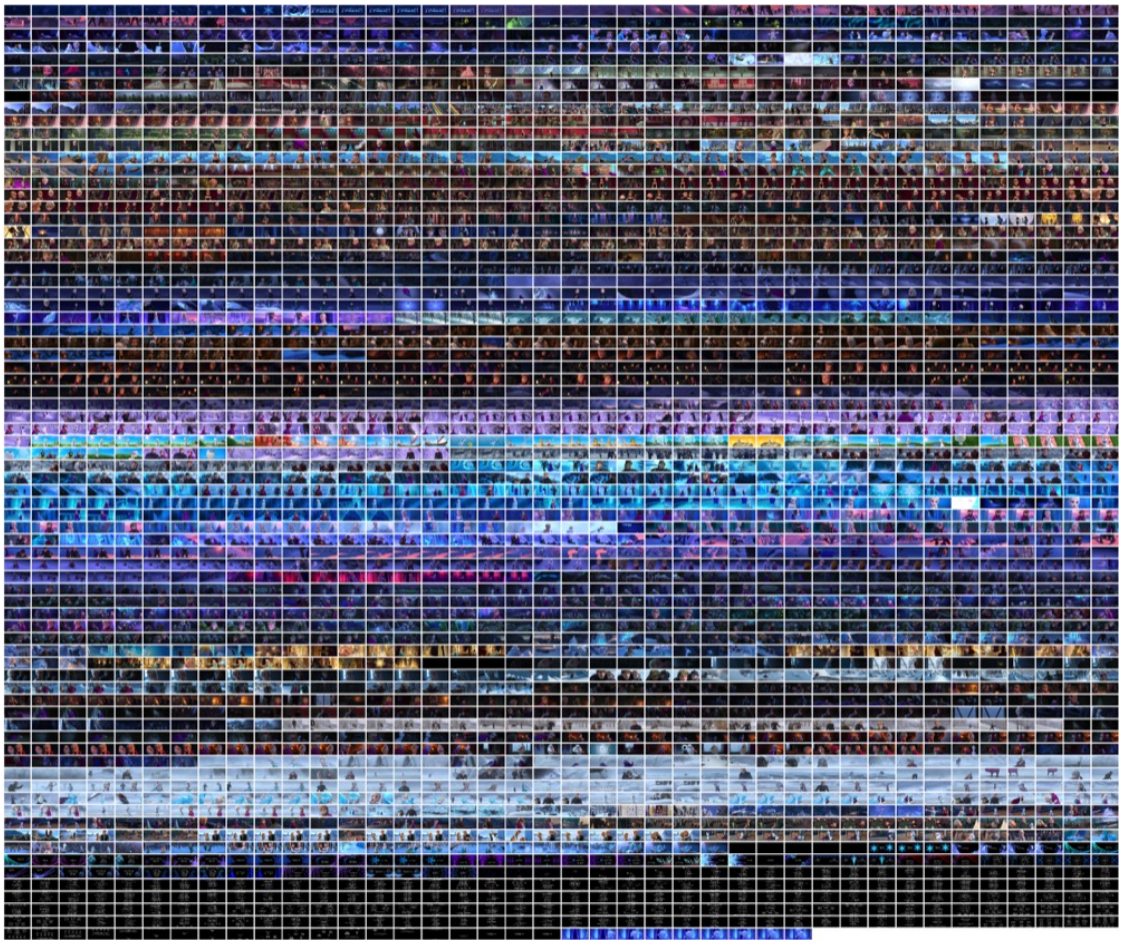

Figure 3. Montage of 2,832 evenly-distributed frames from *Frozen*

Once these slices are imported into ImageJ as a stack, there are any number of manipulations users can perform on a film. Here I describe only one — summed z-projections — which achieve my digital surrealist aim of transforming the film text into a new object of research. This process visualizes films in ways that were otherwise impossible for humans through most of the last century, capturing the extreme boundaries of the moving image and collapsing all of the frames into a single space. ImageJ offers six z-projection methods for creating a flattened, two-dimensional image from the three-dimensional stack: average intensity, maximum intensity, minimum intensity, sum slices, standard deviation, and median. Each projection type works by performing a different mathematical operation on the RGB (red, green, blue) values of each voxel in the image, examining the same pixel location for every slice in a stack.[6] Thus, Minimum and Maximum Intensity simply print the darkest or brightest pixel for each coordinate, while Average and Median Intensity print the pixel color somewhere in the middle and Standard Deviation a new pixel representing, obviously, the standard deviation of all the pixels along a particular coordinate. The one I am most interested in is Sum Slices, which adds together the voxel space of the stack of slices, compressing the film's visual field to reveal a single representative image. Below is a simple demonstration of the six operations on a small twenty-frame stack.

Figure 4. Twenty sample frames from a sequence in *Snow White*

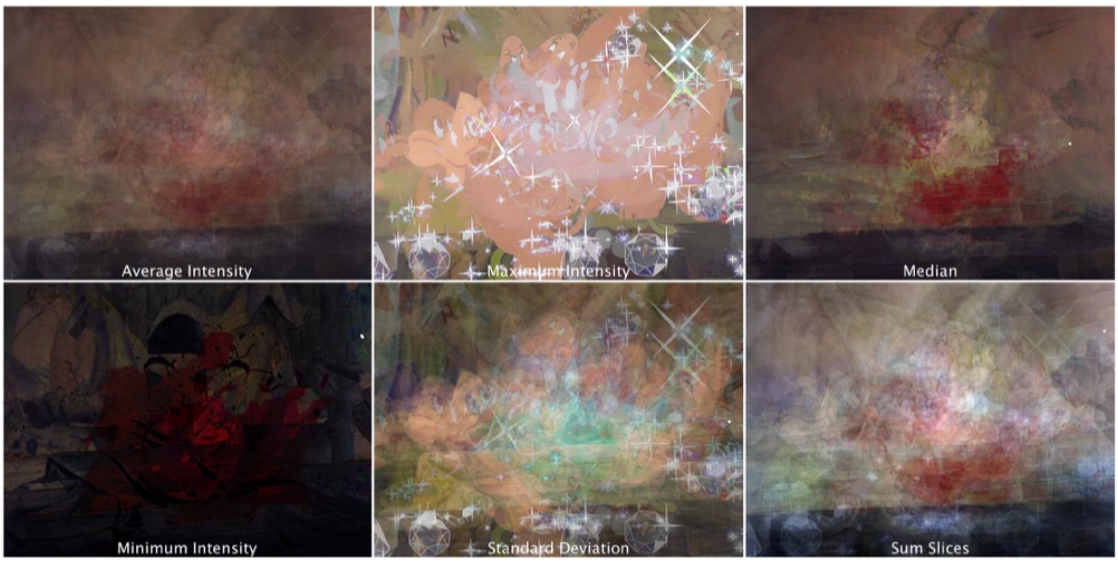

Figure 5. the six z-projection methods in ImageJ used on the *Snow White* sequence

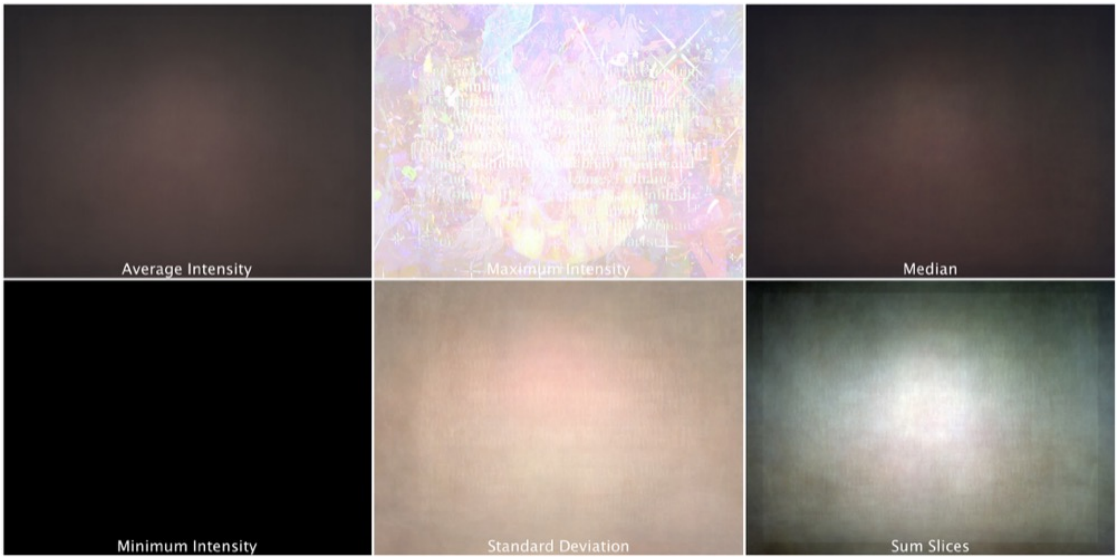

Figure 6. The six z-projection methods in ImageJ used on the entire film *Snow White*

What is a Sum?

What does it mean to “sum” a film, to “add it up”? Cinema is excessive: there is too much, either along the diachronic or synchronic axes, for viewers to be able to process the moving image without recourse to a science like mathematics or an art like theory. While most audiences and reviewers would not think specifically of math while watching a narrative film (outside of box office results), mathematical metaphors abound in discussions of film. For instance, contemporary reviews often “sum up” movies, resulting in an image of cinema as having unlike component parts that need to be added together in order to make sense: the acting was good, the dialogue worse, the soundtrack better. An informal search of the film critic Roger Ebert’s website (http://www.rogerebert.com/) finds seventy-four uses of the phrase “doesn’t add up” to describe the failures of movies under review. Even the director Sergei Eisenstein, in famously explaining how hieroglyphics inform his theory of montage, resorts to math: “the point is that [the combination] of two hieroglyphs of the simplest series is to be regarded not as their sum, but as their product” [Eisenstein 1949, 29–30]. Rejecting simple addition for complex multiplication, for Eisenstein cinema comes partly from the world of numbers: shots proportioned, framings balanced (or not), and all aspects directly measurable, as in his well-known audiovisual notation of a scene from his film *Alexander Nevsky* (1938).

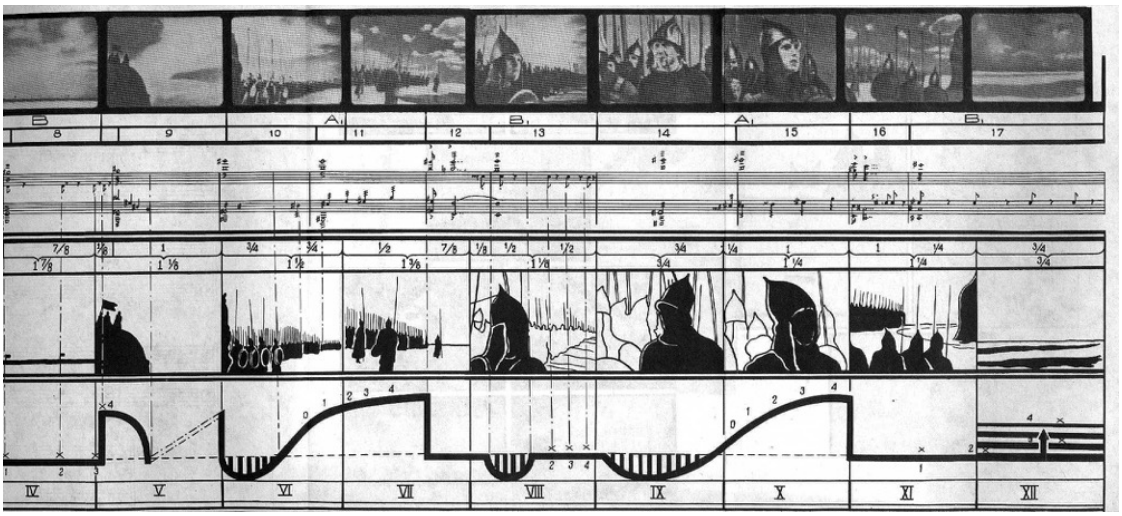

Figure 7. Sergei Eisenstein’s audiovisual notation of *Alexander Nevsky*

While my summed images erase montage and the possibility of two specific images colliding to produce a third dialectical meaning, they do democratize the film's images in a way that is impossible to imagine while watching, collapsing with a grander equation the important and unimportant, the major and minor, the dark and bright. In these images, all that is left is the trace of the filmmaker's intentions; even a master like Eisenstein is unable to direct the viewer's attention to anything other than the sum of everything photographed, intentional or accidental. While collapsing the film text to a single frame might initially strike some as overly reductive, this process magnifies a cinematic experience that is otherwise entirely unnoticeable: the pure, cumulative effect of duration on our eyes and brains without the distraction of narrative or image. Photographer Hiroshi Sugimoto, known for *Theaters*, a series of long-exposure photographs of movie theaters lit only by the light reflected off the screen, is also interested in trying to capture the time of a whole film in a single image. Conceptually my work is similar to his, but his process results in black-and-white images with luminous, blank screens, whereas mine reveal color, shading, and depth. Last, I point to artists Jason Salavon and Jim Campbell, who independently worked with statistical processes and averaging in the late 1990s and 2000s on collections of yearbook photos, *Playboy* centerfolds, Dutch paintings, novel pages, and films. My use of digital surrealism as a media studies research strategy is thus is conversation with an artistic tradition of visual analysis of groups of images.

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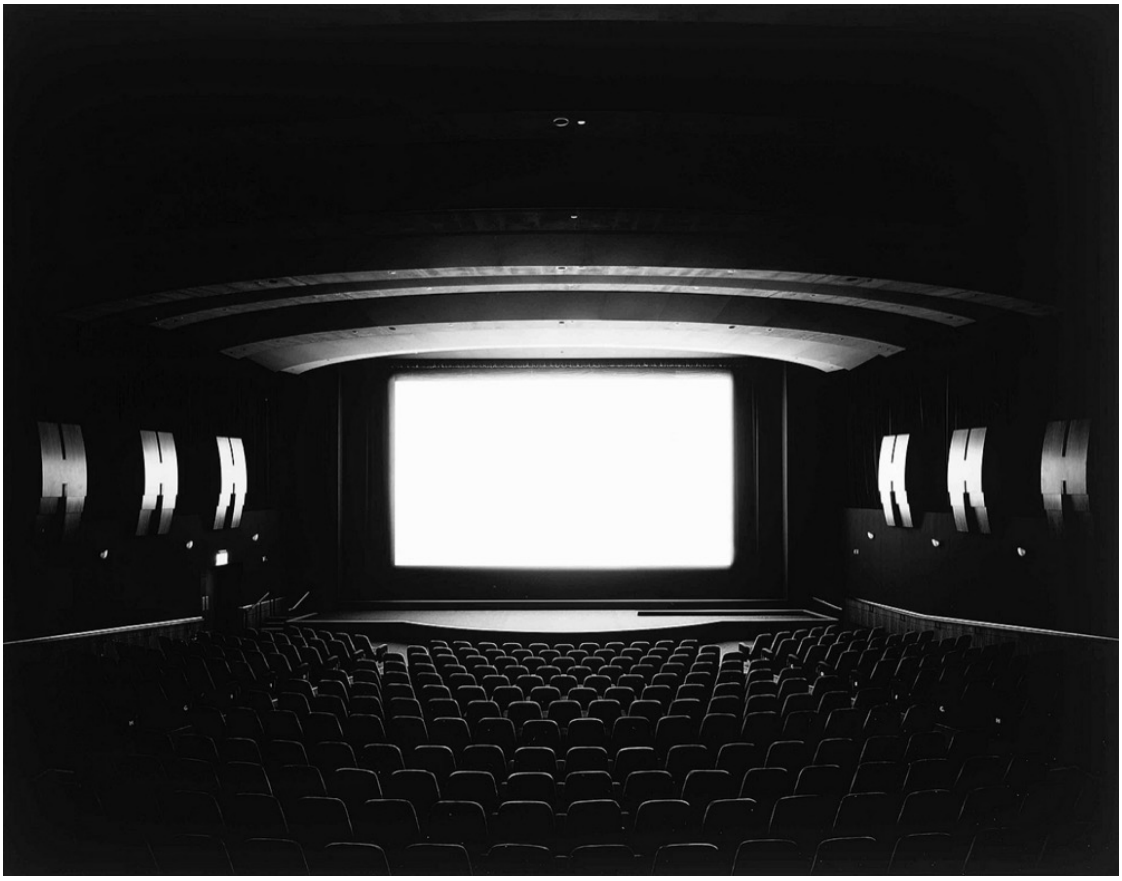

Figure 8. Hiroshi Sugimoto's long-exposure photographs of movies projected in theaters

Here are the fifty-five sums of Walt Disney animation I created. For the sake of visual comparison, I have scaled all of these images to the Academy aspect ratio of 1.375:1, although obviously the films were initially released in a variety of aspect ratios.[7] They are presented in chronological order from upper left to lower right in eleven rows of five columns, and for the sake of reference I have included the film's number along with the title here and in the text below (thus, 21 *Robin Hood* can readily be found at the beginning of row five). The images are labeled here, but for individual high resolution images without captions see https://www.flickr.com/photos/a2050/albums/72157661482387425.

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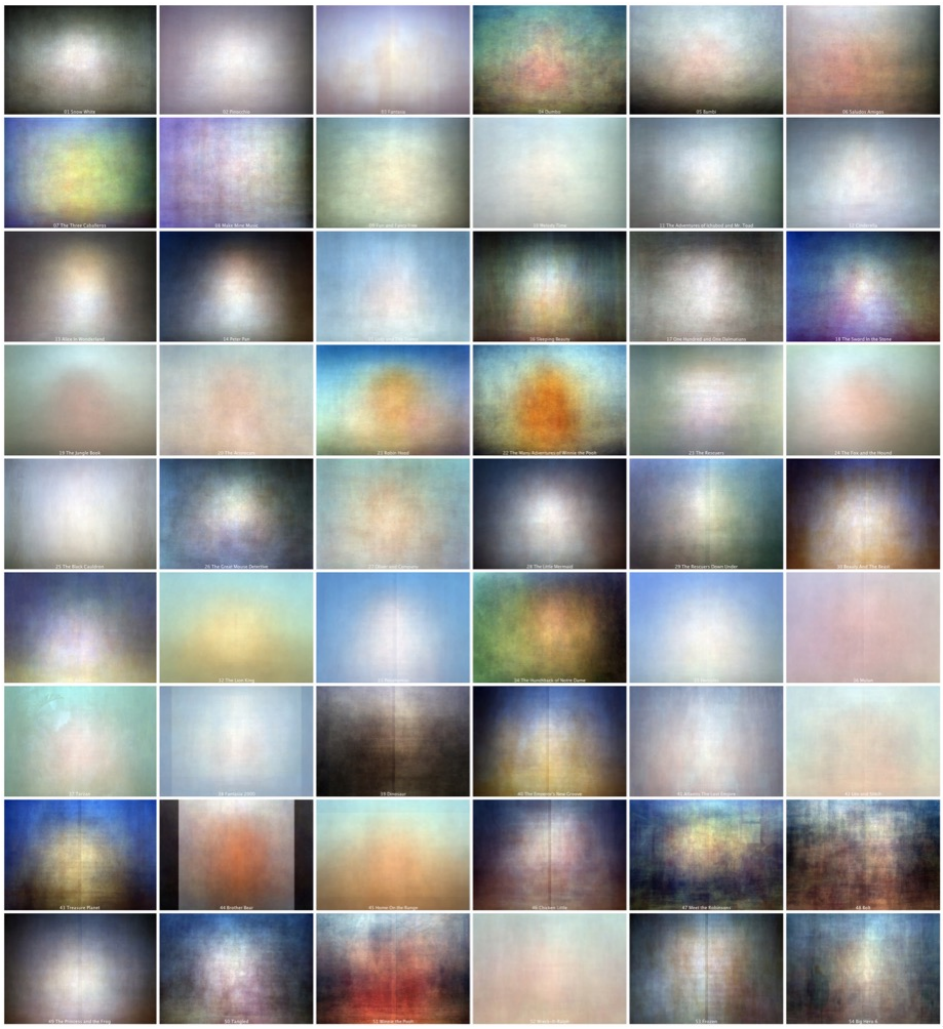

Figure 9. Summed z-projections of the fifty-five feature films of Walt Disney Animation Studios scaled to Academy Ratio

At first glance, these images seem remarkably similar, despite being produced in a wide range of styles, techniques, and years. As a form of scholarship or criticism, then, we would begin simply by comparing and contrasting our transformed films, articulating the final effect and questioning what differences in production might have resulted in the subtle differences in the final result. Thus, glancing at the corpus, one aspect readers will likely notice immediately is the strong symmetry of these images. The majority of them feature a lighter, horizontally central shape on a differently-hued background with a varying degree of darker shaded vignetting in the corners. For example, 22 *The Many Adventures of Winnie the Pooh* has a very recognizably Pooh-shaped blob smack in the center of a sky blue background and darkened corners and bottom. Likewise, 14 *Peter Pan* has a glowing off-white central shape that falls off into blue hues on the left and brown ones on the right, with strong vignetting in the corners and along the top of the image. Forty-three *Treasure Island* shows a very distinct yellow central shape surrounded by deep blue with darker magenta in the lower corners. But of the symmetrical center shapes, 13 *Alice in Wonderland* is the most remarkable: rather than the triangular pale blobbiness of the others, the central shape here indistinctly shows both Alice's straw hair and faint blue dress below.

Figure 10. Summed frame z-projection of *Alice in Wonderland*

This becomes even more pronounced when increasing the contrast and saturation of the image, but it is also evident in the numerous medium shots of Alice from the film, which show how often she is isolated on a dark background.

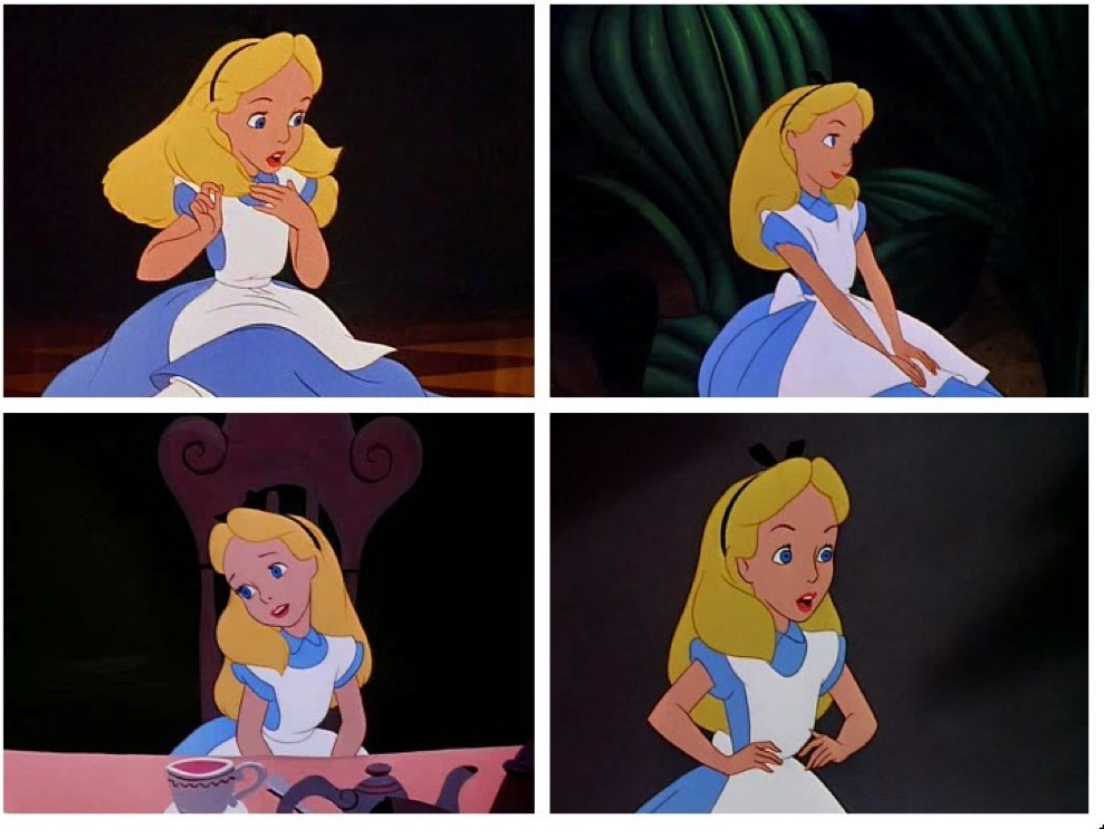

Figure 11. Individual frames from *Alice in Wonderland* showing Alice in medium shot

Thus, contrasting this summed frame with the edge-to-edge evenness of something like 36 *Mulan*, one initial possibility is to use summed frames to gain information about framing choices or emphasis on specific characters. For example, we could conclude that *Alice in Wonderland* is the Disney film that most consistently frames the titular character, and that it does so to an unusual degree compared to the other films (and to almost all of the other non-Disney films I have analyzed). This is not something that viewers could have intuited across the entire corpus, while this digital surreal method visually quantifies that information for us.

Figure 12. Summed frame z-projection of *Fantasia*

For example, while not as legible as Alice, 03 *Fantasia* also has a more clearly-defined central shape than the other summed frames. But here, the sharper definition of the shape is obviously due to the repeated shots of the Master of Ceremonies Deems Taylor and the conductor Leopold Stokowski, either of Taylor directly addressing the audience or Stokowski with his back turned preparing to lead the orchestra.

Figure 13. Individual frames from *Fantasia* showing the conductor and MC's repeated presence

This is an unusual exception to the norm for these summed images, whose shapes are oval at best but often simply indiscernible. Fascinatingly, one other film also serves as an exception to the blobby central trend: 53 *Frozen* has two faint central shapes rather than only one.

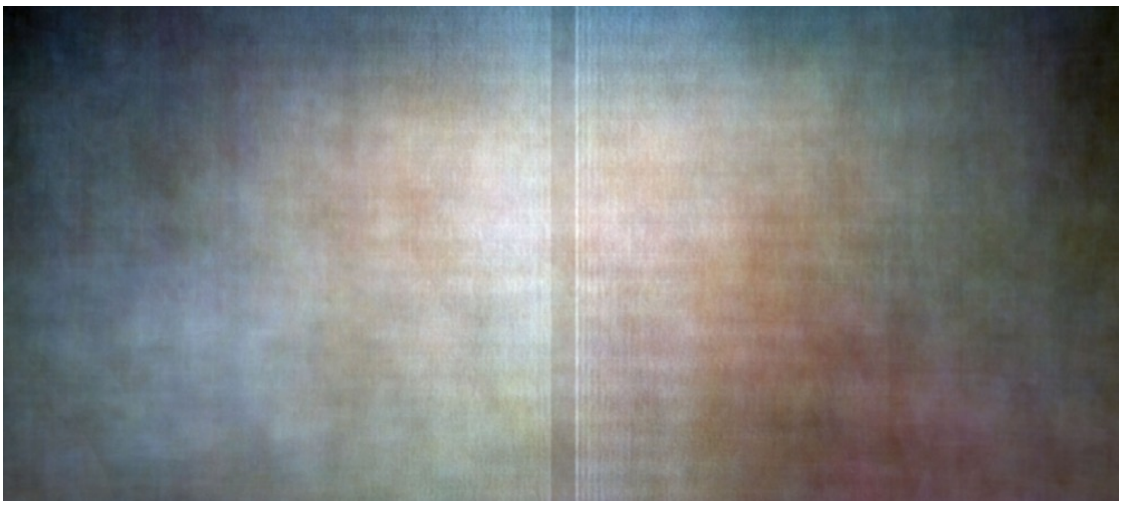

Figure 14. Summed frame z-projection of *Frozen*

While clearly one of Disney's "Princess Pantheon" films featuring a central female protagonist, *Frozen* visually breaks with the others by using a preponderance of two-shots motivated by the fact that it revolves around the relationship between two orphaned sisters, a queen and a princess. While other Disney films have used wider aspect ratios, *Frozen*'s rather wide 2.24:1 aspect ratio easily allows for shots where both protagonists are framed in closeup. This is also true of two-shots among other groupings of characters. 16

Figure 15. Numerous two-shots in *Frozen* are evident in the summed frame z-projection

While in some respects this is an effect of Disney's ability to know that today they would be able to successfully release a home video in widescreen format and not have to crop it as with widescreen films in the earlier days of hated letterboxing and square televisions, it is also evidence of *Frozen*'s strategy to visualize interactions between characters without relying on over-the-shoulder shots or needing to centrally frame speaking characters. In this way, the summed z-projection technique can quickly allow for larger intuitive comparisons of how films position main characters on screen, whether emphasizing single characters, duos, or groups. In the case of *Frozen*, we see clear evidence of an unusual (for Disney) choice to frame two characters in closeup for extended periods of time. 17

The other noticeable similarity among many of these summed frames is vignetting, a darkening of the periphery of an image caused by insufficient light.[8] Vignetting is most pronounced in 14 *Peter Pan*, 28 *The Little Mermaid*, 29 *Beauty and the Beast*, and 49 *The Princess and the Frog*. Compare those four images to 10 *Melody Time*, 33 *Pocahontas*, 35 *Hercules*, or 36 *Mulan*, which all have a central shape but a background that runs seamlessly to the edges without significant darkening. I attribute this difference both to the conventional wisdom of the cinematic dominant, that moviegoers' attention can be drawn to the most important subject by making it the best lit, and that the four unvignetted films take place primarily outdoors, while those with vignettes occur inside or in darker, secluded locations. *Pocahontas* and *Hercules* are nearly identical in this respect, and their sky-blue backgrounds are obviously evident in the summed frame, compared to the relatively shadowed and clouded undersea kingdom of *The Little Mermaid* or the forest and castle interiors of *Beauty and the Beast*. Vignetting is traditionally considered a problem in photography, with the ideal photograph showing a consistent range of tones all the way to the edge. Obviously, animated films need not suffer from this optical problem, and so many of the images that display strong vignetting do so intentionally in an attempt to imitate a vignetted "historical" look or to illustrate how a scene is artificially lit and to direct the spectator's attention to the privileged center of the frame. An example from *The Princess and the Frog* shows this common strategy, where the central characters in this shot are brightly lit while the background dancers and setting are increasingly (and unrealistically) darker as we move to the edges. 18

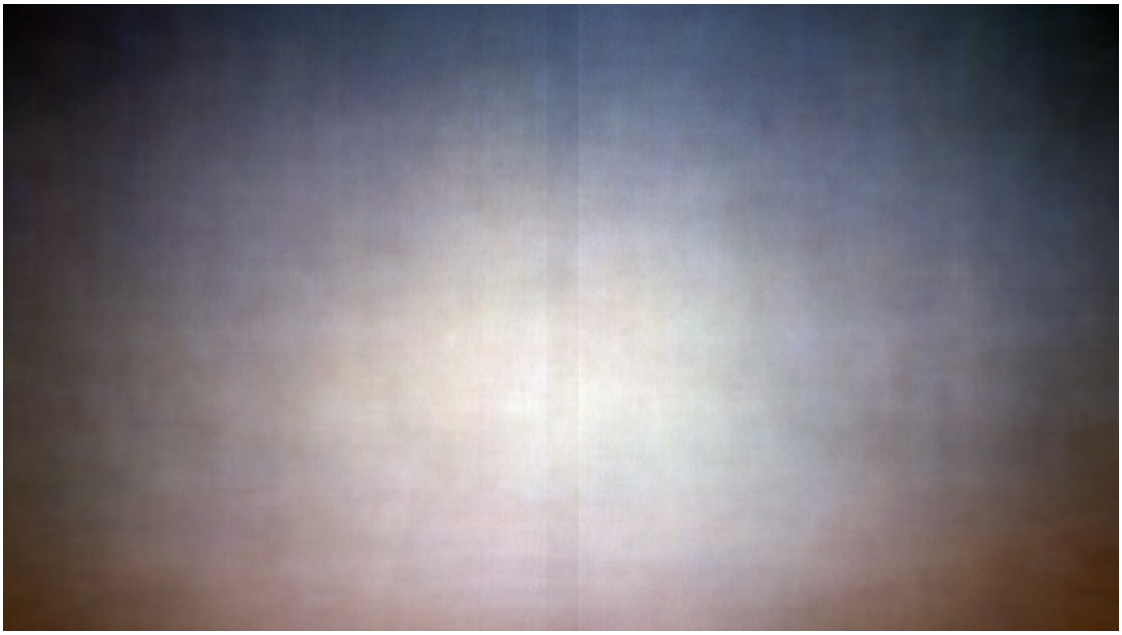

Figure 16. Summed frame z-projection of *The Princess and the Frog*

Figure 17. Artificial vignetting is clear in many shots from *The Princess and the Frog*

While vignetting is also apparent in summed frames of live-action films, particularly those not shot primarily on evenly-lit studio sets, animated films that feature vignetting even more consciously perform this photographic flaw for aesthetic reasons. Comparing the degree and type of vignetting in summed frames can offer insight into both the lighting style of live-action films and the imitation of real-world lighting in animated films. While there might be set photographs or lighting notes for live-action films, clues about overall lighting strategies in cel-animated films must be deduced from methods like digital image analysis. 19

Looking at the vignetted symmetry of so many of these images, 08 *Make Mine Music* stands out as an anomaly: is the dark gradient on the right side of the frame an example of something unusual about the film's visual strategy, or is it just an error in transferring the film print to a home video release? 20

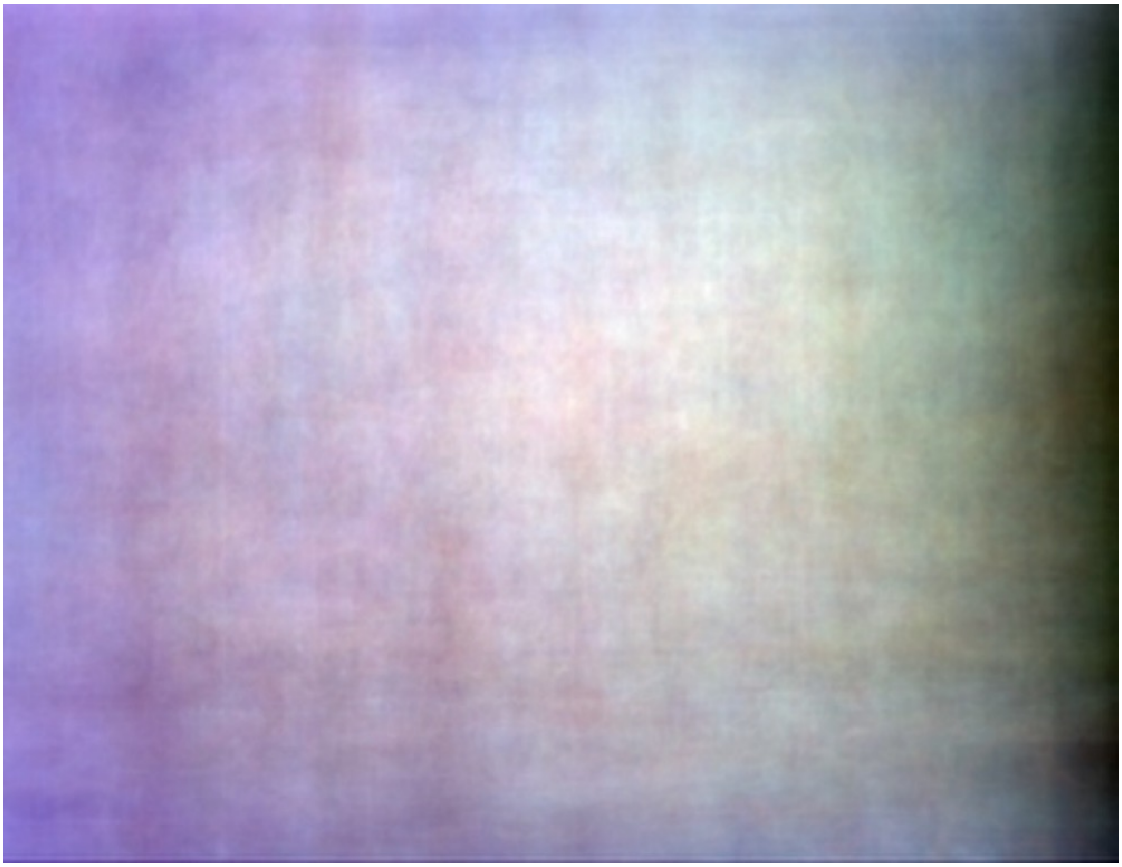

Figure 18. Summed frame z-projection of *Make Mine Music*

This image does not display vignetting, nor does it display a prominent central shape or even a symmetrical background: the image is unbalanced with a predominance of magenta hues on the left side and greenish ones on the right. Looking at the constituent frames, it appears that there is indeed a slight visible darkening error covering the right side of the digital copy, but that there are also frames like Figure 20 that are noticeably intentionally darker on the right.

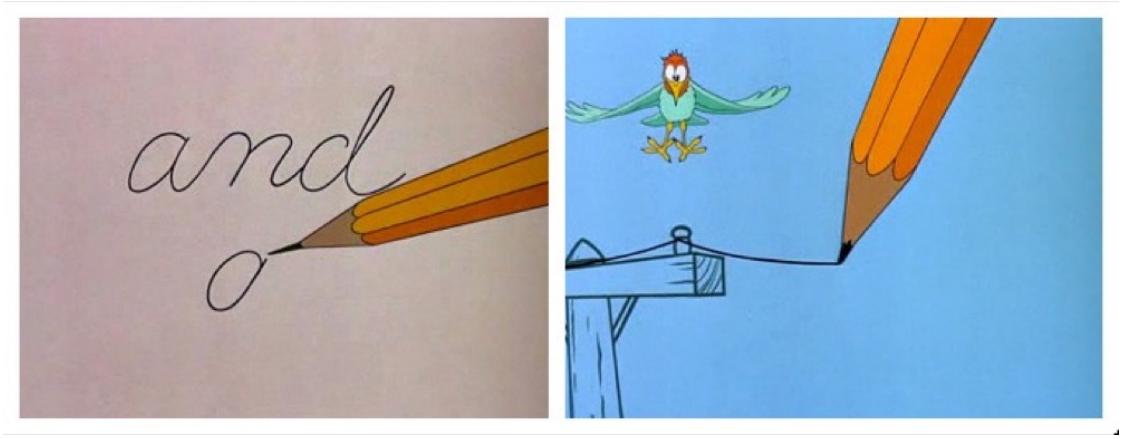

Figure 19. Individual frames from *Make Mine Music* that show a darkening error on the right side

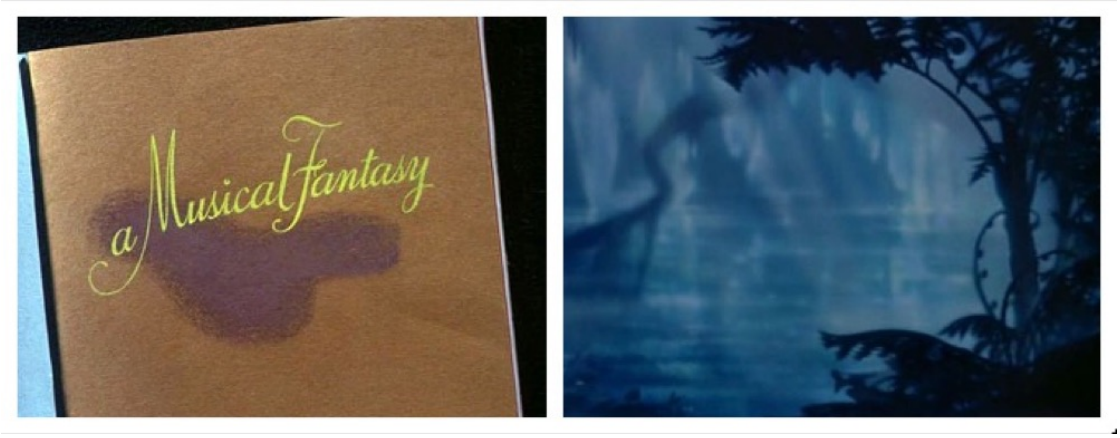

Figure 20. Individual frames from *Make Mine Music* that show intentional darkness on the right

While much of the film features its characters in symmetrically centered compositions, the animation emphasizes vibrant gradient backgrounds, established in the title credits, that places characters in long shot on flat, brightly colored, and changing backgrounds. Thus, compared to the rest of the corpus, the *Make Mine Music* summed frame stands out due to its gradient color shift. Readers familiar with the film will also point to the fact that it is an anthology film composed of ten segments visualizing the interplay between animation and classical and popular music (Debussy, Prokofiev, Donizetti, Benny Goodman, The Andrews Sisters). Thus, the greater variety of animation styles, characters, and settings clearly shows up in the rich mottled image. Using the summed z-projection technique can easily reveal outlier films, those that depart for different reasons from maintaining a dominant, conventional style. 22

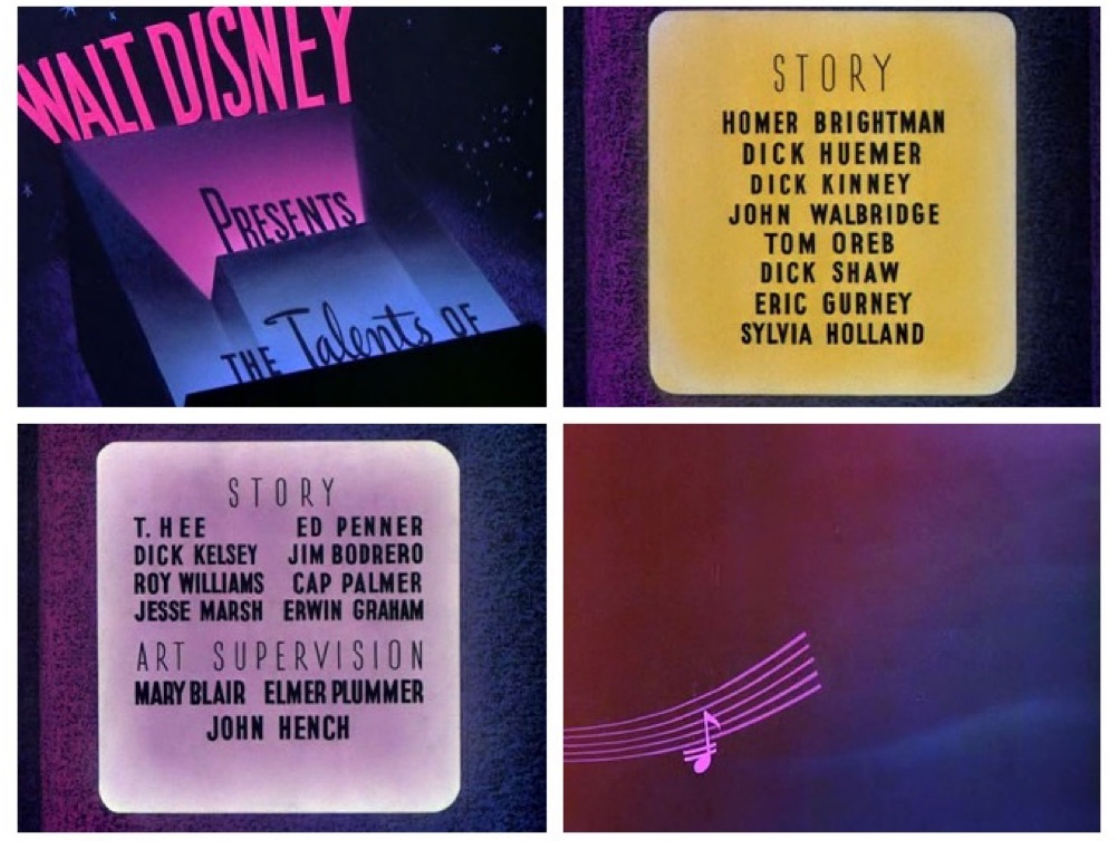

Figure 21. The bright, gradient title credits of *Make Mine Music*

Scanning the other summed frames for similarly mottled images, readers might mistakenly assume that 34 *The* 23

Hunchback of Notre Dame is also an anthology film since its summed z-projection likewise has an unusually uneven composition and unbalanced colors.

Figure 22. Summed frame z-projection of *The Hunchback of Notre Dame*

Much of the film takes place at night and there are numerous frames where the right side of the image is indeed completely black, so we can rule out a film transfer error. Many sequences take place in candlelight and there is a climactic fiery battle (as well as the orange and brown credits), so the warm red tones make sense, but what of the green dominating the left?

Figure 23. Individual frames from *The Hunchback of Notre Dame* show intentionally dark illustration on the right

Figure 24. The warm-toned credits of *The Hunchback of Notre Dame* affect the summed frame

I think there is a rather intuitive explanation that our digital surrealist method confirms: throughout the film, Quasimodo wears a drab green tunic, and since he himself is asymmetrical, with a hump on his right side, his characteristic features are best portrayed when he occupies the left of the frame facing frame right (see Figure 25). 25

Figure 25. A specific and repeated framing of Quasimodo is clearly evident in the summed frame z-projection

Closer investigation of the film's slices shows asymmetry is a visual theme throughout — for instance, Esmerelda wears only one hoop earring in her left ear with a hair scarf dangling on the right and a thicket of bracelets on her left arm offset by a lone bracelet on her right wrist — and the summed image supports this strikingly by showing how often Quasimodo's back and hump occupies the left third of the frame, even as his face is centered. While we would expect anthology films unintentionally to appear unbalanced given the varying range of source material, we can see clearly in the summed image from *The Hunchback of Notre Dame* how carefully the animators worked to create a dominant visual asymmetry for framing Quasimodo and how this is a wholly unique strategy in the Disney corpus. Since Disney's typical 26

visual strategy is almost entirely conservative, framing characters centrally or following the rule of thirds, we can see just how unique *The Hunchback of Notre Dame* is visually, crowding its protagonist's unruly body to the side. In this way, inspecting the summed frames and accounting for unexpected details allows researchers to pursue new questions from empirical evidence or visually confirm an intuitive hunch.

Another common shape is apparent in many but not all of these images: the horizon or ground line. It is most visible, for example, in 05 *Bambi*, 22 *The Many Adventures of Winnie the Pooh*, 43 *Treasure Planet*, 45*Home on the Range*, and 51 *Winnie the Pooh*, although readers will see faint examples in other films. Of these, *Bambi*'s darkened lower portion is the most pronounced, especially contrasted with the brightness of the center of the image and the lack of vignetting in the two upper corners. 27

Figure 26. Summed frame z-projection of *Bambi*

The dark lower portion in this film is not due to vignetting or lighting effects, but mainly because the film has more long shots of characters that include the forest floor than it has medium or closeup shots of characters that do not show the ground. This makes some sense for a film like *Bambi*, focused on placing a young character in his woodland environment and detailing his interactions with smaller, ground-dwelling forest creatures. And yet, the forest floor in *Bambi* is not particularly black, and the film often captures a downward-looking perspective so that the forest floor occupies much of the frame, not just the bottom ribbon. 28

Figure 27. Individual frames that show *Bambi*'s downward-looking gaze

Closer investigation better explains the dark bottom portion: the animators often occluded the foreground of the frame with brush, tree limbs, or other natural objects (see Figure 28).

Figure 28. Individual frames of *Bambi* show how frequently animators obscured the bottom of the frame

This is not only an excellent strategy to the problem of creating a perceived sense of depth in flat animation (so that including specific foreground shapes sets off the central characters from other visual planes), but it also generates a voyeuristic effect to make it seem as if viewers are peering through underbrush to watch Bambi's life unfold. With this example, we can readily see that the spectator's psychological distance from the non-human protagonist is encoded in the summed image, again offering a way to produce empirical visual evidence to support an intuitive argument. 30

A similar strategy is at work in another film focusing on non-human forest characters, 22 *The Many Adventures of Winnie the Pooh*. 31

Figure 29. Summed frame z-projection of *The Many Adventures of Winnie the Pooh*

The animation here is much flatter, but as with 05 *Bambi*, the animators create many downward-facing shots and include darker objects in the foreground of the frame to provide spatial depth cues.

Figure 30. Individual frames from *The Many Adventures of Winnie the Pooh* with darker objects at the bottom of the frame

Disney's second Pooh movie, 51 *Winnie the Pooh*, offers an interesting comparison since both films are about the same characters and animated in a very similar way.

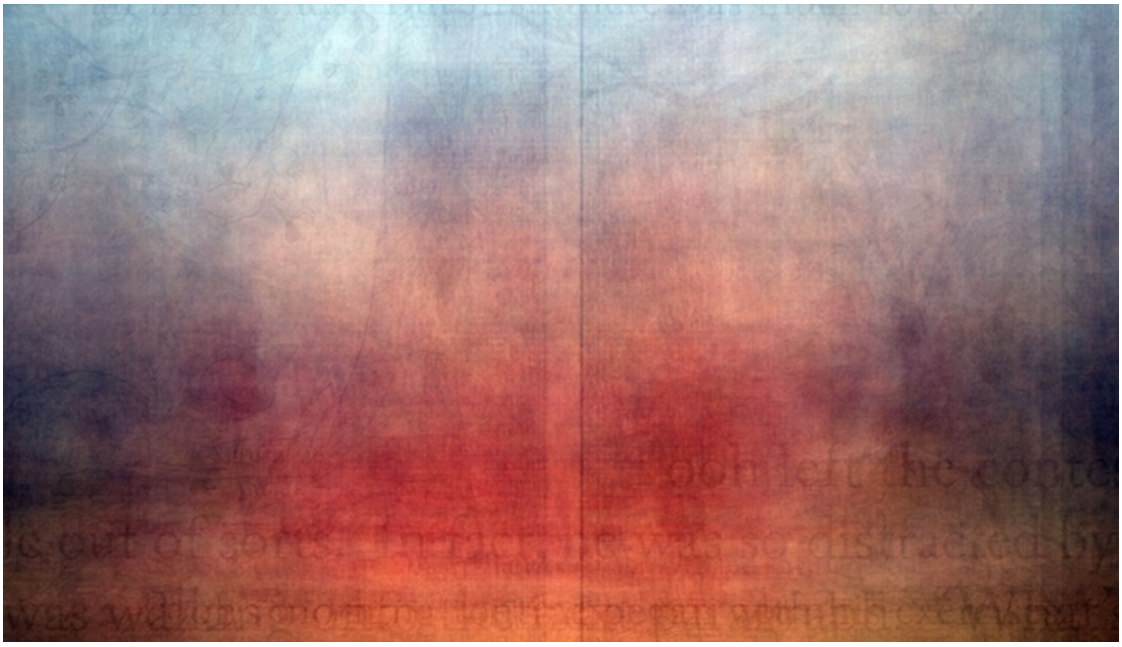

Figure 31. Summed frame z-projection of *Winnie the Pooh*

Here, however, there is a noticeable thick, darker ground line about a third from the bottom of the image, obscured by the central blob shape. It's difficult to see why *Winnie the Pooh*'s summed image looks so different from *The Many Adventures of Winnie the Pooh*, but I speculate that *Winnie the Pooh* has more shots that are level, revealing more of the sky and making the forest less wooded, and that its foreground objects are not darkened so that the overall image is evenly bright (see Figure 32.

Figure 32. Individual frames from *Winnie the Pooh* do not show the ground or dark objects as frequently

The retro-future 43 *Treasure Planet* has a much more dazzling, dense, and vibrant animation style that appears in the summed image.

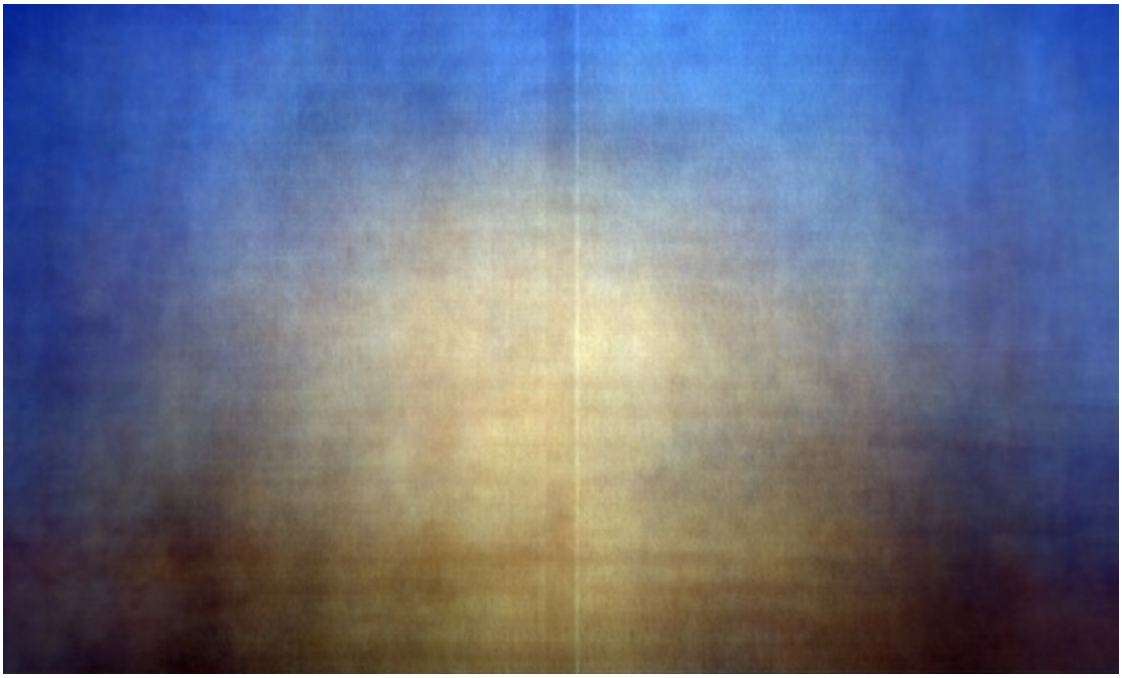

Figure 33. Summed frame z-projection of *Treasure Planet*

But here I think we see less of a horizon line and more evidence of the fact that much of the film takes place on a horizonless spectacular flying ship and that our novice hero is often shown against the brown wood of the gunwale with blue sky in upper two-thirds (see Figure 34). 36

Figure 34. A individual frame of *Treasure Planet* with dominant blue sky

The defining blue sky is also apparent in 45 *Home on the Range*, which has a much different kind of horizon line, defined less by the foreground and more by the skyline. *Home on the Range* is a western, evoking the Monument Valley locations of John Ford's films, and we can clearly see how often the three cow heroines are drawn in bright exterior shots. 37

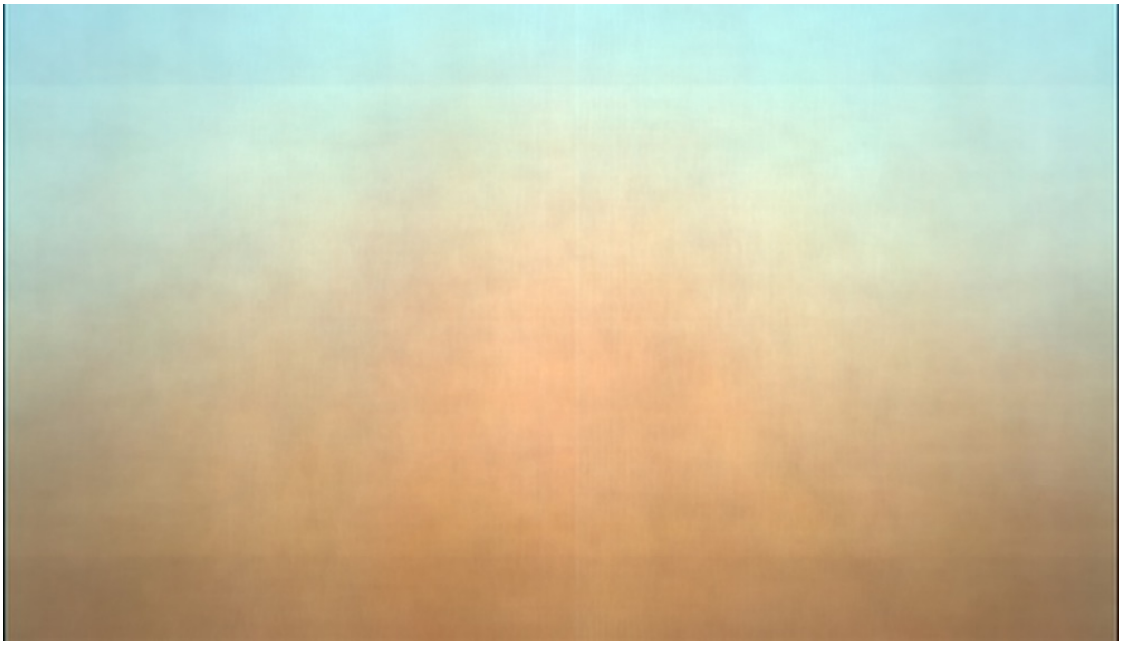

Figure 35. Summed frame z-projection of *Home on the Range*

Figure 36. Individual frames of *Home on the Range* show grand, outdoor, western-inspired framings

Home on the Range most resembles 32 *The Lion King* in that the dominant presence of the blue sky clearly defines the film's majestic outdoor location. Both of these films' images are remarkably similar to a summed image that I produced for an initial exploration of this project using a corpus of fifty western films: John Ford's *The Searchers* (1956) [Ferguson 2015b]. 38

Figure 37. The summed frame z-projection of *The Searchers* closely resembles *Home on the Range*

Many of the Disney films feature blue hues, but only a handful like *Home on the Range* and *The Lion King* contrast the blue sky with a different-hued lower two-thirds (for example, consider how 33 *Pocahontas* and 35 *Hercules* are almost all blue). In doing so, we can see how much less defined the central shape is in these, instead showing how the characters in films set in grand exterior locations disappear into their surroundings or are balanced with numerous extreme long shots. 39

Fifty-one *Winnie the Pooh*, mentioned above (Figure 31), also brings us to the final noticeable shape to discuss in these summed frames: textual elements that remain on the screen and "burn" their way into the summed image. *Winnie the Pooh* illustrates the first version of this: in the lower right quadrant we can make out the letters "ooh left the conte," which indeed turn up in eleven of the slices used (0.59% of the total frames). 40

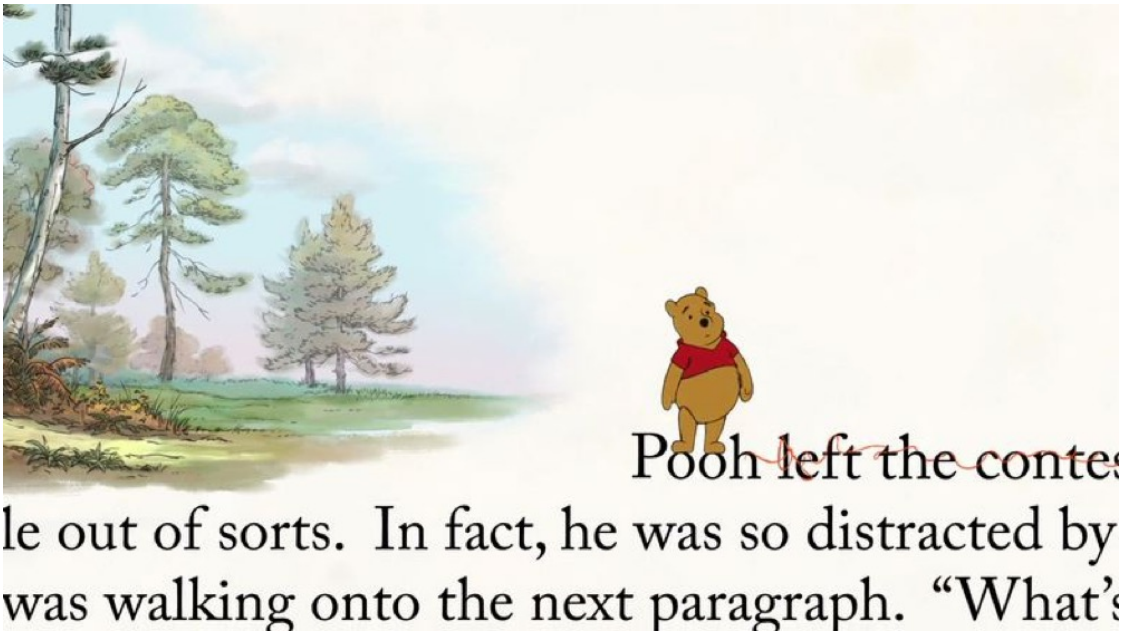

Figure 38. Individual frames in *Winnie the Pooh* demonstrate the film's play with text

While much more indeterminate, we can also barely make out nondescript characters in the center of 23 *The Rescuers* and 21 *Robin Hood*. These two films do not have as much meta-textual play with writing as *Winnie the Pooh*, but what they do have in common is that they illustrate the second way that text appears in the summed images, namely, as title or closing credits. In the case of *The Rescuers* and *Robin Hood*, the fashion at the time was to list production credits at the beginning of the film rather than the end, and so the credits remain on the screen long enough to be amplified in the summed image; for instance, in the case of *The Rescuers*, the phrase "With the voice talents of" remains for 16 slices (0.72% of summed frames) while the cast list changes. Interestingly, a film with the same credit sequence strategy, 20 *The Aristocats*, does not visibly display text in the summed image, perhaps because the text is in black but on a darker background and thus less distinct (see Figure 39).

Figure 39. Sample images of the credits for four Disney films

In 51 *Winnie the Pooh* we also see a second way that production credits affect the summed image, where a very long

list of names scrolls continually over either a static or moving background. *Winnie the Pooh* has well over 400 names listed in its closing credits in addition to song credits and other information; textual credits appear on 246 of the 1859 frames I generated, or a little more than 13% of the film. This shows up in the summed image as two varying width columns starkly separated by a thin stripe.

Figure 40. Sample frame from *Winnie the Pooh*'s closing credits showing the negative space that appears in the summed frame

This effect is noticeable as early as 28 *The Little Mermaid*, and has become more pronounced as credits become longer (I calculate the closing credits occupy 5.26% of *The Little Mermaid* versus 9.63% of Disney's recent film 54 *Big Hero 6*). [9] 43

Like many, 51 *Winnie the Pooh*'s credits take place over a moving and constantly varying background, but readers will no doubt be able to identify the fewer films with extensive credits that scroll over a relatively unchanging background. The most obvious of these are 25 *The Black Cauldron*, 37 *Tarzan,* and 54 *Big Hero 6*. In each of these, a particularly prominent shape is evident: *The Black Cauldron*'s manuscript borders, *Tarzan*'s tropical rainforest leaves, or *Big Hero 6*'s floating dirigibles. 44

Figure 41. End credits from three Disney films that play over a repeated image

Twenty-six *The Great Mouse Detective* has a slightly fainter but still visible image, since it adopts the common strategy of beginning the closing credits over a scenic establishing shot before switching to a black background to display secondary credits.

Figure 42. A frame from the end credits of *The Great Mouse Detective* plays over an establishing shot

Careful readers might also wonder about 47 *Meet the Robinsons*, which appears to have a window-shaped square in the upper right quadrant; however, we discover the credits are a scroll over a solid black background. 46

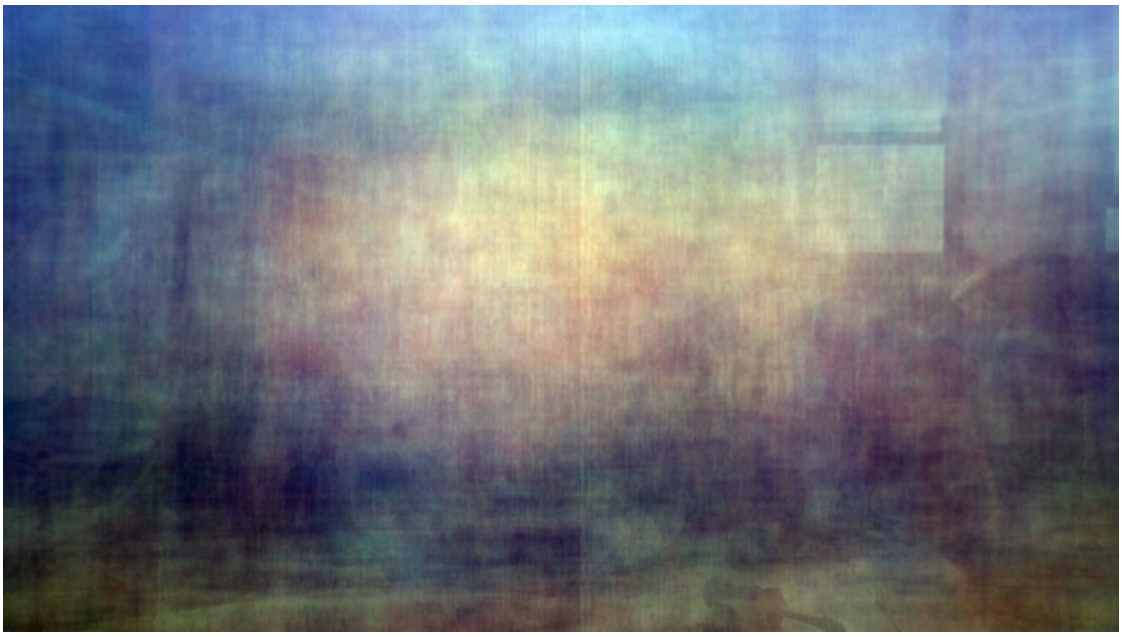

Figure 43. Summed frame z-projection from *Meet the Robinsons*

In this unusual case, investigation reveals that the window shape is from a scene early in the film, with a shot of our inventor hero inventing. 47

Figure 44. One scene from *Meet the Robinsons* clearly appears in the summed frame z-projection

In this scene, there is one cutaway, and then we return to the same camera setup for a total of 39 slices or 1.4% of the film's length. Further experimentation is required, but this figure gives some suggestion that there is a threshold for particular objects to appear in static shots and that the placement and brightness of those objects is important (for instance, other unmoving aspects of the shot such as the wallpaper or framed diplomas are not as prominent). Is this then the longest camera setup in the Disney corpus? Or just the brightest? 48

While aesthetically I find the summed images more attractive without the closing credits, they are a striking reminder of how much longer the narrative film's paratext has become due to the greater number of credited contributors. I also find something compelling about the strong central vertical line in images like 46 *Chicken Little* and 53 *Frozen*, which call to mind Abstract Expressionist painter Barnett Newman's "zip" paintings. 49

Figure 45. Barnett Newman's zip painting *Onement, I* (1948) http://www.moma.org/collection/object.php?object_id=79601

In a 1970 interview with filmmaker Emile de Antonio, Newman describes his zips as a way to unite the parts of his painting and, in a phrase relevant to cinema, speculates on his thought process in creating them: "I suppose I thought of them as streaks of light" [O'Neill and Newman 1992, 306]. Mark Rothko, another well-known Abstract Expressionist painter whose work these summed images call to mind, also describes his paintings as having "their own inner light and if there is too much light [in the museum], the color in the picture is washed out and a distortion of their look occurs" [Breslin 1993, 412].

Figure 46. Mark Rothko's color field painting *Untitled* (1968) http://www.moma.org/collection/object.php?object_id=37042

Art critic Clement Greenberg championed Rothko's work as part of a "color field" tradition, which used uninflected color to collapse traditional differences between figure and ground. The summed images I produced achieve in related ways this effect, but are built out of some of the most figural images available. I think the summed z-projections evoke the tradition of Rothko and Newman's work with color, but on another version of a similar project, Kevin Oleary pointed out to me how similar these summed images are to an earlier tradition — the paintings of English Romanticist J. M. W. Turner, such as his later work *Venice with the Salute* (c.1840-5) or *Landscape* (c.1840–c.1845).

Figure 47. J. M. W. Turner's *Venice with the Salute* http://www.bbc.co.uk/arts/yourpaintings/paintings/venice-with-the-salute-202458

Figure 48. J. M. W. Turner's *Landscape* http://www.bbc.co.uk/arts/yourpaintings/paintings/landscape-97520

So far I have focused on the shapes of these images, but with Turner and the Color Field painters in mind I want to turn to a brief analysis of the color of these images. Below are two simple graphs of all the summed frames created using

ImageJ's ImagePlot macro, plotted first by median hue on the x-axis and median brightness on the y-axis, and then by standard deviation hue on the x-axis with standard deviation brightness on the y-axis. This allows us to more analytically compare the summed frames. We thus expect to see a horizontal distribution of images in the rainbow spectrum of hues (i.e., from red on the left through green in the middle to violet on the right), with brighter images moving upwards. While sourcing and creating digital copies of these texts from DVDs, I discovered that older, softer prints often resulted in lighter summed z-projections. I also question how accurately color was reproduced in transferring older films to home video format, particularly whether or not the color was balanced properly and whether the proper color saturation was achieved (and to that matter, who would be the authority on the "proper" color of an eighty-year-old print and what it means to speak of a film's projected brightness, which comes down to the age and brand of the light bulbs in the projectors which originally screened these films). So we should be careful not to read too much into our results when comparing films to each other, although we can immediately see patterns and outliers of interest.

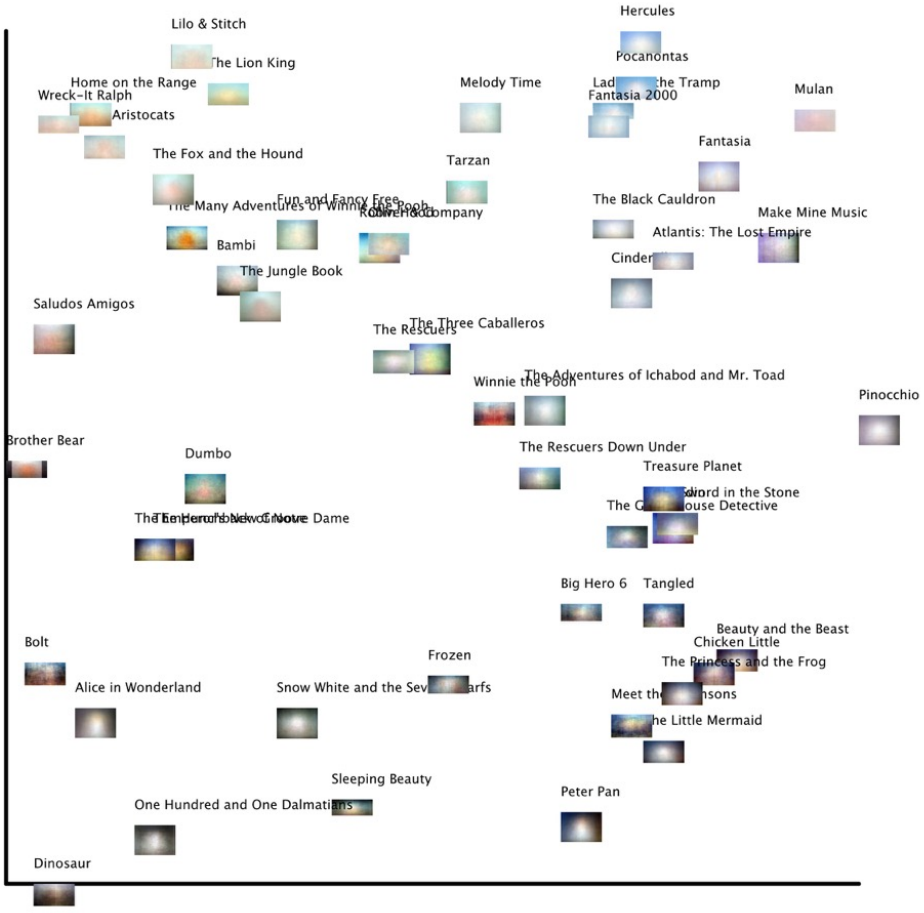

Figure 49. Graph of summed frame z-projections of the Disney corpus, plotted by median hue [x-axis] and median brightness [y-axis]

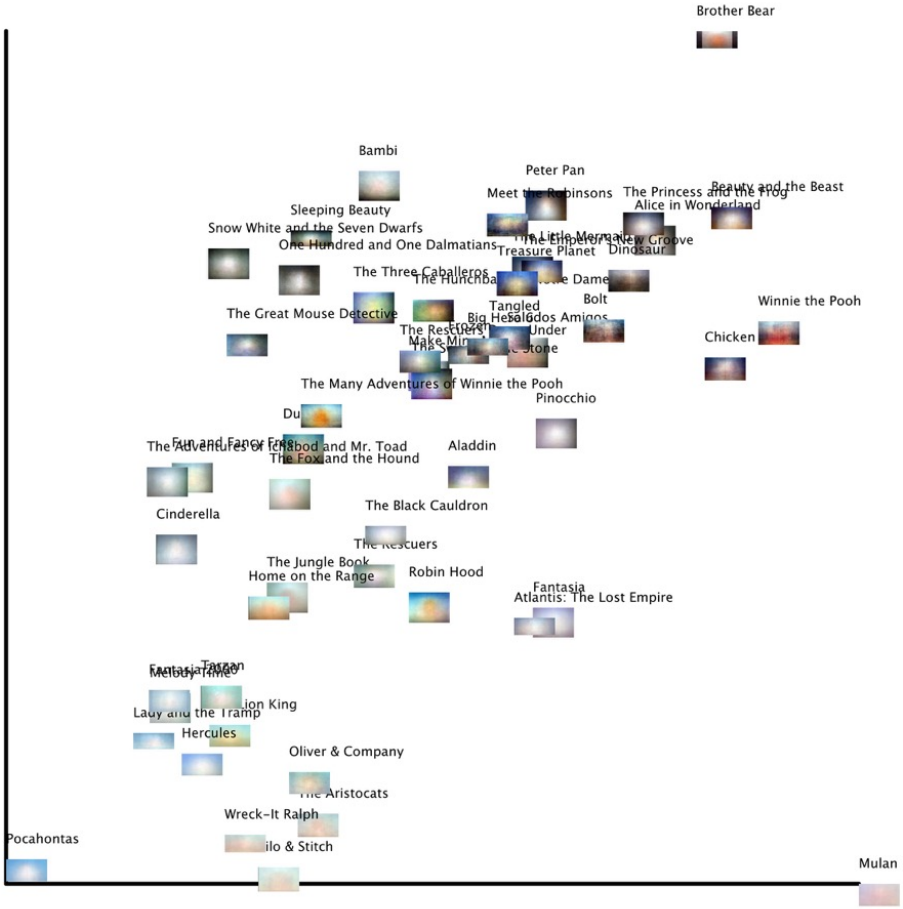

Figure 50. Graph of summed frame z-projections of the Disney corpus, plotted by standard deviation hue [x-axis] and standard deviation brightness [y-axis]

Looking at the first graph of median values allows us to spot some clusters of similarly hued films: the airy blue in the upper right corner that I have discussed, but also the surprising similarity in the upper left between comic western 45 *Home on the Range* and the video game world of 52 *Wreck-It Ralph*, whose long outdoors sequences in desert-like Sugar Rush Kingdom influenced the hue. The majority of the films are clearly within the blue register, in a tall stack ascending from 14 *Peter Pan* to 35 *Hercules*, but there is also quite a bit of variance in hue that covers the spectrum almost completely. 02 *Pinocchio*, whose image looks rather plain and flat, is uniquely the most violet-hued, even more so than the brighter 36 *Mulan* which has clearer areas of purple. Many pairs of films are practically on top of each other, such as 40 *The Emperor's New Groove* and 34 *The Hunchback of Notre Dame*, 21 *Robin Hood* and 27 *Oliver & Company*, and 18 *The Sword in the Stone* and 31 *Aladdin*; remarkably, each of these pairings were separated by at least five other releases, suggesting that while the summed frames can be surprisingly similar this is not necessarily due to the same animators or production methods (for instance, *The Sword in the Stone* and *Aladdin* are nearly identical and yet were made nearly thirty years apart). This visual evidence of hue and brightness would suggest further archival research to examine how consciously Disney animators wanted to distinguish their use of color from other films. 53

Plotting by standard deviation, rather than median values, allows us to quickly see some outliers: 33 *Pocahontas*, *36 Mulan*, and 44 *Brother Bear*. *Brother Bear* shifts aspect ratios from 1.75:1 to 2.35:1, so the first 28.7% of the film has black side pillarboxes which make it deviate predictably in terms of both hue and brightness. Excluding *Brother Bear*, the next film with the most deviation in brightness is 05 *Bambi*, which confirms what I suggested earlier about the strangeness of the dark bottom line versus the lightness of the top of the frame. Curiously, *Pocahontas* and *Mulan*, two of Disney's three films about ethnic women, are both nearly equal in terms of brightness but completely opposite in 54

terms of hue; that is, compared to the other films, *Mulan* displays much more deviation in the hues that make up its summed image, but very little deviation in its brightness (the third, 42 *Lilo and Stitch*, is differently hued but is also one of the least bright films). *Mulan* bears even more deviation than 51 *Winnie the Pooh*; this is difficult for one to tell at first given *Mulan*'s even brightness compared to *Winnie the Pooh*'s varied brightness. But just as we did with the summed z-projections, we can also create graphs of median hue and brightness for each individual film using our folder of slices. Here are three, plotting as I did before median hue on the x-axis and median brightness on the y-axis, illustrating how the brightness and hue of *Mulan*, *Pocahontas*, and *Bambi*'s individual slices do and do not contribute to the overall summed effect.

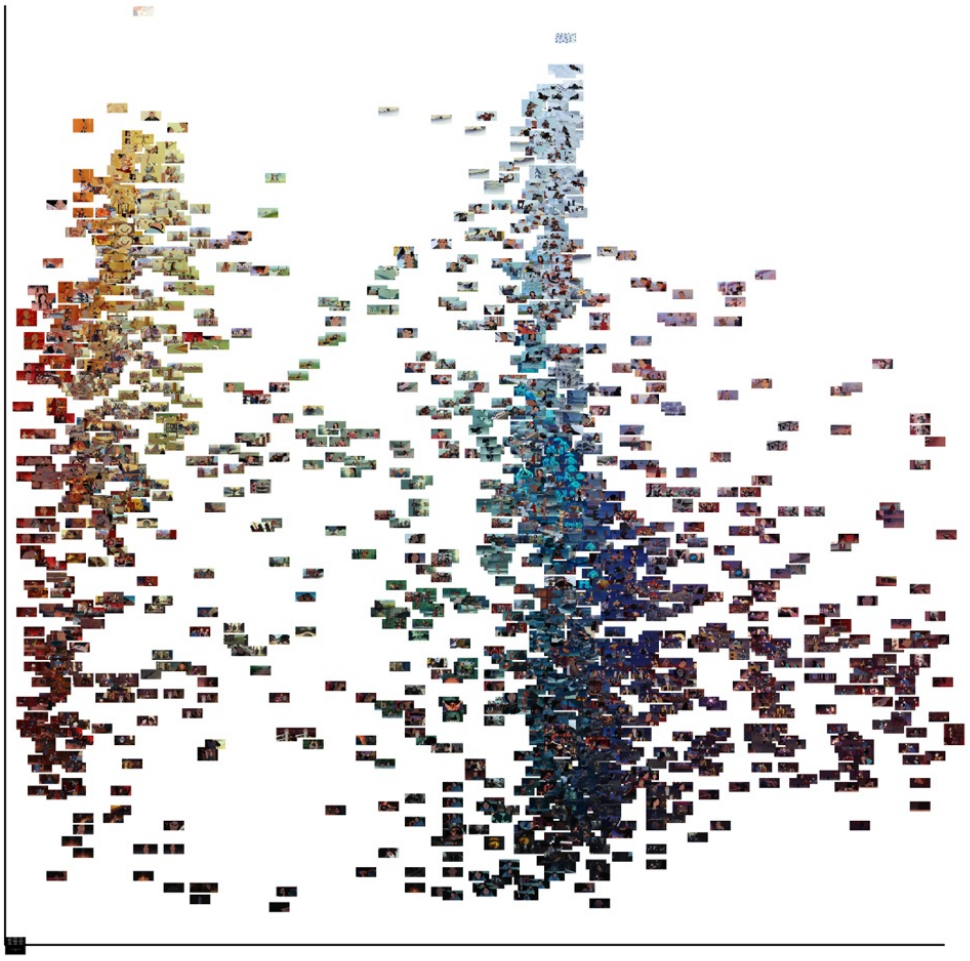

Figure 51. Individual frames of *Mulan* plotted by median hue [x-axis] and median brightness [y-axis]

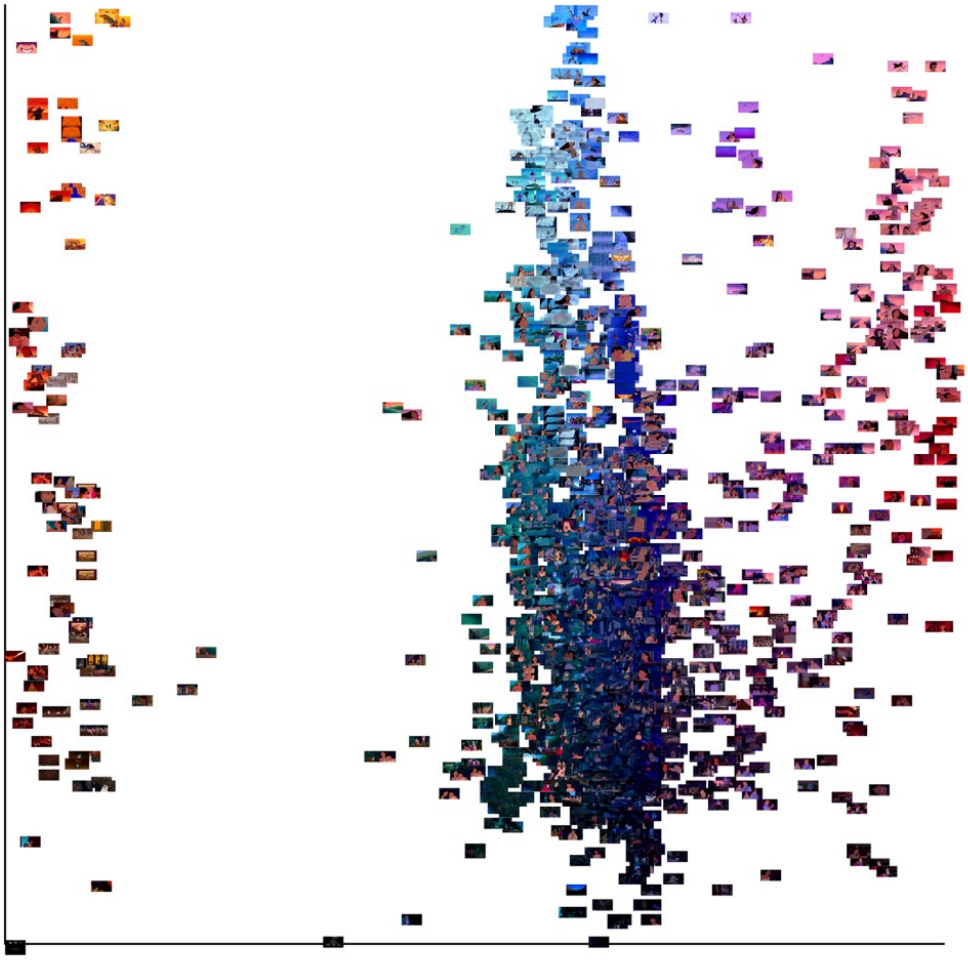

Figure 52. Individual frames of *Pocahontas* plotted by median hue [x-axis] and median brightness [y-axis]

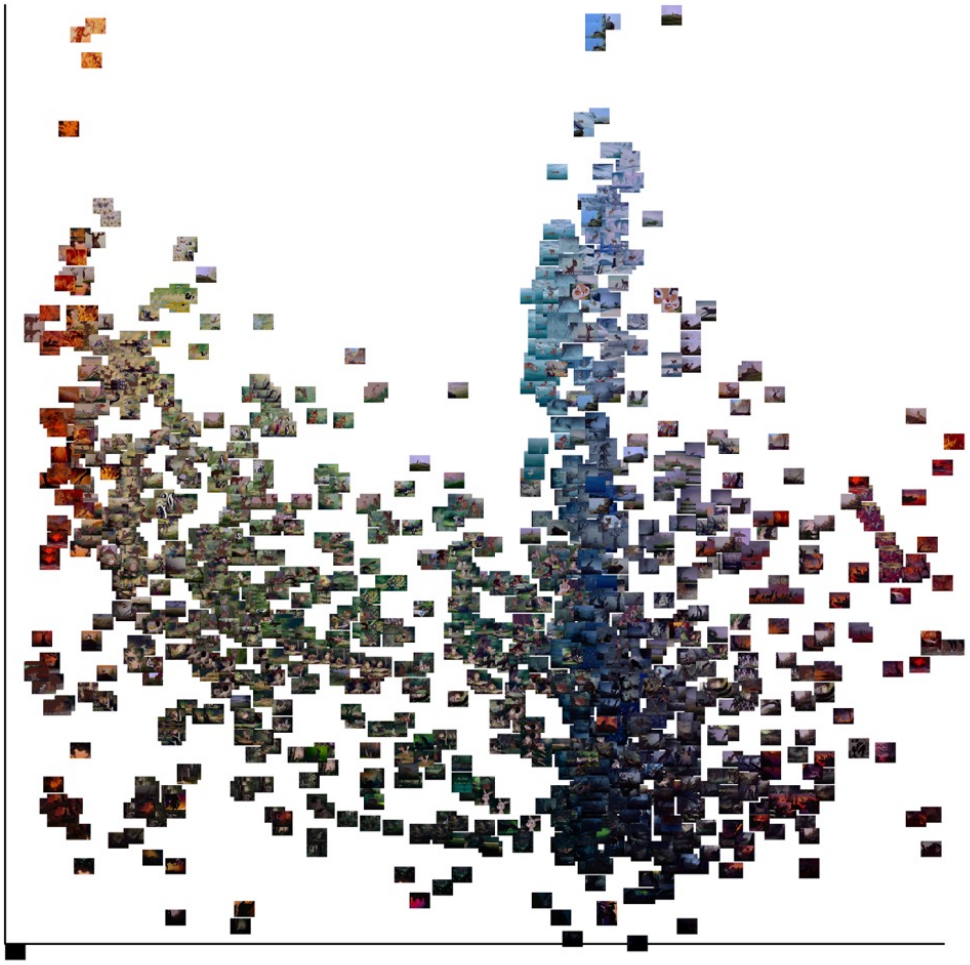

Figure 53. Individual frames of *Bambi* plotted by median hue [x-axis] and median brightness [y-axis]

From these visual thumbprints or "style spaces,"[10] we can quickly confirm our earlier results and see that *Bambi*'s frames are much more frequently distributed at the darker bottom of the graph than the other films, and that *Pocahontas*'s are very much concentrated in one band while *Mulan* has a wider range. While I will not discuss them in depth here, examining such plots for each individual film allows researchers to compare signatures and see how internally consistent the films are: *Mulan*'s summed image makes it look almost entirely violet, but we see that a good percentage of the film is actually red–orange hued. This can be a crucial tool for digital humanities approaches to film and media studies, particularly in terms of quantifying the consistency of a film's visual style or the historical shifts in a production studio's filmic look. Here are two such visualizations of the style signatures of all fifty-five films, first a montage plotting the median hue and brightness for each film, followed by a combined image plotting the median hue and brightness for every slice used in this project. The first montage shows how individual films' varying hue and brightness create a unique signature; the second shows the combined hue and brightness of the entire Disney corpus, offering an unprecedented macro-view of all of their films.

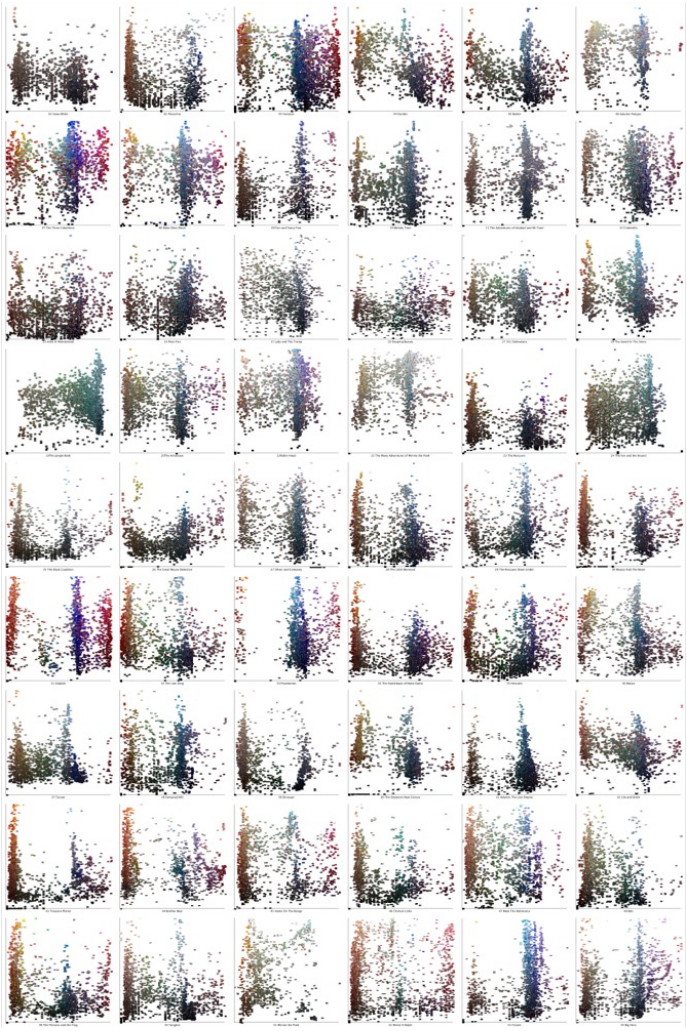

Figure 54. A montage of graphs of individual frames for each Disney film, plotted by median hue [x-axis] and median brightness [y-axis]

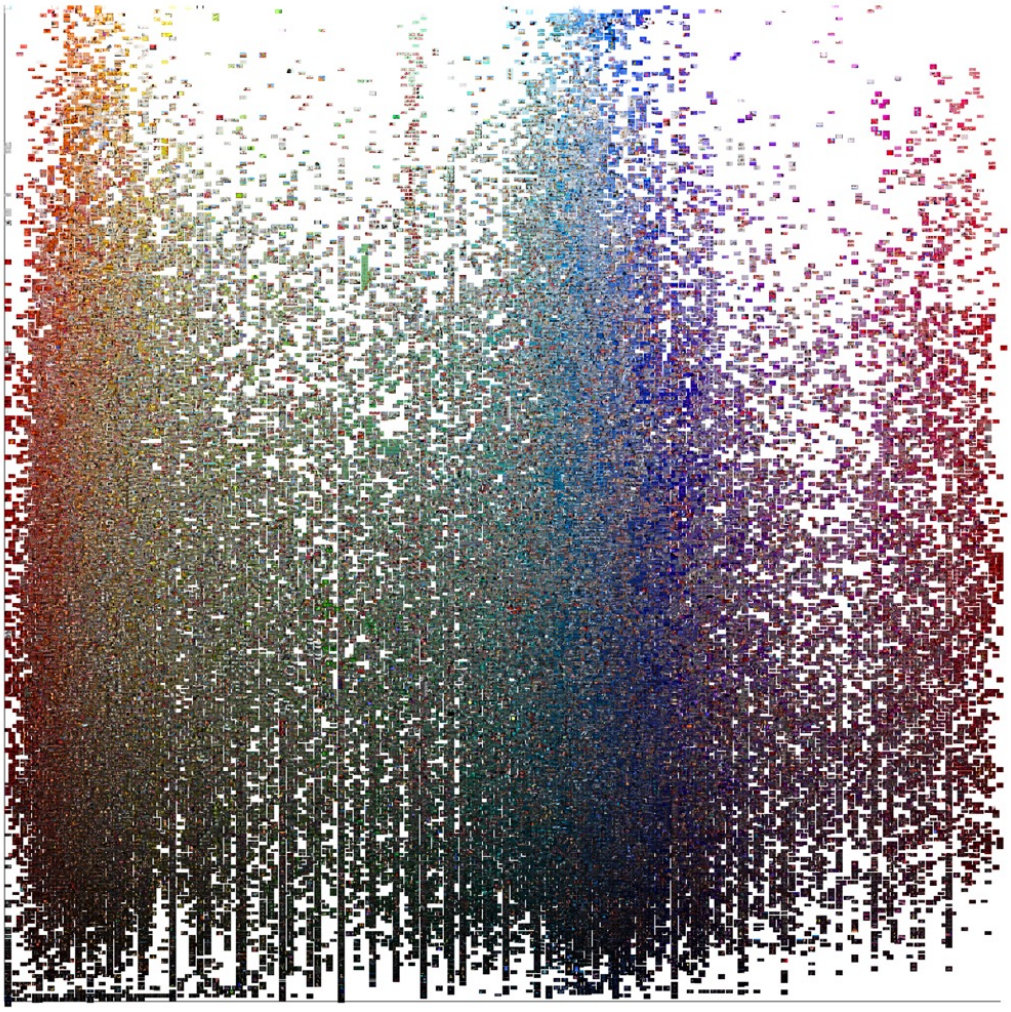

Figure 55. All the frames of Disney films used in this project, plotted by median hue [x-axis] and median brightness [y-axis]

Contexts

I conclude by putting these summed frames into a larger context. As futuristic or speculative as this work might seem, it is in fact very much in line with mid-twentieth-century formalist theories of literature that sought to treat the text not as the inspired culmination of an author's intellectual genius, but as an objective structure open to grounded analysis. In addition to contemporary digital humanists and experimental media artists, I am also inspired by what readers will no doubt recognize as a rather old-fashioned line of thought: "the structuralist activity" described by Roland Barthes in 1963, from which even he had moved on by 1970's *S/Z*. Barthes begins his essay by rejecting categorizations of "structuralism" as a school, movement, or even a set of vocabulary, and instead proposes that we understand structuralism more simply as an activity, a labor experienced by both artists and critics. In this formulation, the structuralist critical activity has as its goal to 56

reconstruct an "object" in such a way as to manifest thereby the rules of functioning (the "functions") of this object. Structure is therefore actually a *simulacrum* of the object, but a directed, *interested* simulacrum, since the imitated object makes something appear which remained invisible or, if one prefers, unintelligible in the natural object [Barthes 1972, 214–215]. 57

To show how an object works is to reconstruct that object, to make a copy of that object that reveals something hidden or illegible in the original. Thus for Barthes, the structuralist activity of imitation requires an emphasis on technique over mere analysis: this activity is real, tangible labor that reconceives art and analysis as a paired activity, rather than seeing 58

criticism as merely the lofty, disinterested contemplation of a work. Likewise, my project does not intend to offer a definitive solution to a digitally-aided analysis of cinema, but rather to provoke inquiry into how meaning is possible and how different meanings arise from different means. These summed frame z-projections quite literally “make something appear which remained . . . unintelligible” before, and the researcher’s task is to discover in what way these simulations of films are “interested” simulacra.

59 Barthes’s proto-digital humanist approach foregrounds specific meaning-making techniques of dissection and articulation over the scrutiny of works thought to be previously endowed with meaning, and thus it offers a direction for critical analysis particularly appropriate for the digital humanities. While they may prefer to avoid something as unfashionable as structuralism or semiotics, digital humanists would do well to reconsider the framework introduced in Barthes’s essay. Indeed, Franco Moretti’s lauded work on “distant reading” is in many ways a rewrite and amplification of Barthes; for example, in *Graphs, Maps, Trees*, Moretti proposes that we adopt a method whereby we “*reduce* the text to a few elements, and *abstract* them from the narrative flow, and construct a new, *artificial* object” [Moretti 2005, 53] (italicized in original). These steps of reduction, abstraction, and artificial construction are identical to Barthes’s dissection, articulation, and fabrication of meaning. Stephen Ramsay’s “screwmeneutics” also invokes Barthes, particularly the well-known distinction between the readerly and the writerly text, which Ramsay connects to two modes of using a library: when a person searches a library for bits of information, she invites texts to be readerly in order to be passively consumed, whereas when a person browses a library, “just screwing around,” she hopes to encounter writerly texts that might offer “an invitation to community, relationship, and play” [Ramsay 2014, 119]. Last, Lisa Samuels and Jerome McGann have made a well-known argument for “deformance” which argues that “*all interpretation is a function of the poem’s systemic intelligibility*” and that we should set aside the idea that humanities work applies an interpretation *to* a text and instead work to discover a text’s system by performing actions on it that render it strange but reveal something organic (italicized in original) [Samuels and McGann 1999, 40].

60 Finally, I connect these examples to an older tradition of surrealist engagement with cinema. Film scholar Robert B. Ray calls Barthes “the most obvious heir to the Surrealist concern” with the fragment and summarizes Barthes’s *modus operandi*: “if the movies’ relentless unrolling prevents your noticing anything except narratively underlined details, the only response is to stop the film” [Ray 2001, 100]. Unspooling a reel on a film editing table, pausing a VCR, stepping frames back and forth on a DVD, converting a movie into a folder of jpegs on a laptop: all of these ways to stop the film’s emphatic focus on narrative allow for renewed pursuit of an abandoned trajectory of surrealist investigation. But whereas the Surrealists and Barthes were limited to working with modernist technologies such as the camera, photograph, or typewriter, the digital humanist can take advantage of more sophisticated computer-aided methods of stopping cinema.

61 Alongside Barthes’s desire to “stop the film,” surrealism offers a way to consider the stopped film’s metaphoric unconscious. That is, I want to move beyond the initial step of using digital tools to pause, enlarge, slow down, or re-edit film texts, and towards a second step of using digital tools to modify the film text in a way that reveals its otherwise unintelligible facets. The surrealists in the 1920s, influenced by Freud’s theory of dreams, privileged the unconscious as a more genuine site of creativity and followed his lead in developing strategies to access this hidden part of the mind, emphasizing in particular “automatic” techniques to shortcut conscious perception and decision-making. Similarly, in my project of digital surrealism, I attempt a computer-based form of automatism, a screwmeneutical, playful, digital surrealist method that extracts what we might metaphorically imagine as a film’s “unconscious” visual field without conscious intervention.

62 I have given examples here of how summed frame z-projections can open up inquiry around composition, framing, lighting, and color, allowing researchers to gain new information about framing choices or emphasis on specific characters or groups of characters, to offer insight into both the lighting style of live-action films and the imitation of real-world lighting in animated films, to easily reveal outlier films in a corpus, to visualize static shots or repeated camera setups, and in general to either pursue new questions from empirical evidence or visually confirm an intuitive hunch. Future work could extend this method to other corpora of national, historical, or genre films, generating new claims and questions about connections between corpora. This method also lends itself easily to television or other moving image texts, as well as other collections of images such as comic book pages, poetry collections, photographs, or newspapers.

By pursuing a novel digital surrealist technique that shortcuts expectations for analysis of the visual image, I hope to encourage broader digital humanist use of the “interested simulacra” as a site for productive research that is both study and invention. While I move back and forth between summed images and the text itself, this is not to reestablish the text’s meaning-endowed authority, but to show the iterative process of making meaning, which requires speculation, experimentation, and art. Barthes further defines the “*interested* simulacrum” that underlines his method: “the simulacrum is intellect added to object, and this addition has an anthropological value, in that it is man himself, his history, his situation, his freedom, and the very resistance which nature offers to his mind” [Barthes 1972, 215]. The anthropological value of summed film frames speaks very clearly to the contemporary challenges of using a digital humanities approach towards film and media studies: this project is in palpable ways a product of my history as a film obsessive, my situation as a developing scholar in a new field, my freedom to acquire and manipulate digital film, and the constant resistance I experience over the value of this project in its ability to contribute to the scholarly field. For the traditional film scholar, the anthropological value of these images poses a (hopefully liberating) threat to older methods of searching for narrative meaning in the cinema. For the digital humanist, these summed film frames show the resistance both of nature and of our technology, forcing us to confront again the possibility that our faith in the computer’s excellence at producing rational evidence is a flatness we must leaven with a touch of surrealist play. To that end, I conclude with a final image that remains, to me, most fruitfully illegible: the sum of all of the summed z-projections, the sum of 135,000 slices of Walt Disney Animation Studios.

Figure 56. Summed frame z-projection of all 135,000 frames of Walt Disney Animation Studios used in this project

Notes

[1] Matthew Jockers defines principal components analysis, or PCA, as “a method of condensing multiple features into ‘principal components,’ components that represent, somewhat closely, but not perfectly, the amount of variance in the data” [Jockers 2013, 67]. For literary analysis, this means that the multi-dimensional variance between a large set of variables (such as word count, noun frequency, number of semicolons, named locations, year of publication, or whatever other variables the researcher has extracted) within a corpus of texts can be plotted in only two dimensions.

[2] For example, Yuri Tsivian and Gunars Civjans's excellent and often-discussed website *Cinemetrics* http://www.cinemetrics.lv offers a digital method for calculating shot lengths; while this software approach is certainly much faster than calculating by hand, it is not specifically something that requires a computer, and thus it fits in a different class of digital projects from those that cannot be done (albeit slowly) by hand.

[3] Walt Disney Animation Studios was formed as Disney Brothers Cartoon Studios before being called Walt Disney Productions and then Walt Disney Feature Animation. It was named Walt Disney Animation Studios in 2006 after Disney bought Pixar Animation Studios.

[4] I demonstrate this further in [Ferguson 2015a].

[5] Users have an option to set the number of frames per second to export; experimentation shows that 24 frames per second is overkill and that acceptable results can be found with settings as low as 0.10 frames per second.

[6] The code for the z-projection is available here: http://imagej.nih.gov/ij/source/ij/plugin/ZProjector.java

[7] Aspect ratios were 1.37:1 from 1937–1953, then two films at 2.55:1, 1.75:1 from 1960–1981, one film at 2.20:1, 1.85:1 from 1986 to 2000, then a variety of ratios between 1.75:1 and 2.39:1 from 2002–present. Further complicating matters, home video releases quite often adopted a different aspect ratio from the theatrical presentations, usually following trends at the time.

[8] Sharp rectangular shapes, such as in 44 *Brother Bear* or 45 *Home on the Range*, are caused by the film's narrative-driven shift of aspect ratio (this edge boxing is also visible in 01 *Snow White*, whose home video release slightly shifts aspect ratios after the opening credits).

[9] Over the last two decades, the length of closing credits has remained about the same, and so the varying percentages are a function of shorter or longer running times.

[10] Lev Manovich [Manovich, 2011] uses the term "style space" to describe a visualization where "visual differences are translated into spatial distances" in order to be more easily compared.

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