ARTICLE

Understanding Peanuts and Schulzian Symmetry: Panel Detection, Caption Detection, and Gag Panels in 17,897 Comic Strips Through Distant Viewing.

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In this article, we applied distant viewing to a corpus of 17,897 comic strips from Charles Schulz's *Peanuts* as a primary case study. Distant viewing uses computational techniques to study large-scale visual media, and draws upon interdisciplinary areas including visual media studies, cultural studies, data science, and semiotics. We focus on comic strips, particularly *Peanuts*, due to their widespread readership, historical and cultural cache, and complexity as a medium built on the interplay between text, image, and meaning. First, we discuss previous work done at the intersections of comics studies and computer vision. Next, we establish the processes for applying computer vision to comic strips. After that, we provide several examples, including: panel detection (variations in panel length over a cartoonist's career); caption detection (identification and location of captions in panels); and comics paratext (computer vision analyses/exclusions of copyright text, signatures, dates, etc.). Combined studies of panel detection, caption detection, and comics paratext reveals new insights into the success, longevity, and influence of one of the world's most famous newspaper comic strips. Ultimately, computer vision reveals a subtle stability and symmetry to Schulz's artistry that played an understudied but significant role in the comic strip's popularity.

Introduction

Comics scholars have long analyzed how the medium's connection between text and image, content and form, lends crucial insights into comics' historical, cultural, and commercial impact.[1] This is particularly prevalent within newspaper comic strips. Comics studies scholar M. Thomas Inge wrote that "along with jazz, the comic strip as we know it perhaps represents America's major indigenous contribution to world culture" largely for aesthetic and formal qualities (xi). Their emergence and success in the United States, and beyond, has made them a major area of study in media studies, and, with the publication of studies like Will Eisner's *Comics and Sequential Art* (1985) and Scott McCloud's *Understanding Comics* (1993), led to the establishment of comic studies as a field. For instance, comics' uniquely powerful propensity for visual representation has led researchers to analyze race, gender, queerness, sexuality, disability, and the body within sequential images comprising the medium and its messages.

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1 For a more complete survey, see: Heer, Jeet, and Kent Worcester, eds. *A Comics Studies Reader*. Univ. Press of Mississippi, 2009; Duncan, Randy, Matthew J. Smith, and Paul Levitz. *The Power Of Comics: History, Form, And Culture*. Bloomsbury Publishing, 2015; Hatfield, Charles, and Bart Beaty, eds. *Comics Studies: A Guidebook*. Rutgers University Press, 2020.

Figure 1. Image of a "typical" newspaper comic strip, taken from Charles Schulz, *Peanuts*, June 06, 1952.

Comics' flourishing has led to different publishing formats over the last century, each with unique characteristics that impact their meaning-making. In this article, we focus on comic strips. We delineate them from various other graphic narratives (comic books, graphic novels, manga, etc.) as well as separate from closer counterparts, chiefly editorial cartoons and *New Yorker*-style cartoons, all with their own rich formal and publishing conventions (Cohen 33–37). As a subset of the broader comics medium, comic strips are characterized by their regular appearance in newspapers or similar publications; continuing characters and stories; long aesthetic history dating back to nineteenth century humor magazines; routine publication frequency of daily strips; and reliance on word balloons, among other aesthetic traits (Gardner 241; Harvey, "Aesthetics" 640).

Formally, comic strips have a relatively uniform structure of panels, text and characters due to newspaper design and circulation. Most daily strips are organized into even panel layouts taking up a 1x3 or 1x4 horizontal grid so they can be rearranged according to each individual newspaper's layout: vertically, horizontally, or even in a 2x2 grid. Key here is that, most often, daily strips are primarily black and white due to printing prices which creates a slightly more streamlined reading experience. Sunday strips, on the other hand, are primarily in color, take up more space, and can feature more complex compositions with more panels than the average four-panel daily strip.[2] The extended length allows cartoonists to create more complicated stories and gags, or simply experiment with what a four-panel gag might look like with additional panels and visual space.

Jared Gardner notes this inherently active medium "invites and even requires the reader to become active agents in meaning making," due to the readerly intervention necessitated by several key formal elements: panels, which guide readers and contain visual/narrative components; textual captions and word balloons filled with dialogue; and the spaces between panels, known as the "gutter" (Gardner 248). In comics, sequential images are cordoned off by successive panels, so bridging the narrative between the images involves acts of

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2 For a more comprehensive overview of Sunday strips, see: Allan Holtz, "The Stripper's Guide Dictionary Part 1: Sunday Strips," *Stripper's Guide*, August 14th, 2007, http://strippersguide.blogspot.com/2007/08/strippers-guide-dictionary-part-1.html

closure—imagining or filling in the gaps, the literal gutters, that separate panels to perceive the whole (McCloud 63). In comics studies, analyzing panels reveals how narrative is created and organized through visually ordered sequences of time and space. For comics theorists Paul Karasik and Mark Newgarden, each comic strip panel offers a wealth of visual, textual, and narrative evidence to dissect because every drawn line, shape, word balloon, and letter matters in a comics panel. Word balloons work in tandem with images, figures, and characters within (or outside) panels. These fundamentals are combined with difficult to parse elements including negative space, implied motion, and time. Studying the combination of panels, images, and word balloons tells us how meaning is made in comics.

A major challenge has been exploring questions such as comic strip's formal evolution at scale. While comics scholars in particular have studied the work of significant cartoonists and individual entries in their long-running comic strips, there is a dearth of scholarship on most comic strips due to their volume, particularly on the formal traits of comic strips. Newspaper comic strips that reach syndication status often run for decades. Changes to a strip's formal qualities over time may go unnoticed day-to-day or year-to-year unless the change is visible and significant.[3] Taken together, studying a comic strip that has run for, say, 25 years with over 300 strips published each year becomes a difficult task due to the large quantity of strips, a trait that marks comic strips as prime objects of study for computational analysis.

The average comic strip consists of between three and four panels, meaning our corpus consists of several hundred thousand panels. The scale offers a challenge for a person or even team to look closely at each strip. Should one look at them all, keeping all the elements in mind can be difficult. Thus, studying each individual strip, even the entirety of one cartoon, would take an inordinate amount of time and effort. Distant viewing applies computer vision to study these strips at scale, all at once, and in connection with one another (Arnold and Tilton 2023).

The scale thus makes these comic strips prime objects of study for distant viewing. Drawing inspiration from distant reading's large scale studies of texts, distant viewing involves "viewing" visual materials at scale by: extracting representational informational metadata from thousands of photographs,[4] television/film frames,[5] even comic strips as the current case study will show;

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3 One notable example can be found in Bill Watterson's *Calvin and Hobbes*, which ran from 1985-1995. Watterson famously made an unprecedented change to *Calvin and Hobbes*' format after returning from a brief hiatus in 1992: rather than following the rote Sunday format of regular squares and rectangles that allowed newspaper editors to reformat the comic according to their individual layouts, Watterson vowed to publish *Calvin and Hobbes* strips in an unbreakable ½ page format that newspaper editors were not allowed to break up in any way. Bill Watterson, "Introduction" *Calvin and Hobbes - Sunday Pages (1985-1995)*, Andrews McMeel Publishing, 2001, pages 13-17.

4 Arnold, Taylor, Lauren Tilton, and Justin Wigard. "Automatic Identification and Classification of Portraits in a Corpus of Historical Photographs." *Proceedings http://ceur-ws. org ISSN* 1613 (2022): 0073.

5 Arnold, Taylor, Lauren Tilton, and Annie Berke. "Visual style in two network era sitcoms." *Journal of Cultural Analytics* 4, no. 2 (2019).

applying algorithms to see and engage with that metadata; and analyzing the results. Put plainly, it uses computational programs to expedite analyses of large collections of visual material and complement close reading by seeing the corpus at once. Previous studies have focused on: gender-based visual style in two network-era sitcoms; image region segmentation combined with structured data to enrich historic photography; and the creation of a Python package for analyzing visual culture. Distant viewing excels at computational studies of large visual media corpora when used in conjunction with extant theories of visual semiotics and germane media studies.

In this article, we use distant viewing to study the formal and aesthetic qualities of one seminal North American comic strip: *Peanuts* (1950-2000) by Charles Schulz.[6] *Peanuts* is inarguably one of the most internationally popular and critically successful newspaper comic strips of all time. A popular mainstay of the American comic strip and international newspapers, *Peanuts* ran from 1950 to 2000, ending on February 13, 2000—the day after Schulz passed away. Schulz's comic first appeared in the aftermath of World War II in just seven newspapers in 1950. When the comic ended in 2000, *Peanuts* regularly appeared in over 2,600 newspapers across 75 countries and in 21 languages, reaching a readership of more than 355 million people. This prolonged nature, historian Blake Scott Ball argues, allowed Schulz to reflect and amplify "a complex range of popular feelings on issues from civil religion, racial integration, and women's rights to fears of capitalism's decline, environmental degradation, and the Vietnam War" (Ball 1). Due to this complex nature, *Peanuts* has been adapted into films, movies, theater productions, games, and more alongside countless merchandising ventures.

Using *Peanuts* as an initial computational study of larger questions in comic studies, we ask several key questions: How do cartoon strip formats change over a cartoonist's career? What do longitudinal changes in comic strip paneling signify? How does the image-text relationship manifest not just in a single comic strip, but in the entirety of a comic strip's print run? These questions often drive studies of newspaper comic strips on smaller scales, but we take them up using computer vision to address these formalistic inquiries at a distant scale. Comic studies and media scholars have long since demonstrated how cartoonists grow and evolve over time, and how their work is connected to cultural movements or historical moments; we use computer vision to find evidence of this growth on a formal level in key facets of comics: panels, word balloons, and the image-text relationship.

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6 Our corpus of *Peanuts* strips was collected from the popular online distributor GoComics.com, itself a subsidiary of the larger publishing syndicate Andrews McMeel Universal. We created a web scraper to collect these comics, pulling the comic strips along with their associated metadata, from publicly available web pages on GoComics.com.

We build on previous non-computational quantitative studies of comic strips, which narrowed their studies in several ways: chronologically, regionally, and by content. Ralph LaRossa et al. studied gender roles in comic strips that appeared on Mother's Day or Father's Day from 1945 to 1990 (693). Others like Deborah Chavez focused on gender inequality in comic strips from specific regional or national newspapers over a 30-day span in 1981 and a second 90-day span in 1981 (93). A content analysis study by Sylvia E. White and Tania Fuentez focuses on racially-coded depictions of Black characters in comic strips that appeared in the Akron, OH *Beacon Journal* from 1915-1995 (72). Our study and its findings break new ground in the field, while also speaking to the challenges of the scale of comic strips—the volume of visual data—published each day in a newspaper.[7]

In recent years, computational approaches to comics studies have emerged with increasing frequency. Such approaches include linguistics and cognitive psychology;[8] comics collections as data;[9] scanlation;[10] eye-tracking;[11] digital image processing;[12] and more.[13] These studies demonstrate the potential for computational work applied to a textual-visual medium that has historically privileged literary close readings, historiographies, cultural studies, and adaptation analyses. We build on this work and turn to computer vision as a method and form of evidence to add to our analytical repertoire in comic studies. Recent advancements in computational approaches to visual media, particularly computer vision, are now positioned to aid analyses of large corpora of visual media like comic strips that have, in some cases, been published continually for several decades.

We begin addressing the questions at the heart of this study and build upon existing research in computational studies of comics by digitally studying the complete 50 years of *Peanuts*. Due to the complex nature of comic strips and their visual-textual elements, we created several custom algorithms for our

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7 Using ten-year intervals as their samples, White and Fuentez note, "eleven weeks were randomly selected from each of the nine years chosen," and of those comics, "non-editorial comics were coded Monday, Wednesday, and Friday of each of the selected weeks," meaning that only a fraction of daily or weekly published comic strips were selected. White and Fuentez, "Analysis of Black Images in Comic Strips, 1915-1995," 77.

8 Cohn, Neil. *The Visual Language of Comics: Introduction to the Structure and Cognition of Sequential Images*. A&C Black, 2013.

9 Topham, Kate, Julian Chambliss, Justin Wigard, and Nicole Huff. "The Marmaduke Problem: A Case Study of Comics as Linked Open (Meta) data." *KULA: Knowledge Creation, Dissemination, and Preservation Studies* 6, no. 3 (2022): 1-8; Chambliss, Julian Carlos, Nicole Huff, Kate Topham, and Justin Wigard. "Days of Future Past: Why Race Matters in Metadata." *Genealogy* 6, no. 2 (2022): 47.

10 Manovich, Lev; Jeremy Douglass, and William Huber. "Understanding Scanlation: How To Read One Million Fan-Translated Manga Pages." *Image & Narrative* 12, no. 1 (2011): 206-228.

11 von Reumont, Frederik, and Alexandra Budke. "Strategies for successful learning with geographical comics: An eye-tracking study with young learners." *Education Sciences* 10.10 (2020): 293.

12 Murel, Jacob. "An Exploration in the Digital Analysis of Comics Images." *INKS: The Journal of the Comics Studies Society* 7, no. 1 (2023): 23-48. doi:10.1353/ink.2023.a898385.

13 See: Dunst, Alexander, Jochen Laubrock, and Janina Wildfeuer, eds. *Empirical Comics Research: Digital, Multimodal, And Cognitive Methods*. Routledge, 2018.; and the special issue of *DHQ: Digital Humanities Quarterly* devoted to "Comics and the Digital Humanities." Whitson, Roger Todd, and Anastasia Salter. "Introduction: Comics and the Digital Humanities." *DHQ: Digital Humanities Quarterly* 9, no. 4 (2015). In particular, Olivier Augereau, Motoi Iwata, and Koichi Kise provide an excellent and comprehensive overview of computational studies of comics images and elements in "An Overview of Comics Research in Computer Science," *2017 14th IAPR International Conference on Document Analysis and Recognition (ICDAR)* (IEEE, 2017), 54–59.

study. We begin by applying a custom-built algorithm to detect and number the individual panels in each daily *Peanuts* cartoon. Then, we use a computer vision algorithm to detect the location of text within the comic. Next, we combine these two annotations to determine the position of the caption in panels. Finally, we compare the appearance and placement of captions within panels alongside comics studies scholarship on the relationship between comic strip panels, word balloons, and narrative conventions. Along with addressing our core questions below, we aim to demonstrate how distant viewing offers a computational humanities method for comic studies.

Peanuts: Critical Context

Peanuts first appeared on October 2nd, 1950, nationally syndicated in just seven newspapers, rising to just over 100 newspapers by the end of its second year ("Timeline: Charles M. Schulz & Peanuts"). In a 1977 interview with reporter Stan Isaacs, Schulz stated that *Peanuts* was, by that point in time, appearing in 1,655 newspapers (1,480 U.S. and 175 international newspapers), demonstrating the comics' growth over 27 years (92). In 1984, Peanuts set a milestone, becoming the first-ever strip to reach circulation in over two thousand newspapers (Charles M. Schulz Museum). Speaking to its universal appeal, Schulz noted in a 1971 interview that "we get a strong group of letters each day from little kids, but we also go right on up through teenagers to grandparents. We get letters from quite a broad spectrum of professions, too—doctors, priests, lawyers, nuns, rabbis, athletes, pilots, servicemen, musicians" (Phelan 65–66). The unprecedented popularity and enduring legacy of *Peanuts* alone mark the comic strip as a prime first case study with distant viewing.

Part of why *Peanuts* has earned such high stature owes to Schulz's mastery and standardization of the form. R.C. Harvey tell us that "Schulz's strip...revolutionized comic strip art: his deceptively simple graphic style set a new fashion for newspaper cartoonists" (Harvey, *Art* 202). Schulz's cartooning aesthetic is economic and clear: clean lines, iconic[14] characters and figures, and clever, effective jokes. This sparse and simplistic-seeming style allowed Schulz to deliver sophisticated gags, satire, political commentary, and visual parody, to be sure. But, scholars have noted the strip's enduring popularity is also due in no small part to *Peanuts'* emotional core (Inge, Gardner and Gordon, Harvey). Schulz gave space in his strip for his cast of kids to discuss grief, sadness, disappointment, and other emotions rarely present in newspaper strips featuring children in the 1950s.

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14 Iconic in the McCloudian sense, meaning, abstract and recognizably cartoonish figures that readily lend themselves to readers identifying with the characters, contrasted aesthetically with realistic figures in comics that might resist such identification (McCloud 46).
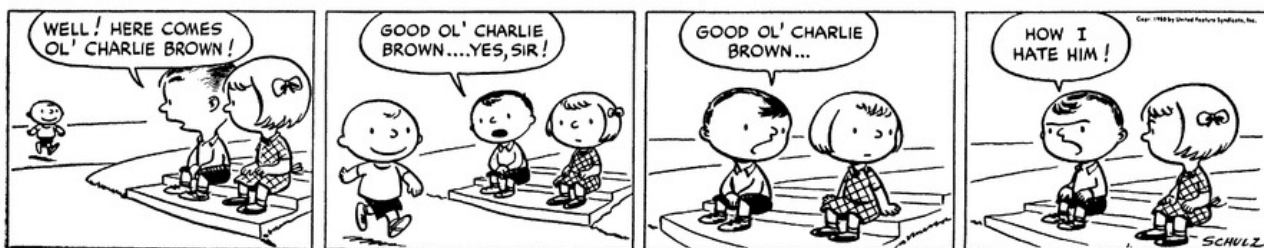
Figure 2. The first *Peanuts* strip, published on October 2nd, 1950. Charles Schulz, *Peanuts*, October 2nd, 1950.

It is thus difficult to overstate the historical and cultural significance of *Peanuts*, even beyond Schulz's countless cartooning awards.[15] Comics scholar M. Thomas Inge states that "arguably without *Peanuts* there might not have been a *Far Side* by Gary Larson, a *Calvin and Hobbes* by Bill Watterson, a *Bloom County* by Berke Breathed, or a *Mutts* by Patrick McDonnell," to name just a few longstanding and historically significant comic strips that *Peanuts* influenced, directly or otherwise (Inge, *Conversations* xi). This can be attributed to Schulz's characteristically clear cartooning, but just as much credit lies with Schulz's cast of characters, long career, storytelling, and merchandising efforts. The comic strips' popularity has generated an ongoing transmedial franchise, earning Schulz over $1 billion in lifetime income.[16]

With 17,897 cartoons in *Peanuts*, we turn to computer vision to parse this high volume of comics. Any single one of these cartoons holds enough comics elements to bear scrutiny for the length of an entire book, as Paul Karasik and Mark Newgarden demonstrate with a strip of Ernie Bushmiller's *Nancy* in *How to Read Nancy: The Elements of Comics in Three Easy Panels*. We focus on three key features within the *Peanuts* strip: panel detection; caption detection; and panel-image-text relationship. With almost 18,000 cartoons, each daily cartoon typically consisting of three or four panels and each Sunday strip holding a variable amount of panels, computer vision provides critical avenues of not only counting these panels across nearly fifty years of comics, but providing visualizations of trends in these cartoons. Likewise, the volume and variety of captions within these cartoons can be equally overwhelming, as most panels contain at least one textual caption. Computer vision can detect these captions within each panel, and compare caption sequences from day-to-day, week-to-week, across decades of comics—streamlining what would be a time-consuming process.

Comics scholar Scott McCloud notes that "words, pictures, and other icons are the vocabulary of the language called comics;" in other words, to study comics for the content involves parsing their vocabulary, the visual formal

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15 These include: the National Cartoonists Society's Humor Comic Strip Award in 1962 for *Peanuts*; the Society's Elzie Segar Award in 1980; the first two-time winner of the NCS Reuben Award for 1955 and 1964; and the NCS's Milton Caniff Lifetime Achievement Award in 1999.

16 When he passed away in 2000, the *Peanuts* empire was said to be bringing in $1.1 billion each year, and reportedly, Schulz himself was earning "about $30 million to $40 million annually" (Boxer n.p.).

elements of panels and captions first (47). This is because comics and comic strips are fragmentary, visualizing moments of a given narrative and sequence in a process that Randy Duncan and Matthew J. Smith term *encapsulation*: "selecting certain moments of prime action from the imagined story and encapsulating, or enclosing, renderings of those moments in a discrete space (a unit of comic book communication that is called a *panel*, irrespective of whether or not there are actual panel borders" (131). In comics more broadly, but comic strips especially due to their uniform publishing formats, panels dictate understandings of space, time, and narrative sequencing. Thus, for comic strips, studying panels provides necessary insights into the kinds of text and images deemed significant enough to be encapsulated.

Finally, computer vision allows for a combination of visual detection algorithms, enabling what comics studies scholar Nick Sousanis terms "allatonce": seeing the entirety of a comic strip at once, including layout, panels, captions, movement, color value, and more (62). Put another way, computer vision allows us to first isolate panels, then captions, and combine those algorithms to examine the panel-image-text relationship at the heart of comics as a visual medium—and to do so by examining all 17,897 *Peanuts* cartoons 'allatonce.' This process of moving from the outside in also mirrors Schulz's own creative process for *Peanuts*. In an interview with journalist Barnaby Conrad in 1967, Schulz reveals that he begins by drawing in panels for each daily and Sunday strip, then inks in the dialogue. According to Conrad, "When he has all six days' strips 'dialogued in,' he begins to draw the figures and the action, preferring to draw directly with the pen with a minimum of penciled guidelines" – so too do we begin our own investigation by zeroing on the panels, moving on to Schulz's inked dialogue, and finally focus on the strips as a whole once they have been 'dialogued in' by computer vision (19).

Peanuts: Panel Detection

Cartoonist Bill Watterson, in his public eulogy for *Peanuts*, wrote that the comic strip "is so thoroughly a part of the popular culture that one loses sight of how different the strip was from anything else 40 and 50 years ago" ("Drawn"). Indeed, its popularity and circulation helped standardize the format of the newspaper strip into a four-panel format. Harvey notes, initially, United Feature Syndicate editors stipulated that:

> [*Peanuts*] should always be drawn in four equal-sized panels, an arrangement that would give editors great flexibility in running the strip. They could run the strip in one column with the four panels stacked vertically, or they could divide the strip in half, the first two panels stacked on top of the other two panels, and run it as a two-column box. (212)

This format became ubiquitous for the newspaper strip, such that other syndicates have continued to use the format for over seventy years. *Peanuts*' sparse, cartoonish, and abstract drawn aesthetic contrasted starkly with

Figure 3. An example of the four-panel format, with each panel being roughly equal size and shape. Charles Schulz, *Peanuts*, February 27, 1988.

bombastic and visually-complex narrative strips from previous decades. This four-panel format is primarily relegated to the dailies, whereas the Sunday strips are often printed in a larger format and with far less formal restrictions than the traditional daily strip. These Sunday strips can take up to half of a newspaper page, though rarely in contemporary times.

Gardner notes that newspaper strips are "inherently elliptical and fragmented": newspaper cartoonists have to tell daily stories in three-to-four panels of focused narrative combined with implied action and narrative occurring in the gutter, the spaces between panels (Gardner 213). As noted above, panels also dictate how comics messages and narratives are received and decoded. Given Schulz's cultural cache, studying his approach to panels on a distant scale provides an opportunity to see where Schulz played with the format, particularly over time. Our investigation is interested in seeing how Schulz plays with, defies, or challenges these initial constraints, especially focused on his panel use given the publisher's early mandates and their crucial formal contribution.

It is this deceivingly simplistic form and steady format that places so much importance on each component in *Peanuts*, prompting our initial study looking at the panel variation over time. Part of this initial study is an attempt to understand whether or how Schulz plays with the initial constraints of the four-panel strip in the daily comics, as well as if there are moments in his career when this format changes. If so, this could indicate subtle shifts in Schulz's cartooning style that may themselves signal that Schulz has earned enough social and economic clout to break away from the United Feature Syndicate formatting stipulations—or, that Schulz stayed true to the format throughout his career.

We build on previous studies of panel detection and comics by reinvigorating critical conversations concerning the formal qualities of comic strips, aesthetic traits that have recently been overshadowed by studies of the graphic novel, graphic memoir, and superhero comics. We do this particularly by combining data science and comics studies to study these strips at scale using Python, RStudio, and custom computer vision algorithms. This compliments work by

Nguyen, Riguad, and Burie[17] who studied previously existing datasets like the eBDtheque, Fahad18, and their own DCM772 dataset that are much smaller in scope than our Distant Viewing: *Peanuts* dataset, which consists of almost 18,000 images. This study also further compliments Xu et al.,[18] who developed a comics genre identification method using panel-page comparisons; our own approach is focused closely on learning how computer vision can reveal new insights into the formal qualities of comics images of the newspaper cartoon variety.

In order to algorithmically identify individual panels in *Peanuts* we developed a custom rules-based algorithm. On manual inspection of several comics, we noticed that every panel we found was enclosed in a black, rectangular, apparently hand-drawn box. These boxes are arranged in a non-overlapping fashion on a white background. Based on this structure, our algorithm for detecting panels proceeds as follows. First, determine all of the pixels in the image that can be reached by starting at a white pixel on an edge of the comic and creating a path of adjacent pixels that are also all white. This set of reachable pixels can be associated with the *background* of the comic. Next, select any non-background pixel. Then, determine the set of all non-background pixels in the image that can be reached by following a path of other adjacent non-background pixels. This set is one of the detected panels of the comic. The process continues by starting with another non-background pixel that is also not in the first detect panel, and continuing until all of the pixels have been accounted for. Finally, we remove very small panels, which are usually extraneous writing on the background, expand the detected panels to be full rectangles, and number the panels according to the standard left-to-right and top-to-bottom reading order. Manual inspection of the results from 135 randomly selected comics showed only a single error in the detection of the panels. In order to detect the "reachable" pixels needed in the different steps of the algorithm, we wrote custom C code that adapts a breadth-first implementation of the well-known *tint fill algorithm* (Smith 1976). The full code implementing this algorithm is included in the article's supplementary materials.

Peanuts' standardized four-panel format thus offers a prime site of investigation for quantitative analysis. For every *Peanuts* strip in our corpus, we ran the algorithm described above to identify the location of each panel. The average panel lengths for the daily and weekly comic strips align with expected outcomes: on average, Schulz used 3.74 panels for comic strips published Monday through Saturday, and a higher average panel length of 9.49 for Sunday strips. While there is slight variation between the panel length in the

17 Nguyen, Nhu-Van, Christophe Rigaud, and Jean-Christophe Burie. 2018. "Digital Comics Image Indexing Based on Deep Learning" *Journal of Imaging* 4, no. 7: 89. https://doi.org/10.3390/jimaging4070089

18 Xu, Chenshu, Xuemiao Xu, Nanxuan Zhao, Weiwei Cai, Huaidong Zhang, Chengze Li, and Xueting Liu. "Panel-Page-Aware Comic Genre Understanding." *IEEE Transactions on Image Processing* (2023).
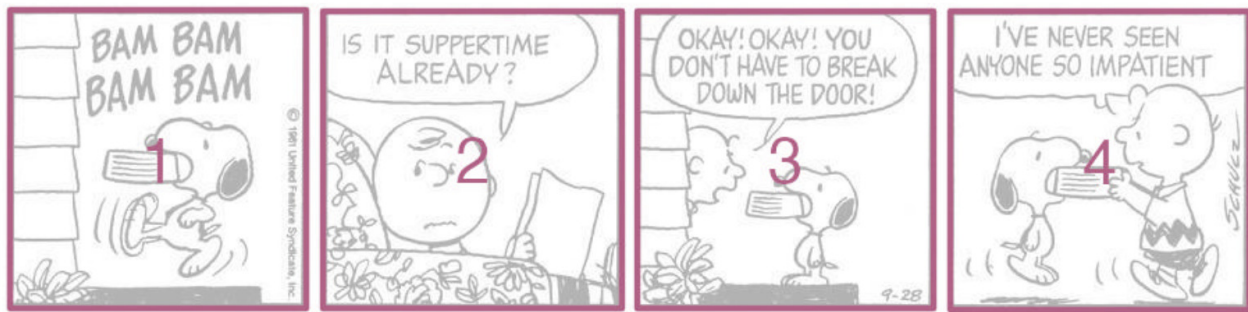
1981-09-28

Figure 4. An example of our panel detection algorithm applied to a sample strip from Peanuts. Our algorithm detects panels and numbers each individual panel from left to right, top to bottom. Original strip: Charles Schulz, *Peanuts*, September 28, 1981.
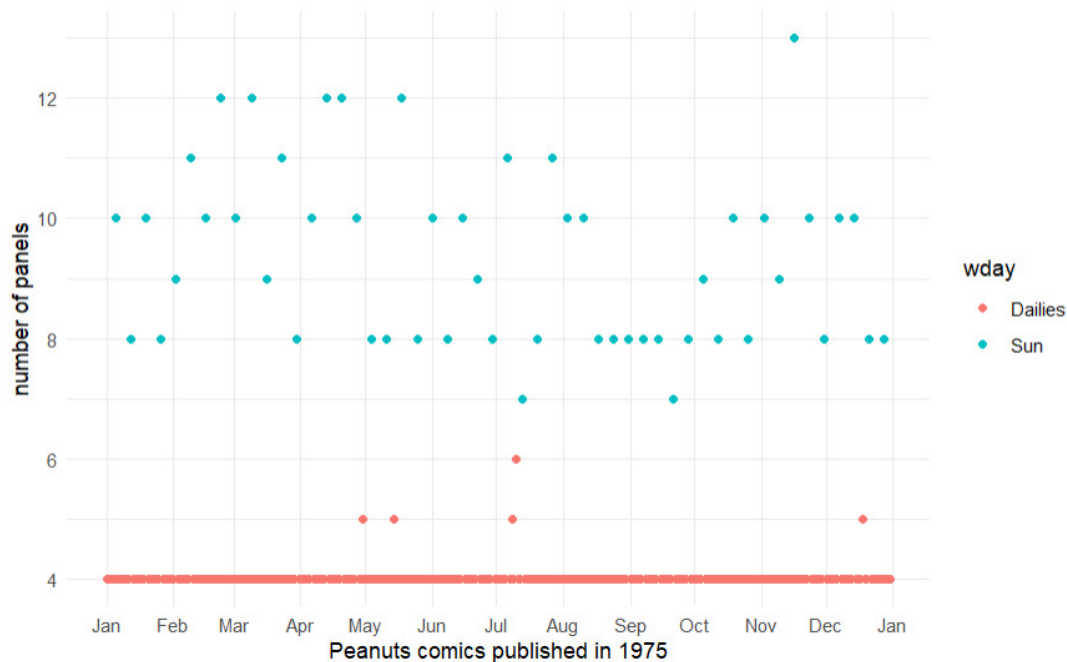

Figure 5. Distant viewing visualization of *Peanuts* comics published in 1975. Note the consistency of the daily panels, the fluctuations in Sunday panel length, and the outlying five strips with more than four panels.

dailies (3.71 on Mondays, 3.78 for Wednesdays), the overall format is consistent across Schulz's cartoon. This consistency is significant when considering Schulz's cartoon ran for almost fifty years, suggesting the initial formulaic nature of *Peanuts* not only stayed during its early period, but later on as well.

Taking a semi-random year as a sample – 1975, the midpoint of *Peanuts* – we can begin seeing the effects of this panel detection play out during the week. Immediately, the formulaic nature of the weekly four-panel strip is apparent, with slight variation in 1975 of five additional days where Schulz deploys a five-panel strip or six-panel strip. A closer examination of these five additional days (4-30; 5-14; 7-08; 7-10; 12-18) reveals that the panel detection algorithm detected panels where they didn't exist; these strips are all comprised of four

Figure 6. Example of a three-panel *Peanuts* strip. This format is particularly prominent after February 29th, 1988 and continues throughout the rest of Schulz's work on the comic strip. Charles Schulz, *Peanuts*, February 29, 1988.
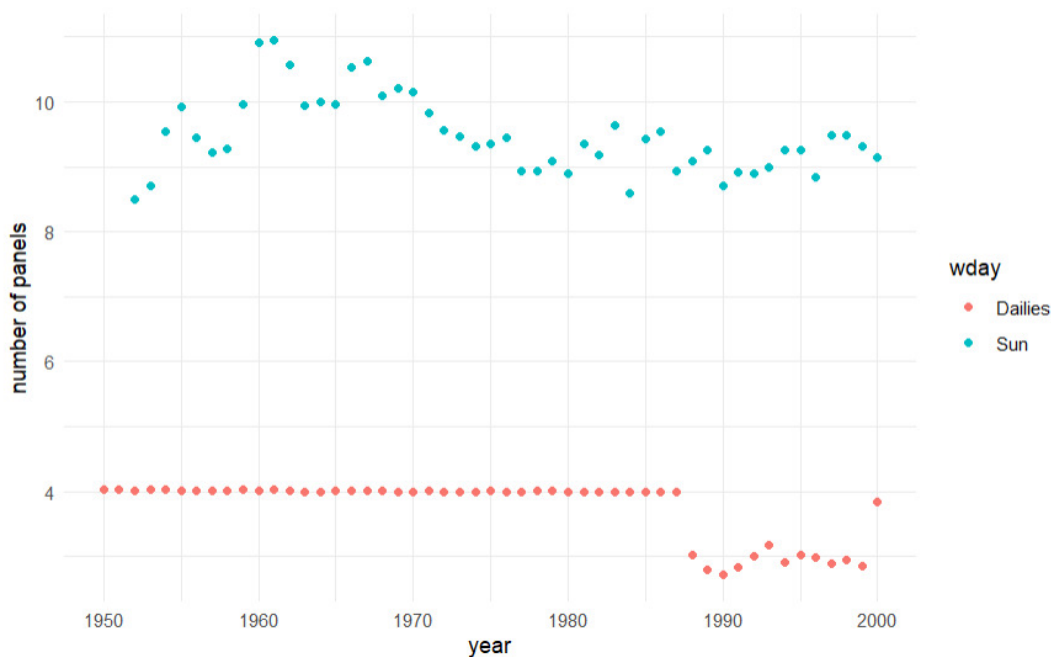

Figure 7. Distant viewing visualization of the average panel length of *Peanuts* strips by year, divided between daily strips and Sunday strips. Note the change in publishing length for daily strips beginning in 1988. The year 2000 is an outlier of incompletion due to Schulz's death on February 12, 2000 and the strip's end on February 13, 2000.

panels, as expected. With the larger space of the Sunday strips, Schulz used no less than seven panels and as many as thirteen panels in 1975. This makes sense given the literal larger format of Sunday strips, which aligns with existing comics studies historians and scholars who note that the Sunday strip's larger size necessarily expands the narrative and visual possibilities of a comic strip.

The consistency of daily strips takes on a deeper significance because fluctuations in the *Peanuts* formula stand out. 1988 is the first year in which Schulz shifts away from the four-panel format for the dailies for extended periods of time, using an average of three panels or less beginning on February 29th, 1988.
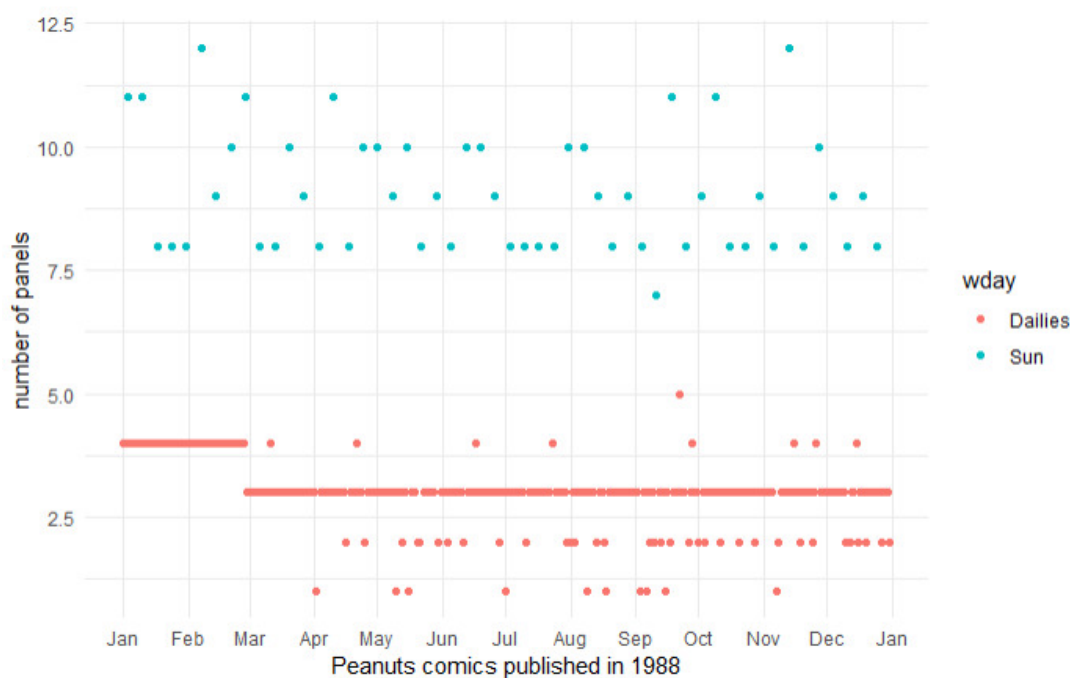
Figure 8. Distant viewing visualization of the panel usage for each day in 1988. The steep change in variance begins on February 29th, 1988 as Schulz shifts further and further away from the four-panel format until his death in February 2000.

On its own, this data might seem an outlier for a variety of reasons: cartoonists often shift formatting as their comic strip ages, whether for personal, editorial, or audience-related reasons. However, the trend continues throughout the strip's lifetime until Schulz's death in February 2000. From March 1988 onward, Schulz returns less frequently to the four-panel format that he popularized through his strip, retaining an average of three panels or less.

In a 1997 interview with comics journalist Gary Groth, Schulz comments on this change in format as a pivotal evolution, where he is finally able to shed the "restrictive" four-panel format foisted upon him by his original editors in the 1950s. While this sheds insight into the practices of a cartoonist creating new entries in the same comic strip for almost fifty years, it also speaks to the editorial and marketing strategies/constraints of the comic strip industry. Schulz's career as a newspaper cartoonist is historic due to his insistence on penciling, inking, lettering, and coloring each strip on his own, not to mention writing new stories and gags for every strip. Rare is the cartoonist who can sustain this individual practice and drive for a decade, let alone for several. Further, Schulz managed to accomplish this while dealing with essential tremor (ET), a neurological disorder causes uncontrollable quivering and shaking that particularly affected Schulz's hands; he was diagnosed with the disorder in 1981.

By March 1988, Schulz had been creating Peanuts daily for 37 and a half years, achieving international, critical, and commercial acclaim in the process. Benjamin Clark, Curator for the Charles M. Schulz Museum and Research Center, speaks to Schulz's longtime resentment of the four equal panels from

Figure 9. A "four-panel" *Peanuts* strip that has been split to be eight equally-sized vertical panels, a clear example of Schulz playing around with the form of *Peanuts* while staying consistent to the original four-panel format. Charles Schulz, *Peanuts*, August 31, 1954.

the beginning of the comic's publication. He states that "arguably, [Schulz] had the clout to make the change long, long, long before" March 1988 (Clark). Schulz maintained creative and artistic control over the comic throughout its entire run, never relying on an assistant for drawings as other newspaper cartoonists often do; in other words, Schulz drew each strip with intentionality and craft, right down to choosing the number of panels. Put simply, Schulz contacted his editor at United Feature Syndicate and "told them he wasn't going to use the strict four-panel dailies any more…nothing to do with his health or any format requirements at the Syndicate." Michelle Ann Abate, in her astute study of Schulz's disability and essential tremor, notes that his ET actually did play at least a partial role in this formal move: "while the cartoonist sought more creative flexibility with this change, this decision was also field by his development of ET…on days when the trembling in his hands was especially acute" Schulz might choose to do a one or two-panel strip over a four-panel strip due to their expediency (19).[19]

Further, Clark tells us that:

> Even pre-1988 dailies with multiple panels and things still conform to this four-panel format. Schulz would play with it. (See below, 8/31/1954) – Although it is in 8 panels, we see it is actually just the four-panel standard in disguise. These anomalies are just Schulz doing what he pleases – it was never asked of him, never part of publishing constraints or anything else outside of his creativity. Unlike many cartoonists, Schulz worked ahead and stayed pretty tight to his schedule for production. So, if it's in the strip, it is deliberate. He's not rushing anything to get in under the deadline.

These consistencies help speak to the universal appeal of *Peanuts*. McCloud notes that comics panels "fracture both time and space, offering a jagged, staccato rhythm of unconnected moments" that are joined together by readers

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19 For more on Schulz's essential tremor and its impact on his cartooning practices, see: Michelle Ann Abate, "Sometimes My Hand Shakes So Much I Have To Hold My Wrist To Draw: Charles M. Schulz and Disability," *Blockheads, Beagles, and Sweet Babboos: New Perspectives on Charles M. Schulz's Peanuts*, University Press of Mississippi, 2023: 14-32.

mentally connecting panels together by the gutter in between panels (67). Part of what McCloud is getting at here is the infinite expression of comics, that a single comics page, or strip even, can have any number of panels and that readers make meaning by connecting the gutter. Previous scholarship on *Peanuts* has noted that readers identify with particular characters or narrative-gag sequences, finding a solace in the strip's steadfast design. But, these findings on *Peanuts'* panel regularities suggest an invisible security to the strip, that the panel uniformity across the strip's lifetime acts as an unseen character and unsung strength to Peanuts.

Through computer vision, *Peanuts'* four-panel format is anything but jagged, staccato, unconnected; it is rhythmic and dependable, both for comics readers and for newspaper editors placing the comic into their page layouts. This aligns with existing scholarship from Harvey, Inge, Gardner, Gordon, Ball, and others that highlighted such characteristics via close reading and qualitative sample studies; computer vision cements this stability by seeing this uniformity across the entirety of the comic strip's fifty-year run. Longtime readers opening the funny pages to find *Peanuts* would not only be able to recognize *Peanuts* by its characters or Schulz's trademark inks, but by its predictable and steady panels. *Peanuts'* stability and uniformity in panels also confirms that our digital methodologies can successfully detect these panels through automated processing and detection, rather than manual annotation. In this, we might also suggest that Schulz's shift away from the four-panel format in 1988 represents a formal manifestation of his essential tremor. As Abate notes, "the aesthetic articulation of comics panels cannot be separated from the physical articulation of the cartoonist's body, be it that of Charles M. Schulz or any other artist" (31). So too do we find that distant viewing allows us to see Schulz's experimentation play out quantitatively, formally: whether that experimentation is due to Schulz's ET—thereby allowing for a visibility of Schulz's invisible disability as evidenced quantitatively in the drop of the four-panel format—or readiness to branch beyond the four-panel format he established is nigh impossible to say. However, with such panel detection established, we move inward to content within the panels themselves: in this instance, captions.

Peanuts: Caption Detection

Textual captions are crucial to the nature of comics, particularly newspaper cartoons. Charles Forceville, Tony Veale, and Kurt Feyearts state that "the tailed balloon is one of the most defining visual conventions of the comics medium," even though they also note that "the presence of balloons is not a defining element of comics" as there are silent comics, comics with text outside of balloons (i.e. in narration boxes), word balloons outside of sequential images, etc. (56). Harvey draws a firmer line in the sand: "'comics'—the thing that distinguishes it from other kinds of pictorial narratives—is the incorporation of verbal content" (Harvey, "How Comics" 25). Schulz's dialogue (writ large) is critical to *Peanuts'* success, giving voice to Charlie

Brown's anguish over yet another missed football kick, Lucy's sharp advice, and Snoopy's various activities as writer/pilot/adventurer. Karasik and Newgarden note that "*Peanuts*' singular dialogue was key to its enormous success," corroborated by countless appreciations by comics scholars, journalists, fans, and even by fellow cartoonists (166). In a way, this makes sense given Schulz's own perfectionism with the careful selection of his word placement and dialogue, stating in a 1956 interview with Hugh Morrow that he does not yield to editorial oversights on the words, though occasionally on matters of punctuation (9). Even if Schulz compromised more on dialogue than he revealed in various interviews, its position as second in sequence behind the panels marks it as a prime candidate for continued computer vision analysis.

McCloud notes that "when words [in comics] are bolder, more direct, they require lower levels of perception and are received faster, more like pictures," and we find this to be a crucial impetus to further understanding *Peanuts* (49). Within comics and newspaper strips, Karasik and Newgarden find that "in the design of comics, situating the text is primary" meaning that for most cartoonists, textual placement comes first in the design process of a comic (81). Schulz too began his cartooning process by first drawing the panels for a given strip, then penciling in the dialogue balloons and letters before finally drawing in the figures, action, and so on (Morrow 19). This emphasizes not just Schulz's dialogue and writing, which has been discussed and lauded at length, but the specific placement and even presence of dialogue within *Peanuts*. One of the defining traits of *Peanuts* is its positioning of dialogue as always being above the characters and in a generally level orientation.

To detect which panels in each *Peanuts* strip contain text, we return again to an automated algorithm applied to the digitized images of the comics. Unlike our approach to panel detecting, here we can start with an existing computer vision algorithm. After experimenting with several options, we decided to apply the scene text algorithms of Baek et al. (2019) as implemented in the *EasyOCR* Python module (Kittinaradorn 2022). The algorithm provides locations in the form of bounding boxes for all detected text in an image. We applied this algorithm to each image and then indicated which panels in each cartoon had some text located within it. Schulz commonly signed each *Peanuts* comic at the bottom of the last panel; this was detected about half of the time by our algorithm as text. To remove the signature from our counts, which does not function as a caption, we automatically removed all text in the bottom third of the last panel.[20] After applying the algorithm to the entire corpus, we randomly selected 100 comics to manually validate our technique. We found that out of the 434 panels, there were only two false detections of the 40 panels without captions and only four of the 394 panels without captions were falsely

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20 Karasik and Newgarden note that "this information usually skulks along a strip's bottom, positioned into the originals, as unobtrusively as possible. Unattractive, nearly indecipherable, and seemingly irrelevant to the proceedings, these persistent little marks cannot be entirely ignored and constitute narrative elements in their own right." *How to Read Nancy*, 150.

Figure 10. Distant viewing's caption detection algorithm at work. Note here that the caption detection finds the title, the author's name, and the captions, but not the paratext of the author's signature in the bottom right-hand panel. From Charles Schulz, *Peanuts*, June 23, 1991.

detected. Most of the errors came from the hard to detect nature of some lettering, such as the letters and words for stylized exclamations and sound effects ("BANG!" "ziiiing!" "Thump.").

As noted above, Schulz typically places his signature in the bottom third of the panel. Other pieces of writing that fall within these bounds include hand-lettered dates or paratextual copyright information. Fine-tuning the combination of panel detection with caption detection, then, effectively leads to only finding the dialogue and speech of *Peanuts* characters. While it might be useful in another instance to identify and include the signature of Schulz or other cartoonists—particularly those with multiple creators, or when the signatures contribute something significant visually—ignoring them leads to a greater confidence in caption detection.

With this algorithm, we are able to not just identify the captions, which could be achieved using any number of traditional OCR identification methods, but locate their positions within the panels themselves. Doing so can reveal how often Schulz deploys textual captions within *Peanuts*, and in which panels. This can be seen clearly in the daily comic strips, which are primarily three and four-panel strips. Concentrating on the four-panel strips as shown in Figure 12, we see a few trends emerge immediately.

The first is that Schulz used textual captions in the first panel of a four-panel strip—the majority of his daily strips—98% of the time. There are slight drop-offs in panels two and three, with a steep rise in textual captions appearing in the final panels 96% of the time for four-panel strips. As noted earlier,

Schulz also relied heavily on three-panel strips in his later daily comics. Textual captions are present in the first panel of 97% of his three-panel strips, just over [80%] of the second panels, and 98% of the panels in the three-panel strips. Schulz's use of textual dialogue signifies a strong balance between text and image across his daily strips, which comprise the bulk of *Peanuts* writ large.

Zooming out slightly to examine textual caption distribution in strips ranging from one to twelve panels total, an interesting trend emerges with respect to that first panel. Schulz utilizes textual captions, on average, in at least 93% of all first panels, regardless of number of total panels. In some formats, Schulz utilizes textual captions in 100% of the first panels: strips with rare singular panels, eight panels, and eleven panels. The data across these strips suggests a strong reliance on textual captions paired with images of Charlie Brown, Snoopy, and the entire *Peanuts* gang. In many ways, this aligns with typical newspaper publishing practices and general conventions of the comic strip as a medium: comics are sequential narratives borne of the juxtaposition between image and text. We would expect to find the presence of captions within most *Peanuts* strips, so detecting them with our algorithm on a distant scale confirms that the algorithm functions properly and allows us to dissect captions' presence and absence as data.

For instance, when the standard reading order of American newspaper cartoons is considered (top to bottom, left to right), rare is the instance of readers encountering a *Peanuts* strip that begins without text to guide the readerly experience in the first panel. Returning to McCloud's note about direct dialogue leading to streamlined reading perceptions of comics, we posit that the direct and almost concretized placement of Schulz's dialogue further contributes to such reading perceptions. In other words, it's not just that *Peanuts* strips begin with the title most often in the top-left corner of the first panel: readers also have dialogue from their favorite characters to help establish the story, the set-up to the strip of the day.

Karasik and Newgarden state that "in a well-conceived comic strip, the strategic placement of word balloons generally takes graphic precedent," meaning improper or ineffective caption placement disrupts the delicate image-text relationship balance at the heart of comic strips (80). Whereas many other comic strips played with convention, form, and design—ranging from the wild layouts of *Little Nemo in Slumberland* to *Nancy* strips that use repackaged gags in different formats—Schulz offered a dependability to the form and layout of *Peanuts* beyond the four-panel format, in the caption placement itself. Fellow cartoonist and Reuben Award winner Bill Watterson noted that:

> *Peanuts* pretty much defines the modern comic strip, so even now it's hard to see it with fresh eyes. The clean, minimalist drawings, the sarcastic humor, the unflinching emotional honesty, the inner thoughts of a household pet, the serious

treatment of children, the wild fantasies, the merchandising on an enormous scale – in countless ways, Schulz blazed the wide trail that most every cartoonist since has tried to follow. (n.p.)

While most comics scholarship surrounding *Peanuts'* form focuses on the sparse lines, economical and unique characters, our findings suggest that one of the "countless ways" that Schulz's *Peanuts* defines the modern comic strip is through the often invisible nature of caption placement.

This reveals new insights into *Peanuts'* engagement with global audiences, and new insights into legacy aspects of *Peanuts'* form. Again, as with our findings on the four-panel format in the previous section, here we do not suggest that Schulz was the first to find a symmetrical balance to the cartoon form in placing captions at the very top of his panels strip after strip,[21] nor that his reliance on them for that balance is unique amidst cartoonists before or after him. What these findings do suggest is a longstanding attention to the formal qualities of a cartoonist working steadily for fifty years, that some amount of *Peanuts'* longstanding critical acclaim is owed in some small part to Schulz's consistency and dedication to precise lettering and caption placement: a Schulzian Symmetry. Visual media scholar Gene Kannenberg Jr. argues that the formal elements of *Peanuts* are so iconic, readers familiar with the strip acquire a kind of *Peanuts* grammar: recognizing not just character imitations and narrative situations borrowed from *Peanuts*, but visual motifs used elsewhere (97). We suggest that some of these visual motifs are not just Schulz's trademark hand lettering, but a nearly-symmetrical caption placement.

On its own, caption placement in Schulz's work may not seem groundbreaking; our findings align with much of the existing *Peanuts* scholarship. But, these findings also firmly rationalize computer vision's necessary intervention in comics studies and visual media more broadly: distant viewing provides new avenues of inquiry through the capacity for investigating cartoon strips at scale in their entirety. We can learn more about the elusive and often-overlooked formal qualities that lead to commercial and critical success for certain comic strips like *Peanuts* by studying formal elements often ignored due to their ubiquitous nature—like panel layouts and caption placement. We can now be more precise in critical conversations about comic strips by saying Schulz's style helped inform the genre, noting a visual and aesthetic balance between text and image, paneling and caption placement, what we call a Schulzian Symmetry. We demonstrate this potential through a combination of panel and caption detection in the following case study on *Peanuts*.

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21 See R.C. Harvey's *The Art of the Funnies* for a comprehensive overview of the comic strip's evolution.

Figure 11. A typical Sunday strip from *Peanuts*. See here the expanded size, increased number of panels, shift in visual form, and more complex narrative. Charles Schulz, *Peanuts*, April 20, 1975.

Peanuts: **Panel + Caption Detection = Gag Panel Study**

The connection between text, image, and meaning is key to reading, seeing, and understanding comics. According to Forceville et al., balloonic information (textual and pictorial information in comics balloons) conveys its full meaning only in conjunction with images, visuals, and panels (56). For McCloud, comics' defining feature is the sequencing of pictorial images (which include textual dialogue, lettering, and balloons), and that while sequentiality is key, it cannot be achieved without panels, images, and text aligned deliberately in a specific order. Harvey similarly notes that comics' quintessential quality is their blending of the three: "in the best examples of the art form, words and pictures blend to achieve a meaning that neither conveys alone without the other" (25). In other words, to understand comics requires a firm focus on how the interplay between pictures and words generate meaning—and for newspaper cartoons like *Peanuts*, that means especially studying their unique formal traits, such as how gags are achieved.

Comics scholars Paul Karasik and Mark Newgarden offer a succinct definition of a gag as it relates to strips: "Gags, like jokes of all kinds, are formal, hermetic constructs whose success depends upon (as much as any perceived funniness) the deft arrangement of innumerable interconnection systems by a discerning engineer"—in essence, jokes at the end of a strip wholly dependent on every other element preceding it within the comic. In their seminal study deconstructing a singular *Nancy* strip across an entire book, Newgarden and Karasik note that visual elements including lines, dots, implied action, panels, and even negative space all combine with textual components and paratextual or invisible aspects of comics in unity or discordance. Within comic strips

particularly, these elements work towards landing the gag, what is often seen as the point of many strips' essential function: the funny at the heart of "the Funnies." The gag at the end of a newspaper strip thus provides a pivotal role in the reading experience, bringing narrative closure and humor at once. As highlighted earlier, Schulz is a lauded master of the gag, whether through what he termed the "slight incident" (character-driven ordinary, mundane events contrasted with more classic "situational" humor of previous gag comics); through the dichotomy of child characters espousing views, dreams, and woes that closely echo the adult world; or through kids being kids, dogs being fighter pilots, and kites landing in trees.

Of note here is that computer vision reveals an interesting trend in how Schulz ended *Peanuts* comic strips—both daily and Sundays. Overall, Schulz utilized dialogue or captions in the final panel for over 80% of his comic strips, and 92.5% on average across the entire run. Harvey, Karasik and Newgarden, and Duncan and Smith note the significant formal role that final panels play within comic strips: punchlines for gag strips; resolving the narrative arc for the day's strip; or for adventure/episodic strips, setting up the next scene or storyline. These findings indicate that Schulz utilized captions to achieve the gags in the majority of his strip, relying on purely visual gags less as time goes on. The data here does not suggest that Schulz relied purely on text for final panel gags in *Peanuts*; rather, Schulz deployed a firm balance between text and image to achieve said gags, one that only grew more prevalent over time. Again, taken together, these trends provide a deep insight into the formal elements of a long-running newspaper comic strip.

The Schulzian Symmetry noted above—Schulz's aesthetic balance between caption placement and image in each panel—plays out narratively, too, with ramifications beyond the strip in isolation. The larger implication, then, is that Schulz and *Peanuts* may contribute more than just the standardization of the four-panel strip as has been highlighted by scholars and historians alike; these findings imply a Schulzian codification of textual-visual gags through a clearly identifiable symmetry between text and image especially prominent in the first and final panels of a given *Peanuts* strip.

Schulz himself acknowledges the formulaic nature of *Peanuts* stories and gags, stating that throughout his craft and his relationship to his audience, he determined twelve formulaic events that contributed to the overall popularity of the strip:

1. the kite-eating tree that frustrates Charlie Brown's every attempt to fly a kite

2. Schroeder's music, the elaborate visual of a stanza of classical music, and Beethoven

3. Lucy's psychiatry booth from which the fussbudget delivers her pragmatic and unsympathetic verdicts
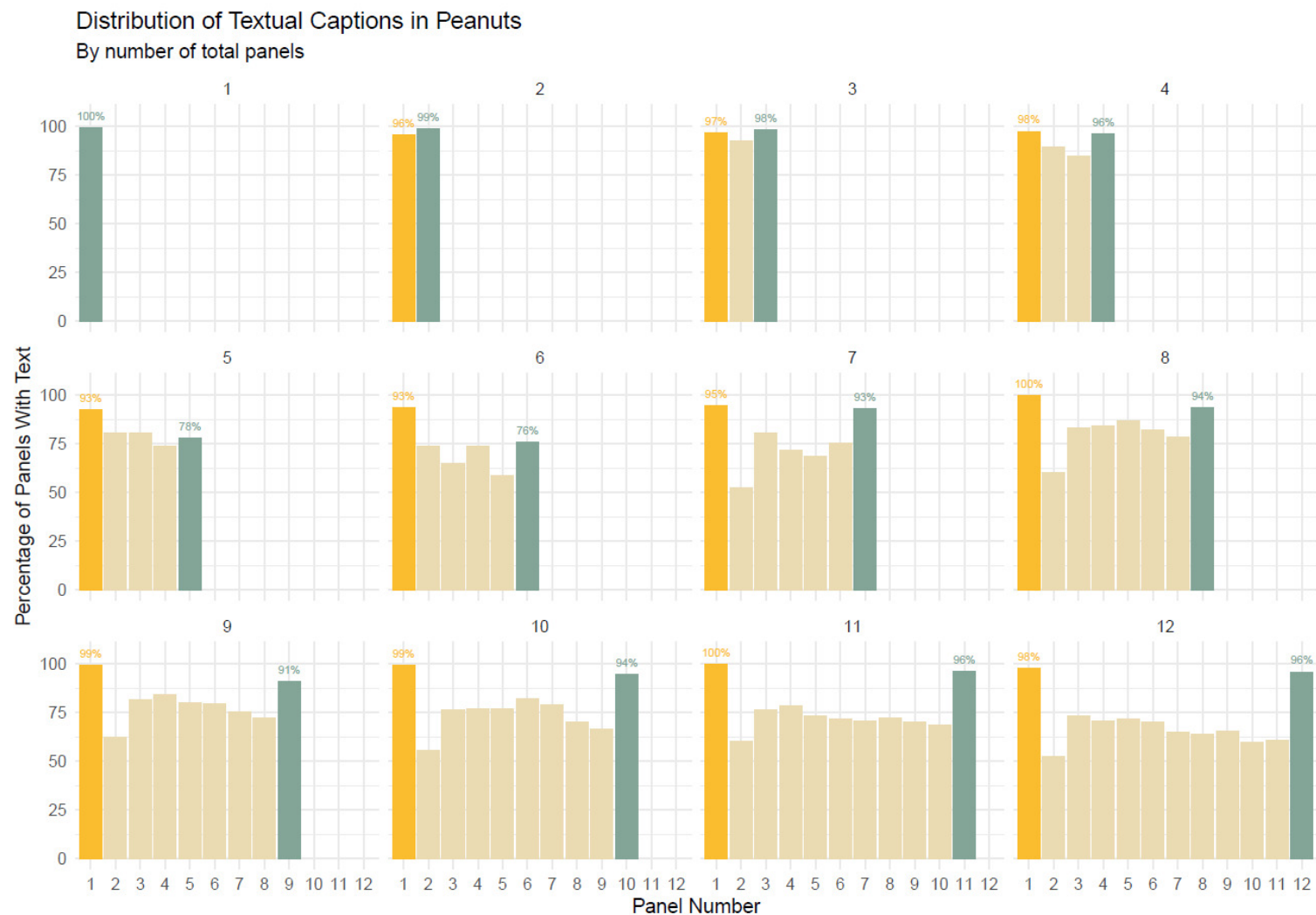
Figure 12. Distribution percentage of textual captions in *Peanuts* by number of total panels for those ranging between one-panel strips and twelve-panel strips, which were the most common formats in *Peanuts*. Of significance is the high rate of caption presence in the first and last panels of any *Peanuts* strip, regardless of panel number size. Likewise, note the above average percentage for caption presence in any panel.

4. Snoopy's doghouse, the vehicle for the beagle's overactive imagination

5. Snoopy himself, another example of a second banana taking over a strip

6. the bird Woodstock, Snoopy's sidekick

7. the Red Baron, symbolizing Snoopy's emergence into stardom

8. the baseball games that Charlie Brown always loses

9. kicking a football, an annual exercise in which Lucy tricks Charlie Brown into trying to kick the football she holds then yanks it away at the last moment, landing the hapless Charlie Brown flat on his back

10. the Great Pumpkin, Linus's yearly search for the confirmation of his spiritual sincerity

11. the little red-haired girl with whom Charlie Brown is hopelessly in love

12. and, Linus's blanket

Just as caption detection uncovers trends in the first panels of strips, so too can it be applied to all panels of *Peanuts* strips. Of note is that, on average, Schulz deployed captions in his final panels 92.5% of the comic's lifetime. Combined with findings concerning first panels, we find that Schulz relied heavily on opening and closing *Peanuts* cartoons with panels featuring captions. *Peanuts* was not just consistently formulaic in its content and visual gags, but its formal elements as well. The final panel in a comic strip serves a significant narrative and humorous function, extending comics into the following days or ending the given cartoon on a humorous gag, often both at once. Schulz's consistency in ending these strips with textual captions combined with visuals suggests a strong correlation in balancing the two to achieve narrative or humorous closure.

Digging deeper into the findings shown in [Figure 13](#), a few notable trends emerge when viewed on a distant scale. For the first five years of *Peanuts* (1950-1955), Schulz used captions in his final panels around 85% of the time. For the rest of the comic strip's run (1956-2000), that number increased dramatically. *Peanuts* featured final panel captions for over 93% of its comics on average from 1956-2000, with only three years dipping below 90% during this time period (1957: 89.8%; 1959: 87.9%; 1975: 87.4%). Similar to the shifting trend of panel conformity in *Peanuts*' later years, this discrepancy in *Peanuts*' final captions for the first five years raises interesting questions about the comic strip's production during this time.
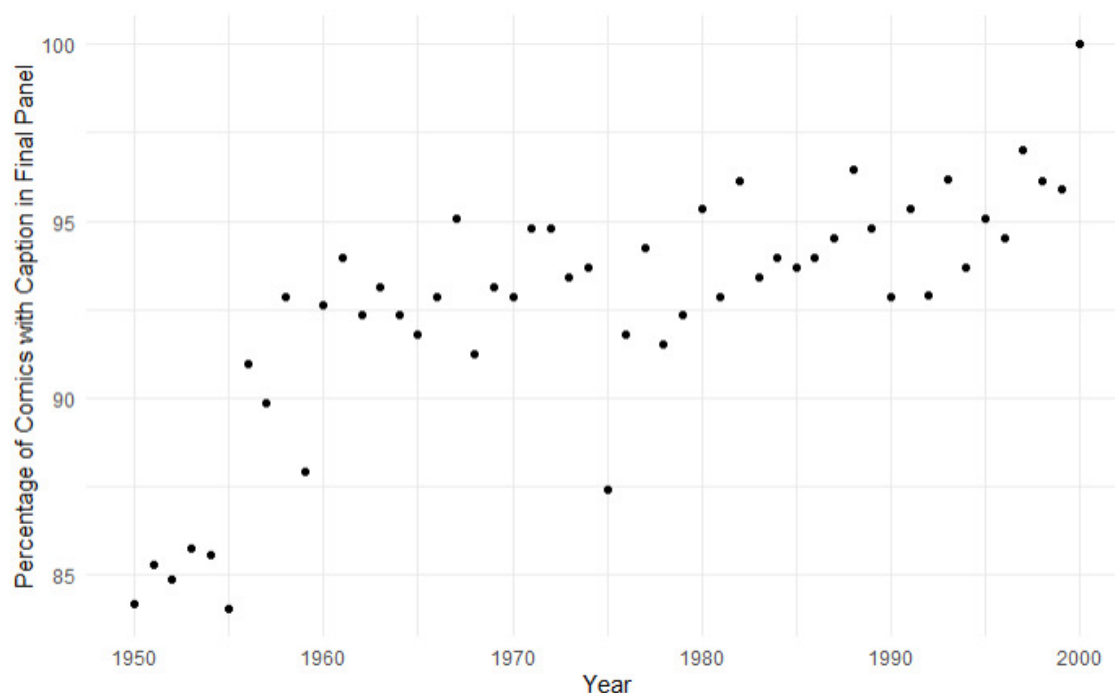
Figure 13. Chart of the proportion of *Peanuts* comic strips with a caption in the final panel as a function of the year of the comic. This allows us to not only see how Schulz's cartooning practices change over time from the first few years onward, but also how consistent they are once Schulz finds his stride with the comic strip.

Schulz notes his early *Peanuts* strips were created in the shadow of the 1940s gag strip magazine-cartoon style. These *Peanuts* strips are more self-contained, containing a singular short joke unrelated to the following daily comic strip, echoing a form popularized by say, Ernie Bushmiller's *Nancy*. For Schulz, this distinction between his earlier gag-centric cartoons and later narrative, verbose comic strips is key: he states his later work is more firmly in the style of comic strip cartoons, those that might end on a gag but continue a longer story day after day for weeks on end. While Schulz does not explicitly mention when his style evolves into the longer form of narrative cartooning, these findings indicate that the shift may occur in 1955.

Cartoonists of course include verbal and nonverbal gags throughout their strips, but Schulz's clear shift away from nonverbal gags from 1955-onwards could teach us much about the creator, the strip, and its readers. Benjamin Clark attributes this, in part, to Schulz reaching "100 papers, which is the 'break-even' point for UFS" earning a contract extension, and, further, that Schulz "gets more into a fully developed strip by 1955" leaving behind the wordless magazine-style gag cartoon format (2023). Comics scholar Barbara Postema argues "wordlessness in comics is always a self-imposed constraint, and cartoonists play around with that limitation, or break it, as they see fit" (206). Because Schulz was so constrained to a smaller size and hewed to the four-panel format in these early years, nonverbal gags and silent comics in this era could signify a yearning for formal experimentation and play. Conversely,

it could have been efficiency: writing less words (particularly in a small format) may have simply been easier on the cartoonist or rendered the comic more legible in its restrictive early years.

As with the tried and true structure of panel-length for the dailies, so too does *Peanuts* seem to settle into formulaic formats with textual captions for first and last panels, along with the bulk of its contained panels. Schulz identified twelve narrative devices that fans routinely value and that he attributes to the popularity of the strip; so too can the coalescing of the comics form and its routine panel structure be read as contributing to *Peanuts'* popularity. Based on our findings, fans could reasonably expect textual captions in the first and final panels, even more so than assuming a given character or gag formula might appear. What's more, textual captions appear in at least 80% of all panels in the most common daily formats: three- and four-panel strips. Within the Sunday strips and those few daily strips with more than four panels, there are some interesting variations in final panel gags for five-panel strips (78%) and six-panel strips (76%). These strips and those with more than four panels (primarily Sunday strips) were more likely to feature nonverbal gags than three- or four-panel strips. Yet, even with this trend, all *Peanuts* comics on average featured captions at least 50% of the time, including Sundays.

On the one hand, the steadfast nature of Schulz's captioning makes sense in the context of Schulz's significant feat in generating, writing, lettering, drawing, and inking all of his own cartoons for nearly fifty years, nearly twenty of which Schulz was drawing the strip while dealing with his hand tremors. But on the other hand, this finding—like that of the panel length and first panel caption—suggests Schulz may have had an even larger unseen influence on the cartooning industry and later cartoonists than previously thought in terms of content, visual style, themes, and more. Our findings on *Peanuts'* final gag panels suggest Schulz profoundly impacted the evolution of the comic strip's aesthetic itself, tied indelibly to his own symmetrical practices of captioning and paneling—formal attributes that go beyond the editorial stipulations of newspaper printing.

Final Gags and Final Thoughts

Through *Peanuts*, Schulz had an undeniable influence on American cartooning, even globally through a large, expansive, indirect effect. We know this for an indelible fact through decades of comics scholarship, newspaper reporting, interviews with cartoonists both contemporaneous to Schulz and those after. And yet, as Ian Gordon and Jared Gardner note:

> given the impact of *Peanuts* and its unparalleled influence on the history of American cartooning over the past sixty-seven years, one might expect a treasure trove of academic scholarship on Schulz's creation. But the truth is in fact very different...the

number of peer-reviewed academic volumes and scholarly essays dedicated to *Peanuts* over the past twenty years can likely be counted on two hands. (4)

Within Gordon and Gardner's own *Good Grief: The Comics of Charles Schulz*, itself the first edited volume of essays on the comic, the chapters focus on four broad categories: philosophy and poetics, identity and performance, history, and transmedia. Indeed, these categories also capture much of the scholarship outside of *Good Grief*, though we might add essays on education and aesthetics. Michelle Ann Abate further illuminates this paradox in her book, *Blockheads, Beagles, and Sweet Babboos: New Perspectives on Charles M. Schulz's Peanuts:* "On the one hand, *Peanuts* was—in the apt words of Geraldine DeLuca—'the most successful comic strip in newspaper history' (308). At the same time, however, it was also arguably the most critically neglected" (6). Indeed, Gordon and Gardner, along with Abate, also note one major hurdle to studying *Peanuts* to be its scale: with almost fifty years of comic strips, almost 18,000 strips within that catalog, studying the breadth of the comic is difficult to say the least. Our present case study attends deeply to the formal elements of *Peanuts*, again an oft-praised but critically-overlooked aspect of the comic, working to better understand Schulz's mastery of the form through the aid of computer vision.

Throughout this case study, we move back and forth between studying panels, captions, and gags as ways of understanding the relationship between image, text, and meaning within American comic strips. Panel detection, reveals evidence that confirms existing scholarship on Schulz's uniformity and stability in panel usage, but panel detection also uncovered instances of Schulz's formal experiments that might go overlooked via traditional close reading. As noted previously, our panel detection findings further allow us to see the exact moment in Schulz's career when he begins to deviate from his four-panel format, whether due to his essential tremor or to formal experimentation, or both. Caption detection demonstrated Schulz placed the bulk of his dialogue balloons at the top of each panel, suggesting his consistency extends not just to panel construction, but caption placement—a consistency that newspaper readers could depend on. This process also demonstrates capacity for automated text detection in comic strips on a large scale, aiding in the study of a medium that has historically been difficult to study due to their large volume. Panel detection and caption placement applied in unison shows Schulz relies less on nonverbal panels and nonverbal gags as his career goes on, focusing more on the relationship between text and image central to comics as a medium. Taken together, computer vision reveals a Schulzian Symmetry underlying *Peanuts* that, we argue, contributes to what makes the comic so powerful, pioneering, and influential.

Schulzian Symmetry refers to the aesthetic comics unity forged by Schulz's uniform panel formula, historically consistent caption placement, and especially, the narrative cohesion between opening and closing panels in gag strips. Given the dearth of scholarship on Schulz, and given that the bulk of this scholarship is devoted to the content of *Peanuts* and its transmedial legacy, these findings offer new insights into Schulz's formal aesthetics throughout his storied career, as well as provide fertile new ground for analysis of contemporary newspaper cartoonists that follow in Schulz's wake.

More than simply testing out hypotheses on Schulz's panel structures or caption placement, computer vision deepens our understanding of unseen and overlooked qualities to *Peanuts*. Through computer vision, we uncover a great significance for the role that panels play in revealing tendencies in cartoonists' aesthetics longitudinally. Moving between caption and panel detection allows for trends to emerge that we might otherwise take for granted as consumers of American visual media, as comics scholars or digital humanists. Humor, poignancy, and charm are all hallmarks of *Peanuts*; distant viewing allows us to add steadfast panel structures, caption distribution, and textual gags to this list. Seeing even just hints of these trends also encourages deeper, large-scale readings of comics that emerge in the wake of *Peanuts* to see how cartoonists follow in Schulz's footsteps or when they diverge—not just aesthetically, which can be understood through close reading, but formally. Rather than simply accepting the four-panel newspaper strip format at face value, we argue that computer vision allows for new ways of seeing comic strips, encouraging returns to the formal traits of Golden Age/public domain comic strips and contemporary strips alike.

While we focus closely on *Peanuts* due to its longstanding popularity and critical successes, we also demonstrate how distant viewing can be applied to the study of comics as a medium, and further, how computer vision can intervene particularly in the study of comic strips due to their large production volume. This is just the beginning. By expanding our studies to other comic strips, with particular attention to the pioneering work of comics by women and people of color, we can see how creators forged a unique, visual form along with new narratives and aesthetics in print, daily, and across the country. These case studies and methods can be adopted to further formal studies of comic strips such as linework, textures, character recognition and representation, which are ripe for computational study.

Our own plans involve deepening this methodology by applying distant viewing to additional contemporary comic strips, including *Luann*, *Cathy*, *Curtis*, and *Jumpstart*, as means of enriching conversations surrounding the aesthetics of the "funnies." Given the dearth of scholarship on *Peanuts*, there is even less scholarship on many contemporary and recent comic strips for many of the reasons outlined earlier (comics studies' focus on comic books and graphic novels/memoirs, the sheer volume of comic strips' production, etc.).

This case study on *Peanuts* will provide a strong initial or baseline comparator for future applications, allowing us to compare future findings against the Schulzian Symmetry of *Peanuts* for instances where strips seem to align with the seminal strip's formulaic conventions or deviate from them. Ultimately, we hope to work together to see where we can go in comic studies, and enjoy a few laughs along the way.

REFERENCES

Abate, Michelle Ann. *Blockheads, Beagles, and Sweet Babboos: New Perspectives on Charles M. Schulz's Peanuts*. University Press of Mississippi, 2023, https://doi.org/10.2307/jj.130881.

Andrews McMeel Universal. *GoComics.com*. 1 Jan. 2023.

Arnold, Taylor, Lauren Tilton, and Justin Wigard. "Automatic Identification and Classification of Portraits in a Corpus of Historical Photographs." *Proceedings*, 2022, p. 0073, http://ceur-ws.org.

Arnold, Taylor, Lauren Tilton, and Annie Berke. "Visual Style in Two Network Era Sitcoms." *Journal of Cultural Analytics*, vol. 4, no. 2, 2019, https://doi.org/10.22148/16.043.

Arnold, Taylor, and Lauren Tilton. *Distant Viewing: Computational Exploration of Digital Images*. MIT Press, 2023.

Baek, Youngmin, et al. "Character Region Awareness for Text Detection." *2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2019, pp. 9365–74, https://doi.org/10.1109/cvpr.2019.00959.

Ball, Blake Scott. *Charlie Brown's America: The Popular Politics of Peanuts*. Oxford University Press, 2021, https://doi.org/10.1093/oso/9780190090463.001.0001.

Beineke, Colin. "On Comicity." *Inks: The Journal of the Comics Studies Society*, vol. 1, no. 2, 2017, pp. 226–53, https://doi.org/10.1353/ink.2017.0015.

Boxer, Sarah. "Charles M. Schulz, 'Peanuts' Creator, Dies at 77." *New York Times*, 14 Feb. 2000.

Chambliss, Julian Carlos, et al. "Days of Future Past: Why Race Matters in Metadata." *Genealogy*, vol. 6, no. 2, May 2022, p. 47, https://doi.org/10.3390/genealogy6020047.

Chavez, Deborah. "Perpetuation of Gender Inequality: A Content Analysis of Comic Strips." *Sex Roles*, vol. 13, no. 1–2, July 1985, pp. 93–102, https://doi.org/10.1007/bf00287463.

Clark, Benjamin. *Personal Interview*. 27 Jan. 2023.

Cohen, Michael Mark. "Cartoon." *Keywords for Comics Studies*, edited by Ramzi Fawaz et al., vol. 12, NYU Press, 2021, pp. 33–37.

Cohn, Neil. *The Visual Language of Comics: Introduction to the Structure and Cognition of Sequential Images*. A&C Black, 2013.

Conrad, Barnaby. "You're a Good Man, Charles Schulz." *Charles M. Schulz: Conversations*, edited by M. Thomas Inge, University Press of Mississippi, 2000.

Duncan, Randy, et al. *The Power Of Comics: History, Form, And Culture*. Bloomsbury Publishing, 2015.

Dunst, Alexander, et al., editors. *Empirical Comics Research: Digital, Multimodal, And Cognitive Methods*. Routledge, 2018, https://doi.org/10.4324/9781315185354.

Forceville, Charles, et al. "Balloonics: The Visuals of Balloons in Comics." *The Rise and Reason of Comics and Graphic Literature: Critical Essays on the Form*, edited by Joyce Goggin and Dan Hassler-Forest, McFarland, 2010.

Gardner, Jared. "A History of the Narrative Comic Strip." *From Comic Strips to Graphic Novels: Contributions to the Theory and History of Graphic Narrative*, edited by Daniel Stein and Jan-Noël Thon, De Gruyter, Inc., 2015, pp. 241–54, https://doi.org/10.1515/9783110427660-010.

Harvey, Robert C. "How Comics Came to Be: Through the Juncture of Word and Image from Magazine Gag Cartoons to Newspaper Strips, Tools for Critical Appreciation plus Rare Seldom Witnessed Historical Facts." *The Comics Studies Reader,* edited by Jeet Heer, University Press of Mississippi, 2008, pp. 25–45, https://doi.org/10.2307/j.ctt2tvd9s.8.

---. "The Aesthetics of the Comic Strip." *The Journal of Popular Culture*, vol. 12, no. 4, Mar. 1979, pp. 640–52, https://doi.org/10.1111/j.0022-3840.1979.1204_640.x.

---. *The Art of the Funnies: An Aesthetic History*. University Press of Mississippi, 1994.

Hatfield, Charles, and Bart Beaty, editors. *Comics Studies: A Guidebook*. Rutgers University Press, 2020, https://doi.org/10.36019/9780813591452.

Heer, Jeet, and Kent Worcester, editors. *A Comics Studies Reader*. University Press of Mississippi, 2009, https://doi.org/10.2307/j.ctt2tvd9s.

Holtz, Allan. "The Stripper's Guide Dictionary Part 1: Sunday Strips." *Stripper's Guide*, Aug. 2007, http://strippersguide.blogspot.com/2007/08/strippers-guide-dictionary-part-1.html.

Inge, M. Thomas. *Charles Schulz: Conversations*. University Press of Mississippi, 2000.

---. *Comics as Culture*. University Press of Mississippi, 1990.

Isaacs, Stan. "Charles Schulz: Comic Strips Aren't Art." *Charles M. Schulz: Conversations*, edited by M. Thomas Inge, University Press of Mississippi, 2000.

Kannenberg, Gene, Jr. "Chips Off the Ol'Blockhead: Evidence of Influence in Peanuts Parodies." *Studies in American Humor*, vol. 14, 2006.

Karasik, Paul, and Mark Newgarden. *How To Read Nancy: The Elements Of Comics In Three Easy Panels*. Fantagraphics Books, 2017.

Kittinaradorn, Rakpong. "EasyOCR: End-to-End Multi-Lingual Optical Character Recognition (OCR) Solution." *Version*, vol. 1, no. 6.2, 2022, https://pypi.org/project/easyocr/.

LaRossa, Ralph, et al. "Gender Disparities in Mother's Day and Father's Day Comic Strips: A 55 Year History." *Sex Roles*, vol. 44, no. 11/12, 2001, pp. 693–718, https://doi.org/10.1023/a:1012250314525.

Manovich, Lev, et al. "Understanding Scanlation: How To Read One Million Fan-Translated Manga Pages." *Image & Narrative*, vol. 12, no. 1, 2011, pp. 206–28.

McCloud, Scott. *Understanding Comics: The Invisible Art*. HarperCollins, 1993.

Morrow, Hugh. "The Success of an Utter Failure." *Charles M. Schulz: Conversations*, edited by M. Thomas Inge, University Press of Mississippi.

Murel, Jacob. "An Exploration in the Digital Analysis of Comics Images." *INKS: The Journal of the Comics Studies Society*, vol. 7, no. 1, Mar. 2023, pp. 23–48, https://doi.org/10.1353/ink.2023.a898385.

Phelan, Jim. "Penthouse Interview: Charles M. Schulz." *Charles M. Schulz: Conversations*, edited by M. Thomas Inge, University Press of Mississippi, 2000.

Postema, Barbara. "Silent Comics." *The Routledge Companion to Comics*, edited by Frank Bramlett et al., Routledge, 2016, pp. 201–08.

Smith, Alvy Ray. "Tint Fill." *ACM SIGGRAPH Computer Graphics*, vol. 13, no. 2, Aug. 1979, pp. 276–83, https://doi.org/10.1145/965103.807456.

Sousanis, Nick. *Unflattening*. Harvard University Press, 2015.

"Timeline: Charles M. Schulz & Peanuts." *Charles M. Schulz Museum*, May 2020.

Topham, Kate, et al. "The Marmaduke Problem: A Case Study of Comics as Linked Open (Meta) Data." *Dissemination, and Preservation Studies*, edited by Julian Carlos Chambliss et al., vol. 6, no. 3, 2022, pp. 1–8.

von Reumont, Frederik, and Alexandra Budke. "Strategies for Successful Learning with Geographical Comics: An Eye-Tracking Study with Young Learners." *Education Sciences*, vol. 10, no. 10, Oct. 2020, p. 293, https://doi.org/10.3390/educsci10100293.

Watterson, Bill. "Introduction." *Calvin and Hobbes - Sunday Pages 1985-1995*, Andrews McMeel Publishing, 2001.

---. "The Grief That Made 'Peanuts' Good." *Wall Street Journal*, 12 Oct. 2007, https://www.wsj.com/articles/SB119214690326956694.

White, Sylvia E., and Tania Fuentez. "Analysis of Black Images in Comic Strips, 1915–1995." *Newspaper Research Journal*, vol. 18, no. 1–2, Jan. 1997, pp. 72–85, https://doi.org/10.1177/073953299701800107.

Whitson, Roger Todd, and Anastasia Salter. "Introduction: Comics and the Digital Humanities." *DHQ: Digital Humanities Quarterly*, vol. 9, no. 4, 2015.