"ALL THE FORMS TODAY ARE MERELY PARADES AND ARRANGEMENTS" THE RELATIONSHIP BETWEEN THE MUSIC AND FILM OF *LE BALLET MÉCANIQUE* AND THEIR INFLUENCE ON TIME

By

Emily Michelle Baumgart

A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

Music Theory - Master of Music

2015

ABSTRACT

"ALL THE FORMS TODAY ARE MERELY PARADES AND ARRANGEMENTS" THE RELATIONSHIP BETWEEN THE MUSIC AND FILM OF *LE BALLET MÉCANIQUE* AND THEIR INFLUENCE ON TIME

By

Emily Michelle Baumgart

This paper offers a structural and cognitive exploration of Léger, Murphy and Antheil's *Le Ballet Mécanique* of 1924. Though much recent literature has addressed the iconic and groundbreaking film by concentrating on the audio or visual elements separately, this paper addresses both as a unit; specifically, it explores the form and structure, or lack thereof, inherent in the abstract nature of the film. While some analyses have claimed there is a clear sense of organization within either film or music (Lawder, 1975; Oja, 2000), this paper takes the opposite approach by theorizing that there is no coherent form to be found in either. Instead, there is a focus on the use of irregular repetition found in both the visual and aural media: looping in the visual element and ostinato in the aural. Furthermore, this study places an emphasis on the effect these unusual techniques will have on an audience. Drawing on the cognitive literature regarding perception and attention, this paper investigates the role that non-narrative video plays in time perception and disorientation. It uses principles of Gestalt psychology and previous timing experiments to accomplish these aims, postulating that the lack of structure, repetitive nature, and disunity between visual and aural elements will lead to a distorted sense of time.

TABLE OF CONTENTS

LIST OF FIGURES	iv
INTRODUCTION	1
I. BACKGROUND INFORMATION	3
II. LE BALLET MÉCANIQUE	9
A. Background and Authorship	9
B. Critical Response	.12
C. The Aesthetics and Style of Le Ballet Mécanique	.15
D. Analysis	. 18
1. Music	. 18
a. Performance Forces	. 18
b. Form	. 20
c. Motives	. 22
2. Film	. 28
a. Performance Forces	. 28
b. Form	. 29
3. Interaction of Film and Music	.31
III. DISCUSSION	. 35
A. Gestalt	. 35
B. Time Perception	. 36
C. Perceptual Relationship to Le Ballet Mécanique	. 38
CONCLUSION	. 44
BIBLIOGRAPHY	. 45

LIST OF FIGURES

Figure 1: Motive I, Measure 105	22
Figure 2: <i>Motive H, Measure 77</i>	23
Figure 3: <i>Motive U, Measure 530</i>	23
Figure 4: <i>Motive M, Measure 403</i>	23
Figure 5: <i>Motive B, Measure 7</i>	25
Figure 6: <i>Motive B2</i>	25
Figure 7: <i>Motive N, Measure 420</i>	
Figure 8: <i>Motive S, Measure 504</i>	27
Figure 9: <i>Motive S2, Measure 522</i>	27

INTRODUCTION

The film and music combination of *Le Ballet Mécanique* was a groundbreaking work of the 1920s avant-garde. Both well known in their own rights, it has only been recently that the musical and video forms of the piece have been reunited. The historical narratives surrounding the origins and composition of the work are incredibly unreliable, and its formal structure (or lack thereof) denies a simple interpretation. Though the exact genesis of the film and music are unknown, both media are composed in a similar fashion: repetitive, non-isochronous musical motives are paired against cycles of rhythmic, recurring visual scenes. Still, there are no consistent patterns to be found here, no sympathy between visual and aural stimuli, and no helpful markers to aid in attention. The nonconformity that is found both within and between these media affect the audience's perception, leading to disorientation and a distorted sense of time. Contrasting stories of the history of the piece paired with conflicting descriptions of the work, by both its creators and by analysts contribute to the confusion inherent in this piece.

The question, then, is how to approach such an untraditional work. What led Antheil to compose in this style? What led the filmmakers to create a plot-less film? If the film and music aren't synchronized or sympathetic, then how do they relate to one another? How does an audience or an analyst comprehend media that reject traditional formal explanations? The answers to these questions lie in Antheil's thoughts on time and silence, Cubist and Dadaist art, and time perception theories. The film and music are similar aesthetically, and both have been subjected to earlier segmented analyses; however, I argue that an alternative approach focusing on music cognition is necessary to truly understand this work. For the purposes of this study, I will focus on the version of the music and film released in the 2013 collection "Unseen Cinema."

1

This is the earliest known extant cut of the film, paired with the original music (with measures154-368 and 1138-1240 removed for the sake of time).

I. BACKGROUND INFORMATION

George Antheil, now recognized for little else beside *Le Ballet Mécanique*, was arguably one of the most well known American composers of his time. Antheil was born in Trenton, New Jersey on July 8, 1900.¹ He was generally closer to his father, the owner of a small shoe store, than his strict and stern mother.² In his first five years of life, the family lived next to a machine shop and the Trenton State Penitentiary. Supposedly, two of his neighbors, pounding away on their piano at all hours to cover up a prison escape, gave Antheil his first memory of music.³ He began piano lessons at the age of six (after chopping the toy piano he got for Christmas to bits), but spent more time composing than practicing.⁴ His mother constantly complained about the music he produced, telling him that "music should soothe, not irritate. Yours is too discordant." Originally bound for a literary career, he was expelled from high school, possibly due to one of his editorials in the school magazine.⁵ After a brief stint working in his father's shop ended poorly, the Antheils decided their son needed a new musical outlet.⁶

Antheil's musical education was rather unorthodox in several ways. He began composition lessons at the age of sixteen with the traditionalist Constantin von Sternberg, a student of Liszt. Sternberg, his "musical godfather" (though he did not himself enjoy modernistic music), encouraged Antheil in his own style, urging him not to copy the likes of Ravel or Debussy, but rather to "speak [his] own language, not bad French."⁷ In 1919, Sternberg informed Antheil that he'd taught him all he could, and suggested the young man study with his musical idol, Ernest Bloch. Bloch, however, turned him away, calling his compositions "empty" and

¹ Grove Music Online, s. v. "Antheil, George," by Linda Whitesitt, et al, accessed June 8, 2013, http://www.oxfordmusiconline.com/.

² Linda Whitesitt, *The Life and Music of George Antheil*, (Ann Arbor: UMI Research Press, 1983), 3.

³ George Antheil, *Bad Boy of Music*, (Garden City: Doubleday, Doran, and Co, 1945), 14.

⁴ Grove, "Antheil."

⁵ Whitesitt, *Antheil*, 4.

⁶ Hugh Ford, *Four Lives in Paris*, (San Francisco: North Point Press, 1987), 6-7.

⁷ Ford, *Paris*, 7.

"pretentious."⁸ Antheil tried again, this time with a set of poems which would become the *Five* Songs, 1919-1920, for soprano and piano, after Adelaide Crapsey, and Bloch then accepted him as a student.⁹ However, while he musically thrived under Bloch's tutelage and began to compose his first symphony, he was financially destitute and starved himself in order to continue lessons; he was hence forced to discontinue them in 1921.¹⁰ Looking for cheap accommodations, he spent a brief amount of time at a house in Bernardsville, New Jersey, living with other lovers of modern music including Margaret Anderson, who introduced him to European modern art. His housemates complained of his compositional style, saying "he would choose a theme of five or six notes and repeat it insatiably for hours on end," and of his pianistic style that he "used the piano exclusively as an instrument of percussion."¹¹ However, these artistic forays did nothing to help his finances. He returned to Sternberg with this dilemma, who gave him a sealed envelope and sent him to the home of philanthropist Mary Louise Bok. The letter assured Mrs. Bok that Antheil was "one of the richest and strongest talents for composition that [Sternberg] ha[d] ever met" and asked for a monetary stipend so the boy could continue to compose without financial worry. She agreed, offering a monthly allowance in return for some teaching duties at the school she had founded, Philadelphia Settlement Music School, later to become the Curtis Institute.¹²

Financial security settled, Antheil set his sights on Europe. While he was teaching at Settlement, he not only composed but also took piano lessons with George Boyle. As early as 1921, he wrote to Mrs. Bok of his longing to be a concert pianist.¹³ He recounted two somewhat prophetic dreams in his autobiography, visions of Europe after the Great War in which people

¹⁰ Ibid., 6.

⁸ Antheil, Bad Boy, 16.

⁹ Whitesitt, Antheil, 4.

¹¹ Ford, *Paris*, 4.

Whitesitt, Antheil, 6.

¹² Ford, *Paris*, 8-9.

¹³ Whitesitt, *Antheil*, 7.

were playing his music.¹⁴ When the modernist pianist Leo Ornstein split with his manager Martin Hanson, Antheil saw an opportunity to make the European dreams a reality. He spent a month practicing up to twenty hours a day and was rewarded when Hanson declared him ready for a European debut tour.¹⁵ Antheil sailed for Europe on May 30, 1922 with a generous sum of money from Mrs. Bok to facilitate his tour; his first European concert took place in London. He played the music of several contemporary composers as well as some of his own; the concert was generally met with poor reviews, deeming Antheil as a pianist of not the "proper kind."¹⁶ He then attended the third Donaueschingen Chamber Music Festival and pronounced his own music on the same level, although he was somewhat upset that there were only Germanic and Central European composers on the program.¹⁷ More financial problems resulted in Antheil semipermanently settling in the much lower-cost Berlin and using it as his base for a concert tour of central Europe. This tour was generally more successful than the first (Antheil recalls a concert in Budapest where the audience "thundered and clapped for five minutes") and garnered the praise of German musicologist H. H. Stuckenschmidt, which put him firmly within the European avant-garde. However, he still had to keep asking Mrs. Bok for money.¹⁸

The move to Europe, while providing a semi-successful concert tour, also facilitated a new compositional style. This was due in large part to the European modernism that was absent from North America during this time. His first work in this style was the *Airplane Sonata*; it and the *Jazz Sonata* were premiered at his first concert in Berlin in February of 1923.¹⁹ Airplane

¹⁴ Ibid., 20.

¹⁵ Ford, *Paris*, 12.

¹⁶ Whitesitt, Antheil, 7.

Ford, Paris, 13.

¹⁷ Whitesitt, Antheil, 9.

Antheil, Bad Boy, 23.

¹⁸ Whitesitt, Antheil, 9-12.

¹⁹ Susan C. Cook, "George Antheil's Transatlantic: An American in the Weimar Republic," *The Journal of Musicology*, 9.4 (Autumn 1991): 500.

Sonata was the first piece to showcase Antheil's obsession with time, making use of his "ostinato block" compositional technique.²⁰ It contains no use of dynamics and directions for the performer to play "as fast as possible," as well as a concern for time-space.²¹ Stuckenschmidt deemed it "machine-music" and called it the musical corollary to visual art's *Neue Sachlichkeit*.²²

Another influential result of this European tour was that he met and spent time with Igor Stravinsky. Antheil claimed that Stravinsky had "discovered [him,]" and "proclaimed [him] to be a great talent and invited [him] to Paris to live and study with him."²³ Stravinsky's own version of events is slightly different – that Antheil had "early fastened [him]self upon his neck and every day thereafter pestered him nearly to death."²⁴ Regardless of which version of events is correct, it was at Stravinsky's encouragement that Antheil moved to Paris in the summer of 1923 with his new wife Böski, with whom he had eloped to Poland in the winter of 1922. This elopement, however, caused Stravinsky and Antheil's relationship to quickly deteriorate, as Antheil consequently missed the Paris debut concert Stravinsky had expressly arranged for him in December of 1922. ²⁵ Antheil eventually admitted that their separation was probably for the best, as he was somewhat overly-devoted to Stravinsky.²⁶

Antheil and Böski moved into a flat above the bookstore Shakespeare and Company owned by Sylvia Beach, mostly for the cheap accommodations, though the new location also allowed him to meet several important members of the avant-garde. Beach introduced Antheil to several important literary figures, including Ezra Pound, who was completely enamored of

²⁰ Grove, "Antheil."

²¹ Whitesitt, *Antheil*, 88.

²² Cook, "Transatlantic," 500.

²³ Ford, *Paris*, 15.

²⁴ Antheil, *Bad Boy*, 30.

²⁵ Whitesitt, Antheil, 15.

²⁶ Ibid., 15-16.

Antheil. Pound thought Antheil was finally filling the musical void "corresponding to the work of Wyndham Lewis, Pablo Picasso or Gaudier-Brzeska," even going so far as to write a book about him. ²⁷ Antheil had mixed feelings about the work, saying on different occasions that people "almost believ[ed] it" but complaining that it "sowed the most active distaste for the very mention of the name 'Antheil' among many contemporary critics." ²⁸ Margaret Anderson and Georgette Leblanc, old housemates of Antheil's from Bernardsville, came to Paris as well and introduced him to Erik Satie; he also met James Joyce, Ernest Hemingway, Fernand Léger, Man Ray, and other members of the Parisian avant-garde. ²⁹

Antheil's Parisian debut was part of a film, *L'Inhumaine*, that Anderson and LeBlanc were arranging with the French avant-garde filmmaker L'Herbier. On October 4, 1923, they rented the theatre at Champs-Élysées; Leblanc would be singing and filming a scene and they needed an accurate portrayal of a riot. The audience was populated by well-known members of the avant-garde: Ray, Picasso, Cocteau, Joyce, Léger, Satie, Milhaud, and Picabia were among them.³⁰ Antheil described the scene as "bedlam," saying part of the audience "screeched, then whistled" while the other part "clapped and yelled bravo until they were quite hoarse."³¹ Satie and Milhaud supposedly got into fisticuffs, all the artists applauded wildly, audience members threw their cushions at the stage, and the overall effect was similar to a small-scale riot. Though it made Antheil instantly famous, the composer himself was a bit put out when he realized that they had not stopped filming during his performance; consequently, he was unsure of how true

²⁷ Ford, *Paris*, 20.

Whitesitt, Antheil, 16-17.

²⁸ Antheil, *Bad Boy*, 135.

Ibid., 120.

²⁹ Ford, *Paris*, 21.

Whitesitt, Antheil, 16.

³⁰ Ford, *Paris*, 23.

³¹ Wayne D. Shirley, "Another American in Paris: George Antheil's Correspondence with Mary Curtis Bok," *The Quarterly Journal of the Library of Congress*, 34.1 (January 1977), 8.

the audience's reactions were.³² The master of ceremonies even asked the audience to reproduce the riot after the performance was done so that it could be recorded when the cameras had been turned to focus on them.³³ It was at this concert that Antheil performed the *Airplane Sonata* and premiered *Mechanisms*, the progenitor for his famous *Le Ballet Mécanique*. Antheil described it as an "eight-movement sonata" for the piano, a precursor to the massive form he attempted to impart to the latter work.³⁴

Antheil gave another concert in December of that year, including a commission from Pound for Olga Rudge, Pound's violinist mistress. This concert was at the Paris Conservatoire where Pound informed the public that Antheil was Stravinsky's "most formidable opponent for the heavyweight built music."³⁵ The critics were not convinced by Pound's declaration: one said he "obstinately refuses to recognize the piano as a musical instrument."³⁶ Antheil only continued this use of the piano, which became the driving force behind *Le Ballet Mécanique*.

³² Ford, *Paris*, 23.

³³ Whitesitt, Antheil, 19.

³⁴ Antheil, *Bad Boy*, 90.

³⁵ Ford, *Paris*, 25.

³⁶ Whitesitt, Antheil, 21.

II. LE BALLET MÉCANIQUE

There is quite a lot of confusion surrounding the history, and especially exact creators, of *Le Ballet Mécanique*. No reliable narrator for the genesis of the idea, for the actual creation of either the film or the music, and the nature of the resulting composition has resulted in analytical challenges for those who have tried to interpret and contextualize it. Because all of the stories of its creators conflict, there is no dependable source of composer intent or even a reliable clarification of the piece's style. These odd elements about the composition's origins only serve to reinforce the confusion inherent in the piece.

The work itself refuses to be categorized, as both the musical and visual aspects reject labels. The music is a culmination of Antheil's style up to this point: loud and brash, using the piano in a percussive manner rather than a melodic one. It is made up of blocks of ostinato patterns and uses very little traditional development or formal techniques. The film, similarly, is plot-less: a series of apparently unconnected images, ranging from geometric shapes to looping clips of people going about their daily lives.

A. Background and Authorship

Everyone involved in the creation of *Le Ballet Mécanique* – Antheil, Léger, Dudley Murphy, Man Ray, and even, to an extent, Pound – insisted that the work was their own idea. As such, the stories surrounding the creation of the work disagree, making it impossible to reconstruct a clear history of the genesis and development of the project. These unreliable narrators each claim that their version of events is correct; they contradict each other and even themselves.

A few days after the Paris *L'Inhumaine* concert, Antheil supposedly put out an advertisement in the paper saying he was writing a new piece of music called *Le Ballet*

9

Mécanique and was looking for a filmmaker to join him.³⁷ Even this innocuous statement is suspect, as Antheil also claimed that he had begun the *Ballet* in Germany with the title "Message to Mars;" the name was swiftly changed to *Le Ballet Mécanique* against the wishes of Sylvia Beach, who was concerned people would mistake it for "mechanical broom."³⁸ According to Antheil, Dudley Murphy (encouraged by none other than Ezra Pound) agreed to make the film only if Fernand Léger would collaborate with him.³⁹ Since Antheil claimed that Léger had wanted to create a film inspired by *Mechanisms*, this was an obvious match.⁴⁰

Léger, on the other hand, maintained that he had been planning an actual ballet along the lines of *Le sacre du printemps* and asked Antheil to write music for it; it was only later that Léger decided to make an abstract film. The painter wanted "percussion in pictures," gathered a large amount of props and intended to create a movie with a definite, music-like rhythm.⁴¹ Fernand Léger also claimed that the film was his own doing. All of the written documents pertaining to the making of the film belong to Léger, including preparatory notes and sketches and a short article about film.⁴² These notes contain specific thoughts about the genesis and structure of the piece, and the article, written in 1924, shows that Léger had a clear "quasimusical" score in mind, and that the film was meant to be divided into seven parts that get progressively faster.⁴³ There is also a definite presentation of dissonance, which echoes that of the music. In Cubism, dissonance is presented through contrasts, as Léger explains: "contrasts = dissonance, that is to say a maximum of expressive effect" and states that this dissonance results

³⁷ Antheil, *Bad Boy*, 134-135.

³⁸ Ibid. 139.

³⁹ Ibid., 134-135.

⁴⁰ Ibid., 8.

⁴¹ Ibid., 30.

⁴² Standish D. Lawder, *The Cubist Cinema*, (New York: New York University Press, 1975), 119.

⁴³ Richard Brender, "Functions of Film: Léger's Cinema on Paper and on Cellulose, 1913-25," *Cinema Journal* 24.1 (Autumn 1984): 51.

in a "sense of movement."⁴⁴ Dissonance in this sense of contrast is obvious throughout *Le Ballet Mécanique*, and Léger's Cubist influence would make sense, though how much of Léger's ideas actually made it into the film is another question. Léger's notes also say that they had asked Antheil to make a "musical synchronized adaptation" for their film; presumably this means that the film had already been finished by the time they had asked for a musical accompaniment.⁴⁵

While Léger might have written the notes and background information for the film, it was Dudley Murphy and Man Ray who had the technical knowledge. Murphy insisted that he contacted Man Ray after seeing his work and the two of them decided to make an amusingly satirical Dada film, including erotic nude scenes between the two men, Ray's mistress Kiki de Montparnasse, and Murphy's wife Katharine Hawley. Ray and Murphy, prior to Léger's involvement with the project, shot the vast majority of the footage: still-life arrangements, the parrot, the mock postcard-like images of Katharine Hawley swinging and in the garden, the androgynous shots of Kiki de Montparnasse, random images of traffic and scenes from an amusement park.⁴⁶ Murphy also claimed that the looped editing was his own idea, specifically mentioning the washerwoman on the stairs, as well as the dancing legs.⁴⁷ However, the duo ran out of money before they could complete the project and Pound suggested they contact Léger because the artist was "in the throes of cinephilia" and he could ask Antheil to write a score to go with it. Ray left the project, assuming (correctly) that Léger would want to take over the enterprise, as well as citing Léger's lack of humor.⁴⁸ Evidence of Ray's involvement with the project has since been largely removed but, as he argued in a later interview, "You don't lend out

⁴⁴ Douglas Cooper, *The Cubist Epoch*, (New York: Phaidon Publisher, 1971), 92.

⁴⁵ Susan Delson, *Dudley Murphy, Hollywood Wild Card*, (Minneapolis: University of Minnesota Press, 2006), 55.

 ⁴⁶ William Moritz, "Americans in Paris: Man Ray and Dudley Murphy," In *Lovers of Cinema: The First American Film Avant-Garde 1919-1945*, ed. Jan-Christopher Horak, (Madison: University of Wisconsin Press, 1995), 126.
 ⁴⁷ Ibid., 127.

Delson, *Murphy*, 46.

⁴⁸ Moritz, *Ray and Murphy*, 126.

your mistress, do you?"⁴⁹ Léger himself claimed that "[he] made it in close collaboration with Dudley Murphy" but as the painter had no film experience before this the extent of the collaboration is debated. ⁵⁰ In fact, out of all of Léger's sketches, the only ones that are featured in the film and are not specifically claimed by either Ray or Murphy are the animated sequences of geometric shapes, intertitles, and the cubist portrayal of Charlie Chaplin.⁵¹ Further confounding the story is the fact that Léger continuously edited the film: no fewer than four different copies are currently in existence.⁵² Unfortunately, Murphy's original copy of the film, erotic nude scenes included, was destroyed in a fire.⁵³

B. Critical Response

The critical response to the music of *Le Ballet Mécanique* was mixed, though it fared better with the European, especially Parisian, audience. As the reporter Bravig Imbs said, "everyone was willing to applaud a man who had at least accomplished something."⁵⁴ Antheil himself had decided that the work "need[ed] some sauce if it's going to get any attention in the newspapers" and concocted a far-fetched plan to miss the premiere by journeying to Africa and then pretending to get lost in the wilderness.⁵⁵ Its first unofficial performance in a concert at Mrs. Christian Gross's salon, though missing drums and propellers, was deemed "good but awful," a terrifying work but well-written, and received well by most of the critics in attendance.⁵⁶ Imbs described it as "terrific thumping" and said that "the *Ballet* was so intense and concentrated, so strange and even irritating to the ear, that there was a gasp of audible relief when the first roll

⁴⁹ Delson, *Murphy*, 46.

⁵⁰ Lawder, *Cubist Cinema*, 119.

⁵¹ Ibid., 127-128.

⁵² Delson, *Murphy*, 65.

⁵³ Lawder, *Cubist Cinema*, 135.

⁵⁴ Bravig Imbs, *Confessions of Another Young Man*, (New York: The Henkle-Yewdale House, 1936), 102.

⁵⁵ Imbs, Confessions, 78-79.

⁵⁶ Ford, *Paris*, 37.

abruptly finished."⁵⁷ One poor girl had the job of working the pianola pedals, during which "sometimes half the keys went down at once."⁵⁸ She was completely exhausted by the end of it, though she agreed to play a section again for James Joyce, who declared that it "sound[ed] like Mozart."⁵⁹

The official Paris debut concert in June of 1926 featured Carl Maria von Weber's Overture to *Der Freischütz* and a Concerto Grosso of Handel before moving on to Antheil's *Symphony in F* and *Le Ballet Mécanique*. During the final piece, two camps broke out in the audience: boos and hisses from one side and applause and praise from the other (led enthusiastically by Ezra Pound) devolved into fist fights in the aisles. When the airplane propellers began, people put on their coats and opened umbrellas.⁶⁰ At the end of the day, however, reviews were generally favorable, praising Antheil's ingenuity, organization, and philosophical implications.⁶¹

The American premiere in April of 1927, however, was a disaster due to several poor choices in presentation and performance. The use of an actual airplane propeller, instead of the *sound* of one, the gaudy visual backdrops, and the presence of too many pianos, which blurred the sound and percussive effect, resulted in more of a circus than a performance. One elderly man in front tied a white handkerchief to his cane and waved it about in surrender.⁶² A further problem with the siren led to outright laughter from the audience: the performer did not realize that the siren needed to be cranked before it sounded, and consequently the instrument missed its entrance but continued on for nearly a minute after the piece had ended.⁶³ Headlines said things

⁵⁷ Whitesitt, Antheil, 22.

⁵⁸ Imbs, *Confessions*, 55.

⁵⁹ Ibid., 57.

⁶⁰ Ford, *Paris*, 44.

⁶¹ Whitesitt, Antheil, 26.

⁶² Antheil, *Bad Boy*, 193, 195.

⁶³ Whitesitt, Antheil, 36.

like "Mountain of Noise out of an Antheil" and "doubted whether any 'music' was presented."⁶⁴ The American concert resulted in Antheil returning to Europe with no money (as his patron had rescinded all but the bare minimum) and gave him a reputation as a charlatan he was still trying to deny decades later.⁶⁵

The film *Le Ballet Mécanique* was generally much better received than its musical counterpart. It had its premiere in Vienna, sans music, at the *Internationale Ausstellung neuer Theatertechnik* (International Exhibition of New Theatrical Techniques) in the fall of 1924 to "great success."⁶⁶ Critics lauded its nonsensical nature, calling it a "mad, fantastic dance of unrelated objects"; or, to put it another way, the film was "like a cocktail in an ice cream parlor."⁶⁷ The film met with varied success in America, where Murphy held the rights. Its initial performance was at the Klaw Theatre in New York in March of 1926, where it was dismissed by the bewildered critics; further screenings only days later, however, seemed to allow viewers to better understand it.⁶⁸ Gradually it became more popular, partially due to the novelty of a black percussionist performing an improvisatory accompaniment, but did not result in offers for funding or further projects for the photographer.⁶⁹

After these early premieres, the film seems to have done much better than the music. Although it is unclear how they were synchronized, both were performed together at the Museum of Modern Art in New York in 1935.⁷⁰ Antheil, perhaps seeking to redeem himself, revised the music sometime in the 1950s with severely reduced instrumentation. Though he

⁶⁴ Ibid., 37.

⁶⁵ Antheil, Bad Boy, 193.

⁶⁶ Lawder, Cubist Cinema, 183.

⁶⁷ Delson, *Dudley Murphy*, 42.

⁶⁸ Ibid., 60.

⁶⁹ Moritz, "Ray and Murphy," 130.

⁷⁰ Carol C. Oja, "George Antheil's *Ballet Mécanique* and Transatlantic Modernsim," in *A Modern Mosaic: Art and Modernism in the United States*, ed. Townsend Ludington, (Chapel Hill: University of North Carolina Press, 2000), 190

claimed he had only changed minor elements, in reality he rewrote or removed entire sections of the work, taking out nearly all sections of silence in the revised version. Now, *Le Ballet Mécanique* is the only thing most people know Antheil for, if they know him at all.⁷¹ The film, on the other hand, is lauded as one of the finest examples of early avant-garde cinematography.

C. The Aesthetics and Style of Le Ballet Mécanique

Antheil's focus in much of the literature surrounding *Le Ballet Mécanique* was a new idea of time. Specifically, he was adamant about *Le Ballet Mécanique*'s relation to time and the Fourth Dimension which was a very important concept during this time period, especially relating to Cubist art. This concept was vague, relating to space, time, and volume in art.⁷² Antheil, in this work as with others in the same style, seems to focus on the time element, as it is most related to music. His argument that "TIME FUNCTIONING IN MUSIC DIFFERS FROM ORDINARY TIME" (Antheil's emphasis) reinforces the idea that music is made out of time and not tone.⁷³ Antheil's formal conceptions stem from these ideas: he made use of silence as a part of music long before many of his colleagues. Furthermore, his compositions do not make use of traditional forms like sonatas or rondos, but rather blocks of one musical idea placed against one another. In another connection to art at the time, Antheil stated that "forms come from the canvas, not the crayon."⁷⁴ His works in this period, *Le Ballet Mécanique* included, focus on the idea of music simply existing in this time space rather than about perceivable compositional structures.

Regardless of Antheil's innovative thoughts on time and music, *Le Ballet Mécanique* was the last piece he wrote in this "ostinato block" style. *Cyclops*, written for James Joyce, would

⁷¹ Antheil, *Bad Boy*, 138.

⁷² Carol J. Oja, *Making Music Modern: New York in the 1920s*, (New York: Oxford University Press, 2000), 84.

⁷³ George Antheil, "My Ballet Mécanique," *de Stijl*, 2 (1921-1932): 455.

⁷⁴ Ibid., 456.

have been a continuation of this aesthetic, including more jazz elements and a use of "cinematic techniques." However, it was never completed and Antheil abandoned this style of composition.⁷⁵ He turned instead to Neoclassicism like Stravinsky, and saw *Le Ballet Mécanique* as the end of this style. "I have said everything I have to say in this strange, cold, dream-like medium...I always tend to write the same work over and over again, so to speak, until finally I get it as nearly perfect as I can, then abandon it."⁷⁶

There are still ongoing debates in both the art and music communities about whether this piece, despite its title, is truly part of the machine aesthetic, an idea glorifying machines above more natural forms. The mechanical performers inherent in this piece give the aesthetic credence; the lack of traditional formal structure giving way to music simply existing in time-space, however, may support the contrary. Antheil himself gave several mixed messages on the subject; he alternately called the piece "a new machinery and a new aesthetic;" "machine aesthetic without imitating machines;" "the rhythm of machinery, presented beautifully;" and the "first piece composed out of and for machines."⁷⁷ However, he later recanted, saying that "[*Le Ballet Mécanique*] had nothing whatsoever to do with the actual description of factories, machinery – and if this has been misunderstood by others, Honegger, Mossolov [*sic*] included, it is not my fault."⁷⁸ In the art and film community, the question of a machine aesthetic is dependent upon whether this film is Cubist or Futurist; the former being a style focusing on broken and flattened forms, while the latter creates a more dynamic sense of movement. Martin Norden claims that there is a "humanization of objects and mechanization of humans" which

⁷⁵ Mauro Piccinini, "Non più andrai farfallone rumoroso': 'You Will Go No More, Noisy Butterfly': Joyce and Antheil," *Journal of Modern Literature*, 26.1 (Autumn 2002), 81.

⁷⁶ Whitesitt, Antheil, 115.

⁷⁷ Oja, "Transatlantic Modernism," 175. Schmidt-Pirro, "Avant-Garde," 412. Ford, *Paris*, 36. Antheil, "My Ballet," 455.

⁷⁸ Antheil, *Bad Boy*, 139.

would lead to a Futurist interpretation.⁷⁹ Charles Harrison, meanwhile, argues that Léger's work, including *Le Ballet Mécanique*, was an "abstract, mechanized version of Cubism."⁸⁰ A third interpretation, put forth by Carol Oja, claims that this piece (and indeed, most of Antheil's work from this period) was a product of American-influenced Dadaism.⁸¹

Antheil's influences were many and varied. At times he was more affected by artists than by musicians, citing Picasso's banality, commonplace subjects, and technique especially: "I used time as Picasso might have used the blank spaces of his canvas."⁸² There were obvious connections between Antheil and Stravinsky, stemming from their strained relationship and similar compositional styles. While Stravinsky's music is seen as "rarely stopping," however, Antheil's is seen as "never stopping."⁸³ There are clear links between *Le Ballet Mécanique* and *Le sacre du printemps*, as well, though one critic described the former as a "brash attempt to out-Stravinsky Stravinsky."⁸⁴ Parallels can also be drawn between Antheil and Varèse for their use of percussion, and Antheil may have also inherited Satie's "strong satirical and ironic sense," as well. ⁸⁵ Despite these connections, Antheil sought to distance himself from his modernist contemporaries. "I do not, as I often protest, belong to the 'ultra-modern school' of composition, like e.g. Stravinsky *has*, or Casella, Szymanowsky, Ornstein, Bloch, or goodness knows who. I often go far beyond them in 'discords' and 'concords' also…But it is in the significance of the form that true 'modernity' lies – and it takes study, and open-mindedness to understand that in a

⁷⁹ Martin F. Norden, "The Avant-Garde Cinema of the 1920s: Connections to Futurism, Precisionism, and Suprematism," *Leonardo*, 17.2 (1984), 109.

⁸⁰ Charles Harrison and Gillian Perry, *Primitvism, Cubism, and Abstraction: The Early Twentieth Century*, (New Haven: Yale University Press, 1993), 234.

⁸¹ Oja, Making Music Modern, 77.

⁸² Whitesitt, Antheil, 98, 106.

⁸³ Schmidt-Pirro, "Avant-Garde," 418.

⁸⁴ Whitesitt, Antheil, 110.

⁸⁵ Ibid., 108.

Glenda Dawn Goss, "George Antheil, Carol Robinson, and the Moderns," *American Music*, 10.4 (Winter 1992), 471.

new work."⁸⁶ And, somewhat paradoxically, Antheil often displayed a love for Beethoven. When his reporter friend Imbs insulted the German master, Antheil retaliated, saying: "You dare stand there and lift your little finger against Beethoven? ... Don't you dare stick up your nose at Beethoven again or I'll bash it in for you."⁸⁷ Perhaps Antheil saw himself, like Schoenberg, as the next composer in the line "…like Beethoven, I wish to use what notes I need, regardless of whether they are suave enough or not."⁸⁸

D. Analysis

1. Music

a. Performance Forces

The instrumentation of the work was fairly modern for its time. It is comprised solely of both pitched and unpitched percussion instruments. The pitched instruments consist of three xylophones, two acoustic pianos, and a minimum of four pianolas (preferably each pianola part is performed on four instruments). The unpitched battery contains four bass drums, tamtam, several electric bells, siren, and three propellers: two of wood (small and large) and one of metal. This large ensemble is centered around the pianos and pianolas; as Antheil said: "Piano is the basis of sound in *Le Ballet Mécanique* as strings are the basis of sound for orchestra."⁸⁹

The original 1924 score states a performance time of around thirty minutes; as the film was barely half as long, this obviously led to a difficulty in coordinating the original version of the piece with the film. To facilitate this in modern performances, several hundred measures have been removed from the score; this effectively eliminates much of the silence that was to

⁸⁶ Whitesitt, Antheil, 70.

⁸⁷ Imbs, Confessions, 45.

⁸⁸ Whitesitt, Antheil, 70.

⁸⁹ Shirley, "Mary Curtis Bok," 10.

accompany the end of the film. There is also a debate about proper tempo: the only two markings Antheil made list the tempo as quarter note equals either 85 or 152 beats per minute.⁹⁰ Neither of these tempos seems to be accurate, as most performers consider 85 to be rather slow and pedantic and 152 is too fast for the human performance of the pianos and xylophones. Most current performances place the tempo between 100 and 130.

Le Ballet Mécanique cannot be understood with conventional analytical methods or formal expectations. The work cannot be described as "tonal" in any way: there are no themes developed here, no recognizable, tuneful melodies, no recapitulations in the home key. If some motives sound briefly tonal, it is only in contrast to the complete lack of consonance found through most of the work. Equally, however, there is no relation to any kind of dodecaphonic system, but rather the piece is built from specific motivic ostinato patterns. In a similar manner to Stravinsky's early "primitive" works, these patterns change from one to the next with no transition, and, while they sometimes occur simultaneously, there is very little development of motivic ideas.

The lack of development in the form and melody is mirrored in other elements of the piece. The entirety of the score is devoid of dynamic markings. Dynamic contrast is achieved either by adding or removing instruments or expanding or decreasing the amount of pitches present. This technique is made possible by the massive performing forces including a strange battery of electric bells, airplane propellers, and siren. Additionally, the quarter note pulse remains constant, although we do not perceive it as such; the audience perceives a gradual speeding up of tempo through the use of progressively smaller note values. The all-percussion ensemble results in very few timbral changes; there are no winds or strings, just a constant wall

⁹⁰ Paul D. Lehrman, "The Ballet mécaniqeu Project: Technology Catches Up with Antheil," Ballet mécanique (Milwaukee: Schirmer, 2003) xv.

of percussive sound. Antheil described the work as "streamlined, glistening, odd, musically silent..." and these descriptors, while vague, seem to reflect this lack of development present in most aspects of the piece. ⁹¹

b. Form

With no development or themes to speak of, the formal structure is understandably difficult to describe. Oja classifies the work as a sort of modified sonata-rondo, with the beginning functioning as a ritornello, sections delineated by entrances or exits of some of the auxiliary percussion like the electric bells and siren.⁹² However, no motive returns frequently or regularly enough to be considered the refrain of a rondo and, given the high rate of pattern change throughout *Le Ballet Mécanique*, it is inevitable that some of those auxiliary percussion events would happen at what may appear to be structural or formal boundaries.

With the lack of any tonal center or thematic development, describing the piece as a sonata is also an inaccurate representation. And, while the opening material does return toward the end of the piece, it is too brief to be a true recapitulation as it lasts for only a fraction of that of the original iteration. Smaller forms, such as a binary or ternary, are wildly ill-equipped to describe the scale of the work. I argue that a traditionally formal view of this piece is not only completely inaccurate but furthermore neglects a large part of what made the work groundbreaking.

Unsurprisingly, Antheil spoke quite a lot about his thoughts on the form of *Le Ballet Mécanique*. The composer described the form as "the whole that is ONE and gigantic," a

⁹¹ Antheil, "My Ballet," 456.

⁹² Oja, "Transatlantic Modernism." 189, 193.

massive "AAAAAAAAAAAform," and "a single section repeated 25 times."⁹³ This interpretation, while novel, is also not accurate; while some of the motivic material does repeat, it is clear that the entire work is not simply a repetition of the opening.

In Antheil's "My Ballet Mécanique," he criticizes tonal composers for the way they organize and structure their pieces:

"I believe that all the forms today are merely parades and arrangements, derived from a tonal nuclei; section A against section B with section C added thereto...all with slight overlappings. Parades. Various formations. Interminglings. In my eyes it is impossible to give further consideration to the tonal forms."⁹⁴

However, if one removes the references to "tonal nuclei" and "slight overlappings," this is a perfect description of the underlying construction of *Le Ballet Mécanique*. The piece is made up of a procession of motives, connected more by their proximity than by any developmental transition. These "ostinato blocks" appear and disappear at random, and occasionally occur simultaneously. Whereas Stravinsky used the combination of ostinato motives to create and develop new patterns, Antheil's combinations simply exist in time space and cease when a new motive begins. The complete lack of fulfilled expectations confuses the audience and builds tension but never allows for release. Nothing reliable enough for a resolution occurs, leaving the listener disoriented for the whole of the work.

It is, therefore, meaningless to consider form in a piece that was composed largely without structure. Neither traditional viewpoints nor Antheil's assertion of a giant single entity can illuminate meaningful relationships or hidden elements of the work. Given what Antheil was focused on during this period and his statements that "the only canvas of music can be time," and that "music does not exist all at once like a painting, but we must consider it as such," lead to the

⁹³ Whitesitt, Antheil, 70.

Schmidt-Pirro, "Avant-Garde," 409.

Antheil, "My Ballet," 455.

⁹⁴ Ibid.

strange conclusion that the best interpretation may be no interpretation at all. ⁹⁵ The work is experienced as one portion of time, and an attempt to delineate this portion of time may well take away from its intended purpose. True, I do not think the claim can be made that *Le Ballet Mécanique* was the "beginning of space and time in music."⁹⁶ However, it was for all intents and purposes "new," a work "with no motion or movement" that owes more to Picasso than Beethoven.⁹⁷

c. Motives

Much of the musical material in *Le Ballet Mécanique* is written in the same aesthetic. These motives are all distinct, but sound familiar enough that the concepts of similar and different are almost blurred in this piece. Dissonant intervals like sevenths and ninths and quartal harmonies reappear often. For example, the initial form of Motive I (beginning at measure 105), shown below:



Figure 1: Motive I, Measure 105

has a contour very similar to those of Motive M and Motive S, described below. Likewise, Motive H (measure 77):

⁹⁵ Schmidt-Pirro, "Avant-Garde," 413.

Whitesitt, Antheil, 105.

⁹⁶ Ford, *Paris*, 36.

⁹⁷ Antheil, "My Ballet," 456.



Figure 2: Motive H, Measure 77

and Motive U (measure 530):



Figure 3: Motive U, Measure 530

though dissimilar in harmonic content, both emphasize the melodic interval of the third.

There is nothing stable or regular about the motives and how they are structured. The periodicity, especially, is mostly random. These are not the constant ostinato patterns found in the works of composers like Stravinsky. Take, for instance, the following motive, named M. This motive first appears in mm. 403-438.



Figure 4: Motive M, Measure 403

On first glance, the motive seems comparatively simple. An initial quarter note chord consisting of quartal harmony in the bass voices and a minor-Major seventh chord in the upper voices is followed by stepwise descending eighth notes, ending a fifth below the starting chords and then turning around, ascending with quarter notes. Were this a piece based on traditional ostinato structures and patterns, the audience should expect this figure to repeat exactly. However, even the first repetition of Motive M deviates from its initial form: it does not return to its initial starting pitch of A, instead only reaching G before descending again. Perhaps, in a different work, this method would set up a sequential pattern. Predictably, this is not the case in *Le Ballet Mécanique*, for the second repetition varies the motive even further: it completely forgoes the ascent and leaps directly up to the A. After this deviation, the pattern almost seems to fall apart. Sometimes the quarter notes in the ascent are replaced by eighth notes, sometimes a single eighth note chord in the descent is replaced by a quarter note. Occasionally, the motive reaches its peak and simply repeats that chord for as many as five quarter notes. Each iteration of the motive is clearly identifiable as the figure, but varies widely in form and length and which version of the motive will repeat is completely random.

Another example occurs very early on in the piece with Motive B. It makes its initial appearance in measure 7, where it seems to briefly be confined to traditional ostinato roles.

24



Figure 5: *Motive B, Measure 7*

However, this motive differs in function from many of the other materials in that it seems to appear throughout the piece at random, often only for a single measure, intersecting several other figures in the process. Motive B is mimicked by a similar one, B2, which functions in much the same way, using a triplet pattern instead of sixteenth notes.



Figure 6: Motive B2

The instances of B2 are mostly confined to the middle of the piece, occurring near measure 500, while the original B motive reappears throughout the work, especially concentrated toward the end.

An even more confusing example can be found in Motive N. This particular motive is noteworthy for its use of silence as part of the compositional process. Motive N's first form appears in measure 420. As can be seen, it consists of parallel augmented octaves:



Figure 7: Motive N, Measure 420

But, as before, the pattern is soon twisted. It is lengthened at random: sometimes it descends the original fourth, sometimes a fifth or a sixth, and there is no consistency as to which version will come next. Once this inconsistency is established, Antheil takes it a step further by inserting occasional quarter rests into the motive, such as at measure 439. Although these cease after only a few measures, a new problem arises in that the motive is suddenly doubled in the xylophone part and transposed a fifth higher. The original form continues in the piano part (offset by the pianolas on Motive A1) while this new iteration continues the idea of silence: the utterances in the xylophones are offset by much larger breaks, sometimes complete measures of rests. The rhythm in the xylophone version begins to break down, as well, as the xylophones insert a duple two-sixteenth-eighth pattern where the triplets had been before.

Finally, Motive S further subverts expectations. This motive, similar in content to Motive M and N, makes use of minor ninths.



Figure 8: Motive S, Measure 504

The rhythmic pattern, as with many of the other motives, becomes a bit mangled, freely mixing eighths and quarters. On its own, this manipulation of the motive would not be so surprising, given the context of this piece. What is different about Motive S, however, is the inclusion of a second section after the initial motive has already been established. S2, a fanfare-like addition inserted into the beginning of Motive S, serves to disorient the listener further.



Figure 9: Motive S2, Measure 522

Equally confusing is the fact that S2 does not reappear on every repetition of Motive S, instead recurring randomly whenever S is present.

It is these motives – random, non-developmental, and disorienting – which most closely tie the music to the film. Though the two media may seem disparate, the ostinato block technique is mirrored by the looping, disconnected film clips. The lack of melody here is echoed by the lack of plot, and lack of predictability only heightens the disorientation felt by the audience.

2. Film

a. Performance Forces

The visual aspect of *Le Ballet Mécanique* was incredibly influential for abstract cinema. The opening credits bill the work as "The first film without a plot," which becomes obvious even before the credits end when a Cubist representation of Charlie Chaplin (Charlot, in French) appears on the screen and proceeds to fall to pieces, quite literally. The rest of the film follows in a similar vein – without a plot, the film is structured around series of repeated images divided into several categories: geometric (triangular or circular shapes), idyllic/slice-of-life (garden scenes, a woman on a swing, street scenes, playgrounds, etc.), machine elements (pendulums, pistons, spinning contraptions, etc.) as well as miscellaneous images, including a section of intertitles and several shots of an androgynous woman's face. Of note is the special kaleidoscopic effect made possible by Murphy's signature beveled camera lenses.

As in the music, there is debate in film and art circles pertaining to the role of the machine aesthetic in this work and what exactly it means. Ray and Murphy, for their part, were largely uninterested in the mechanical idea; though some parts of Murphy's erotic version of the film compare the act of sexual intercourse to engine pistons, for their most part the goal was to present a satirical Dada montage.⁹⁸Likewise, Ray mentioned that he took most of the random

⁹⁸ Delson, *Dudley Murphy*, 51.

Moritz, "Ray and Murphy," 126.

scenes, "without any attempt at careful choice of people or setting, emphasizing the idea of improvisation."⁹⁹ Clearly the comparison between human and machine was not the focus for the photographers. While some film critics, such as P. Adams Sitney, saw a "humanization of objects and mechanization of humans" in the film, Léger seemed to see it only as a method – he focused on "speed [as] the law of the modern world," saying that "life rolls by at such a speed that everything becomes mobile.¹⁰⁰ The rhythm is so dynamic that a 'slice of life' seen from a café terrace is a spectacle."¹⁰¹ Léger's intent, then, was to give movement to an object (regardless of what that object was), forcing it to become plastic.¹⁰²

b. Form

Most interpretations of the film make use of segmentation to describe the form and structure. Malcolm Turvey claims that what the film really focuses on is revolution: its purpose to change the perception of reality. He demonstrates this interpretation by reading compartmentalization into the film, so that reality is "no longer perceptualized as smooth, but now fragmented and unstable flux."¹⁰³ Other analysts, too, describe a sectionalized form. For David Bordwell and Kristen Thompson there are nine segments: opening credits, an introduction of rhythmic elements, the addition of the beveled lens, rhythmic movements, comparison of people and machines, rhythmic movements and intertitles, rhythmic movements of circular objects, a "quick dance of objects" and a final return to opening material.¹⁰⁴ Standish Lawder echoes these

⁹⁹ Lawder, Cubist Cinema, 118.

¹⁰⁰ Norden, "Avant-Garde Cinema," 409.

¹⁰¹ Malcolm Turvey, "The Avant-Garde and the 'New Spirit:' The Case of 'Ballet Mécanique,'" *October*, 102 (Autumn 2002), 42.

 ¹⁰² Fernand Léger, *The Functions of Painting*, trans. Alexandria Anderson, (New York: Viking Press, 1973), 35, 48.
 ¹⁰³ Turvey, "New Spirit," 39.

¹⁰⁴ David Bordwell and Kristen Thompson, Film Art: An Introduction, (New York: McGraw-Hill, 2001), 151.

structural findings, adding that the film is a "mouvement écranique," a film technique in which each shot cues the next.¹⁰⁵

These segmented interpretations of the film are taken from Léger himself, who envisioned seven sections to the film (or "vertical parts," as he described them), which got progressively faster and were interspersed with dissimilar "horizontal parts."¹⁰⁶ Léger's notes show that he was focusing on the rhythmic aspect of the film, both expected and unexpected: "divide the screen into equal sections, and project the same picture – absolutely similar – in different rhythms" and "at sudden intervals, a perfectly ordinary view of anything."¹⁰⁷ His quasimusical score detailed seven parts that would get progressively faster. "From one end to the other the film sustains an arithmetical law that is rather precise, as precise as possible....An object is projected at the rhythm of: 6 images a second for 30 seconds; 3 images a second for 20 seconds; 10 images a second for 15 seconds."¹⁰⁸ However, as noted, it is very unclear which members contributed what material to the film. As Murphy and Ray claimed most scenes were filmed before Léger was involved, and that they had intended the film to be a collage, a form that rejects structure inherently, it is difficult to assert that Léger imparted this clear sense of segmentation. Turvey agrees, stating that the segmentation analysis is "imprecise and arbitrary."¹⁰⁹

Therefore, like the music, it might be more telling to forego a sectional interpretation of this film. Without a plot or narrative thread, the typical audience member no longer has a method to follow the film. Regardless of whether the segmentation described above is a definite structure put in place by Léger or simply a perceived structure found by grouping items, it is nearly impossible to experience while watching the film, especially for a person unfamiliar with

¹⁰⁵ Lawder, *Cubist Cinema*, 149.

¹⁰⁶ Brender, "Léger's Cinema," 51.

¹⁰⁷ Ibid., Lawder 123, 127.

¹⁰⁸ Lawder, *Cubist Cinema*, 131.

¹⁰⁹ Malcolm Turvey, *The Filming of Modern Life*, (Cambridge: The MIT Press, 2011), 51.

abstract film. Even style, a cue generally used to experience these types of works, does not lend much help to understanding the film. Elements such as color are irrelevant in a black and white film (though there is some evidence that earlier versions may have been in color), and exposure stays constant throughout.¹¹⁰ Neither mise-en-scene nor editing do much to assist in perception, either – isolated as they are, the objects in most shots are taken out of context and need to be understood in a non-traditional way. Contrast, then, is one way to understand the work, as Léger said in another instance: the film was "focused on contrasting objects, slow and rapid passages, rest and intensity."¹¹¹ Contrast is expressed through the heavy use of dissonant jump cuts; this creates an inherent rhythm, but it too is difficult to perceive and understand. The goal of the work, then, as Léger says of film in general, is to move "from storytelling to collective spectacle."¹¹² Le Ballet Mécanique is, above all, a work of art displayed in temporal duration, a "picture orchestrated like a musical score," and should be perceived within the context of time.¹¹³

3. Interaction of Film and Music

Both the film and the music are composed in similar ways: unstable cycles of particular scenes or motives recur at random. The aperiodic motives of the music can easily be seen as a corollary to the nonisochronous shots and sequences of the film. Though a segmented understanding is possible, these groupings are nearly impossible to perceive while viewing the film or listening to the music. Furthermore, I question whether a focus on this segmentation is the best way to experience either part of the work.

¹¹⁰ Delson, *Dudley Murphy*, 61.

¹¹¹ Léger, Functions, 50.

¹¹² Brender, "Léger's Cinema," 48.¹¹³ Turvey, "New Spirit," 48.

Certain aesthetic elements of both media, such as dissonance and mechanism, as well as formal elements like tempo and lack of subject matter, are also similar. There is an apparent (albeit gradual and difficult to perceive) acceleration found in both portions of the work – the film through consistently shortened shots and the music through smaller note values. Both also make brief returns to beginning material at the end – the woman swinging in the garden and Charlot paired with the opening motives of the music. Stuckenschmidt likened Antheil's musical structure to "a kaleidoscope";¹¹⁴ though this could be simply be a pretty description, it could also link back to the kaleidoscopic effects of the film. "The first film without a plot" seems to be echoed in Antheil's tuneless music; indeed, the composer once declared that "melody does not exist!"¹¹⁵ Both music and film are composed with techniques that achieve their effects through indirect means. Léger's claim that "the subject and object are nothing - it is the effect that counts" relates to Antheil's statement that "melody is rhythm, comes out of rhythm."¹¹⁶ As Léger himself said: "by isolating a thing, you give it personality."¹¹⁷ Through the use of continuous repetition, nearly every aspect of the film and music are focused on in this way. There are mechanistic connections found in both, not least in the title itself. Though in both cases, as Léger said, the "mechanical element is only a means and not an end"; the film and music make use of these elements but are not expressly mechanistic.¹¹⁸

Though there is clear evidence that both film and music were created with the same aesthetic and similar methods of construction, the noncontemporaneous effect gained from experiencing both media is especially interesting. While both visual and aural forms seem to be

¹¹⁴ Schidmt-Pirro, "Avant-Garde," 410.

¹¹⁵ Ibid., 413.

¹¹⁶ Léger, *Functions*, 49.

Schmidt-Pirro, "Avant-Garde," 413.

¹¹⁷ Léger, Functions, 50.

¹¹⁸ Turvey, "New Spirit," 47.

derived from the use of nonperiodic sequences, there is almost no simultaneity to be found in the work as a whole. One could make the argument that, in its current twenty-first century form with measures missing from the music to accommodate the film, the music and film are not viewed in their original form and the intention of the artists is lost; however, this claim cannot be proven given the lack of communication between its creators. If the composer and filmmakers (whoever they may have been) intended the work to be viewed in a certain way with synchronous sequences and attacks, then they should be expected to have spoken in length about how the musical and visual elements would have interacted. What the audience is left with, however, is a musical composition twice as long as the film – clearly synchronicity was not a goal of the project. Rather, the isochronous interplay between both media serves to deliberately hinder the audiences' already disoriented perception. The end result is a complex, intentionally disconcerting, and "willfully nonconformist" combination of aural and visual media.¹¹⁹

As the music and film are such novel and difficult to characterize elements, I have created a Microsoft Excel spreadsheet as a tool for visual analysis (Appendix 1). This document places analyses of the aforementioned versions of the music and film directly against each other so that the two media can be inspected simultaneously. This is a temporal representation, as well: each specific musical measure is scaled according to its time signature, and the filmic aspects are based on half-second intervals. Though most of the analysis is clearly presented with different colors representing different material, short black blocks in the music section represent moments in which there is no clear motive occurring. Rows in the music are divided by motives; rows in the film are divided by content and effects. A shorthand system also denotes which instruments are playing in which measures. Using this tool, it is clear to see how, though the two media are rarely synchronized, they are structured in an incredibly similar manner. It also becomes obvious

¹¹⁹ Bordwell and Thompson, *Film Art*, 128.

how both film and music seem to "speed up" over the course of the work through shortened time signatures and shorter film shots.

With so many disparate elements and no formal organization, one must wonder how an audience understands what is happening in this work. How does the human mind perceive one medium of nonisochronous sequences, much less two media changing at different rates? Is it possible to truly comprehend all of what is happening in this work, or even some of it? Psychological and cognitive methods, such as Gestalt and theories of time perception, are necessary to answer these questions.

III. DISCUSSION

A. Gestalt

Gestalt Psychology is primarily a theory about how humans perceive things by grouping them together. Its earliest forms, championed by the likes of Max Wertheimer and Kurt Koffka, began in the late nineteenth century. Oliver Reiser defines Gestalt as "spatio-temporal organisation, or pattern, of matter in which the relations are internal to each other."¹²⁰ This means that patterns of things that are similar to each other get grouped together, and when things change, a new Gestalt grouping is initiated. Both similarity and time-proximity are necessary in order to group things together under a Gestalt model.¹²¹ These groups obviously affect perception and comprehension of objects and events, generally making them easier to understand.

Gestalt is a large and broad concept, but several distinct elements are at work when it is applied to music. In this context, Gestalt groupings are often tied to hierarchical structures like meter and harmony, and top-down methods of understanding, such as harmonic rhythm.¹²² Even non-traditional forms reveal these perceptive strategies: "processing of irregular sequences…reveals top-down cognitive structures."¹²³ However, Gestalt groupings are not always black and white. Group boundaries may be affected by differing ideas, such as feature theory or schema theory, and could be brought about by anticipation or memory.¹²⁴ Additionally, groups may be affected by whether a listener is perceiving vertical, harmonic boundaries or those

¹²⁰ Oliver L. Reiser, "Time, Space and Gestalt," Philosophy of Science, 1.2 (April 1934), 198.

¹²¹ Harold Osborne, "Artistic Unity and Gestalt," *The Philosophical Quarterly*, 14.56 (July 1964), 219.

¹²² Eugene Narmour, "Music Expectation by Cognitive Rule-Mapping," *Music Perception: An Interdisciplinary Journal*, 17.3 (Spring 2000), 368, 386.

¹²³ Christiane Neuhaus and Thomas R. Knösche, "Processing of Rhythmic and Melodic Gestalts – an ERP Study," *Music Perception: An Interdisciplinary Journal*, 24.2 (December 2006), 222.

 ¹²⁴ Mark Reybrouck, "Gestalt Concepts and Music: Limitations and Possibilities," in *Music, Gestalt, and Computing: Studies in Cognitive and Systematic Musicology*, ed. Marc Leman, (New York: Springer, 1997), 63, 65.

brought on by horizontal melodic lines.¹²⁵ A general view of Gestalt, initially a visual theory, can be seen in the visual analysis of *Le Ballet Mécanique* in Appendix 1. The patterns that are both similar and proximal in time are grouped together: these groups can clearly be seen by the sections of color in the analysis. When one group comes to a close, a second group begins immediately afterward. Although the same theme or motive may reappear later in the work, these multiple instances are not grouped together as they contiguous occurrences.

B. Time Perception

Cognitive scientists are still not sure how time itself is perceived. Two prevailing theories are those of interval and entrainment. The former postulates that pulses are emitted in the brain and subconsciously counted to measure duration, while the latter is based on the idea of events being compared to mental oscillations which classify moments as early, late, or on time.¹²⁶ Even the concept of perceiving time is difficult to grasp – the line between past and present is blurred and time itself must become an object to be observed. As Maryam Moshaver puts it, "when present of sound passes into retention, retention itself is also present."¹²⁷ Though we perceive time as a continuum of events, the idea of time as a line is a human construct, and a distinction needs to be made between the "before" and "having-gone-before" and the "being-together" and the "being-all-at-once" must be made.¹²⁸ Furthermore, there is a difference between "real time" is progressing.

¹²⁵ Leman, Schema Theory, 61.

¹²⁶ J. Devin Mcauley, "Tempo and Rhythm," in *Music Perception*, ed. Mari Reiss Jones, Richard R. Fay, and Arthur Popper, (New York: Springer, 2010), 169.

¹²⁷ Maryam A. Moshaver, "Telos and Temporality: Phenomenology and the Experience of Time in Lewin's Study of Perception," *Journal of the American Musicological Society*, 65.1 (Spring 2012), 197.

 ¹²⁸ Edmund Husserl, On the Phenomenology of the Consciousness of Internal Time (1893-1917), trans. John Barnett Brough, (Boston: Kluwer Academic Publishers, 1991), 81.

¹²⁹ Reybrouck, "Gestalt Concept," 60.

This is true especially when applied to music; the concept of duration is constructed by rhythm, which may not always be uniform or temporally regular.¹³⁰

Any type of grouping mechanism, including Gestalt, will alter the perception of time. Often, elements of rhythm will be perceived to "migrate" toward the boundary points of these groups.¹³¹ This is because humans in general have a tendency to group objects and durations in simple ratios, such as 1:1 and 2:1.¹³² Additionally, people prefer consistent patterns of strong and weak accents and those that are evenly-spaced.¹³³ Anticipation and the subversion of these expectations, then, affect perception. Predictability results in pleasure, and while periodic timings are most easily perceived, random events hinder cognition and cause physiological stress.¹³⁴

Perhaps obviously, then, more regularity results in greater perceptual accuracy. Several experimental tests have shown that a regular musical meter will produce better temporal acuity than an irregular meter; specifically, isochronous sequences produce more stable hearing than non-isochronous ones.¹³⁵ The sequences of film and music found in *Le Ballet Mécanique* can most definitely be classified as "non-isochronous," thereby further interfering with temporal perception. Unexpected, irregular patterns like these thus necessitate rapid shifts in attention.¹³⁶

¹³⁰ Paul Fraisse, *The Psychology of Time*, trans. Jennifer Leith, (New York: Harper and Row, 1965), 76.

¹³¹ Aniruddh D. Patel, *Music, Language, and the Brain*, 106.

¹³² Mari Riess Jones, "Musical Time," in *The Oxford Handbook of Music Psychology*, ed. Susan Hallam, Ian Cross, and Michael Thaut, (New York: Oxford University Press, 2008), 82.

¹³³ Caroline Palmer and Peter Q. Pfordresher, "Incremental Planning in Sequence Production," *Psychological Review*, 110.4 (October 2003), 688.
Elizabeth Murrie, "The Demonstration of Phythm in Non Tornel Music: Phythmic Contours in the Music of Ed.

Elizabeth Marvin, "The Perception of Rhythm in Non-Tonal Music: Rhythmic Contours in the Music of Edgard Varèse," *Music Theory Spectrum*, 13.1 (Spring 1991), 71.

 ¹³⁴ David Brian Huron, Sweet Anticipation: Music and the Psychology of Expectation, (Cambridge: MIT Press, 2006), 175, 307.

¹³⁵ Jones, "Musical Time," 83, 86.Ibid., 83.

¹³⁶ Edward W. Large and Mari Reiss Jones, "The Dynamics of Attending: How People Track Time-Varying Events," *Psychological Review*, 106.1 (1999), 123.

Recall is also an important component of perception; this sense is hindered by similarity.¹³⁷ As many of the musical and visual motives are similar, and due to the large amount of repetition inherent in the work, it can be assumed that recall of *Le Ballet Mécanique*, and by extension perception, would be adversely affected.

C. Perceptual Relationship to Le Ballet Mécanique

Both film and music, even those as untraditional as *Le Ballet Mécanique*, contain rhythm. It is these rhythms, described by Marian Winter as outwardly-perceived (as in film) and inwardly-perceived (as in music), that make up the sequences and perceptual interaction when experienced simultaneously.¹³⁸ The unsympathetic stimuli and patterns of this piece can only serve to disorient the audience when experienced together.

Because Gestalt groupings are most often informed by meter and hierarchy, it stands to reason that the irregular structure of *Le Ballet Mécanique* will cause disorientation. With no hierarchy to speak of, there is no way for the audience member to organize the groups. This is further made difficult by the differing rates in the music and film; additionally, as the groupings constantly change duration there is no way to anticipate when the next change of patter will occur. There are also durational limits to Gestalt groups; Marc Leman proposes that groups must be limited to less than five seconds.¹³⁹ The pattern durations found in the music of *Le Ballet Mécanique* are many and varied, but several are longer than five minutes, including a particularly memorable pattern that continues for two minutes. Furthermore, a tonal hierarchy seems to be necessary for perception, as only three or four events on one structural level can be organized

¹³⁷ Palmer and Pfordresher, "Sequence Production," 684.

¹³⁸ Marian Hannah Winter, "The Function of Music in Sound Film," *The Musical Quarterly*,27.2 (April 1941): 153. ¹³⁹ Leman, *Schema Theory*, 107.

together with Gestalt principles.¹⁴⁰ Without this hierarchical system, it is very difficult for a listener to attend to all of the events in this music. Many of the musical patterns in the piece can be considered ostinati, without a discernible melody – these continuous ostinati are often perceived as "empty," which leads to a further loss of time.¹⁴¹ With no familiar sense of tonality in the music or plot in the film to control attention, the audience is left adrift in a sea of confusion. James Tenney and Larry Polansky have observed that non-traditional types of music such as serial and aleatoric result in a sort of homogenous low hierarchical level, stating the perception that "everything is changing, everything remains the same."¹⁴² Though *Le Ballet Mécanique* is neither serial nor aleatoric, presumably the lack of hierarchical structure will produce similar results.

There has been no previous scholarship focusing on the cognition and perception of *Le Ballet Mécanique*, but research focusing on other non-traditional works may illuminate some strategies and characteristics of perception. In relation to similar compositional methods of Stravinsky, Gretchen Horlacher makes the insightful claim that "repetitive music…reduces the elements of music to one single component: periodicity."¹⁴³ These repetitive ostinato patterns are also present in *Le Ballet Mécanqique*, and indeed the core of the formal structure depends on these periodic groups. Similarly, Stravinsky's patterns are often similar in melodic content, but not in rhythm or meter; the discontinuity present forces the listener to shift their perception to

¹⁴⁰ Joseph P. Swain, "The Need for Limits in Hierarchical Theories of Music," *Music Perception: An Interdisciplinary Journal.* 4.1 (Fall 1986), 121.

¹⁴¹ Eugene Narmour, The Analysis and Cognition of Basic Melodic Structures: The Implication-Realization Model, (Chicago: Chicago University Press, 1990), 37.

¹⁴² James Tenney and Larry Polansky, "Temporal Gestalt Perception in Music," *Journal of Music Theory*, 24.2 (Autumn 1980), 235.

¹⁴³ Gretchen Horlacher, "Multiple Meters and Metrical Processes in the Music of Steve Reichn," *Intégral*, 14/15 (2000/2001), 265.

these musical relationships.¹⁴⁴ As shown earlier, Antheil made use of similar strategies in the formation of his motivic language. Elizabeth Marvin has noted comparable relationships in the music of Varese, in which rhythmic contours alter the listener's perception, resulting in relative as opposed to absolute temporal relationships.¹⁴⁵ Listeners have even been shown to perceive caesuras in between the groups in music by Boulez, regardless of whether or not a pause actually exists.¹⁴⁶ Finally, the rhythm of Ligeti's music is found not in duration, but rather in frequency of specific notes.¹⁴⁷ This compositional choice parallels Antheil's disregard of the printed meter, instead creating periodic formations through the repetition of motives.

In the words of Edgard Varese, "cinema is essentially an art of fragments assembled to form a new unity."¹⁴⁸ Although Varese was describing different frames of film, one could also make the argument that the music is another fragment brought into this unity. Antheil himself, decades after composing *Le Ballet Mécanique*, complained of problems with film music fitting the mood and timing of what it is paired with.¹⁴⁹ Unfortunately, modern film criticism reduces all relationships between music and film to either parallel (similar) or contrapuntal (dissimilar).¹⁵⁰ This is not always the best way to talk about their interaction, especially in a non-traditional work like *Le Ballet Mécanique*. Traditional film relies on music as a method for suspending disbelief; in a work like this one, however, made up of "no scenario…interactions of rhythmic

¹⁴⁴ Marianne Kielian-Gilbert, "The Rhythms of Form: Correspondence and Analogy in Stravinsky's Design,." *Music Theory Spectrum*, 9 (Spring 1987). 48, 50.

¹⁴⁵ Marvin, "Rhythmic Contours," 64-65.

¹⁴⁶ Irene Deliege, "A Perceptual Approach to Contemporary Musical Forms," *Contemporary Music Review*, 4, (1989), 227.

 ¹⁴⁷ Jane Piper Clendinning, "The Pattern-Meccanico Compositions of György Ligeti," *Perspectives of New Music*, 31.1 (Winter 1993), 203.

¹⁴⁸ Marc Treib, Space Calculated in Seconds, (Princeton: Princeton University Press, 1991), 114.

¹⁴⁹ George Antheil, "Music Takes a Screen Test," *The American Scholar* 6.3 (Summer 1937): 355.

¹⁵⁰ Nicholas Cook, Analysing Musical Multimedia, (New York: Oxford University Press, 1998), 107.

images, that is all," music holds a different purpose.¹⁵¹ Here, its goal is a second form of rhythm, paired with the visual rhythm found in the loop-printing and montage techniques.¹⁵² Music and image don't combine in additive manner, but rather interact to create a "semantic effect," a new unified whole.¹⁵³

How music and film interact will affect perception. Annabel Cohen has proven that a secondary function of music in film is to assist the audience in memory; however, as the tests were focused on narrative forms of film, it remains to be seen whether the same could be said for experimental works.¹⁵⁴ Cohen has also theorized about the presence of visual "tonality" in film, stating that it could be considered a central character or theme.¹⁵⁵ If that is the case, then *Le Ballet Mécanique* is doubly atonal for the lack of narrative as well as musical tonal center. A visual stimulus will also have an effect on the hearing of music – a still image is likely to result in a passive response while a montage active, aroused response.¹⁵⁶ Interestingly, temporal aspects of music were affected by visual stimuli, but pitch and harmony were not.¹⁵⁷ This may be because a montage has an inherent rhythm, which conflicts with the temporal perception of the music. Sergei Eisenstein, considered the father of the montage, agreed, stating there are musical

¹⁵¹ Kathryn Kalinak, Settling the Score: Music and the Classical Hollywood Film, (Madison: University of Wisconsin Press, 1992), 33. Treib, Space, 247.

¹⁵² A. L. Rees, A History of Experimental Film and Video, (London: BFI Publishing, 1999), 45.

¹⁵³ George Sirius and Eric F. Clarke, "The Perception of Audiovisual Relationships: A Preliminary Study," *Psychomusicology*, 13, (1994), 121.

¹⁵⁴ Annabel J. Cohen, "Film Music: Perspectives from Cognitive Psychology," In *Music and Cinema*, ed. James Buhler, Caryl Flinn, and David Neumeyer, (Middletown: Wesleyan University Press, 2000), 360.

 ¹⁵⁵ Annabel J. Cohen, "Music Cognition and the Cognitive Psychology of Film Structure," *Canadian Psychology*, 43.4 (November 2002): 221.

¹⁵⁶ Marilyn G. Boltz, Brittany Ebendorf, and Benjamin Field, "Audiovisual Interactions: The Impact of Visual Information on Music Perception and Memory," *Music Perception: An Interdisciplinary Journal*, 27.1 (September 2009), 50.

¹⁵⁷ Boltz, Ebendorf, and Field, "Audiovisual," 52.

implications found in the technique.¹⁵⁸ The exact perception involved in film and music, however, is still debated.

Paul Fraisse's view of "real time" behaving differently from "perceived time" is clearly demonstrated in Le Ballet Mécanique, and is supported by cognitive research. Scott Brown and Marilyn Boltz found definitively more errors in testing time perception when subjects were asked to attend to dual-tasks, such as error detection or listening for targets.¹⁵⁹ A complex second task, such as listening to music while watching a film, in the case of Le Ballet Mécanique, would presumably further confound and distort the perception of time. An auditory stimulus has been shown to increase levels of arousal and attention; however, the introduction of a second mental task also depletes processing resources.¹⁶⁰ Conflicting ideas of whether time is perceptually shortened or lengthened both have merits: the Ornstein storage size hypothesis claims that the more mental space that is consumed, the longer the perceived duration will be, while W. D. Poynter has found evidence that complex sequences are actually perceived as shorter than their real-time duration.¹⁶¹ It is difficult to tell, then, how a difficult to comprehend organization like Le Ballet Mécanique's will affect time perception. The use of nonisochronous sequences may result in a shorter perceived time, but a more complex organization involving two different media could result in longer perception due to the amount of mental processing necessary. Alternately, it is possible for both of these theories to be at work, lengthening the perception of some passages and shortening others. Oftentimes, two stimuli can be falsely heard as synchronous. This perceptual overgeneralization is likely due to a concept known as the "unity

¹⁵⁸ Cohen, "Cognitive Psychology," 218.

¹⁵⁹ Scott W. Brown and Marilyn G. Boltz, "Attentional Processes in Time Perception: Effects of Mental Workload and Event Structure," *Journal of Experimental Psychology: Human Perception and Performance*, 28.3 (2002): 609.

¹⁶⁰ Annabel J. Cohen, "How Music Influences the Interpretation of Film and Video: Approaches from Experimental Psychology," *Selected Reports in Ethnomusicology*, 12 (2005), 28.

¹⁶¹ Brown and Boltz, "Attentional Processes," 602.

assumption," which states that humans are motivated to maintain congruence in perception.¹⁶² This idea is enforced by Cohen's studies of musical and visual stimuli, which are often altered to be heard and seen as a perceptual match even when incongruent.¹⁶³ In a work like *Le Ballet Mécanique*, the unity assumption could wreak havoc on time perception. The audience would want the film and music to coordinate as it usually does in traditional film styles. Expecting the visual and aural cycles to begin and end simultaneously would obviously alter the perceived duration of one or both of the media. Furthermore, the cycles in both film and music are of many different lengths, but they may be perceived as shorter or longer depending on the cycles occurring before or after them.

¹⁶² Boltz, Ebendorf, and Field, "Audiovisual," 57.

¹⁶³ Cohen, "Influences," 25.

CONCLUSION

A set of incredibly unreliable creators. Music with no structure and no melody. Film with no form and no plot. No sympathy or cohesion to be found across the media. *Le Ballet Mécanique* almost seems like it has become famous simply for what it lacks. However, regardless of exactly who created it and with what intentions, it was a revolutionary work constructed in innovative ways. The visual techniques continue to shape abstract film today, and the deeply percussive music has influenced composers for decades. What is often overlooked, though, is the utter nonexistence of structure and what it does to our perception. By subverting the expectations of their 1923 audience and even those of today, the composer and filmmakers created a work that is, at its heart, intentionally disorienting and formless. Attention is taxed, time is lost, and confusion is gained. And no matter how we, as humans, wish to categorize and organize everything we perceive, sometimes this is not the best method for comprehension; not everything can be placed nicely and neatly into little structural boxes. This is a work defined by what it is not, and in the process it forces the audience to understand it in unconventional ways.

BIBLIOGRAPHY

BIBLIOGRAPHY

Antheil, George. Bad Boy of Music. Garden City: Doubleday, Doran, and Co, 1945.

-----. Ballet mécanique. Milwaukee: Schirmer, 2003.

-----. "My Ballet Mécanique." De Stijl. 2 (1921-1932): 454-456.

-----. "Music Takes a Screen Test." The American Scholar. 6.3 (Summer 1937): 354-364.

- Boltz, Marilyn G., Brittany Ebendorf, and Benjamin Field. "Audiovisual Interactions: The Impact of Visual Information on Music Perception and Memory." *Music Perception: An Interdisciplinary Journal.* 27.1 (September 2009): 43-59.
- Bordwell, David and Kristen Thompson. *Film Art: An Introduction*. New York: McGraw-Hill, 2001.
- Brender, Richard. "Functions of Film: Léger's Cinema on Paper and on Cellulose, 1913-25." *Cinema Journal*. 24.1 (Autumn 1984): 41-64.
- Brown, W. Scott and Marilyn G. Boltz. "Attentional Processes in Time Perception: Effects of Mental Workload and Event Structure." *Journal of Experimental Psychology: Human Perception and Performance*. 28.3 (2002): 600-615.
- Clendinning, Jane Piper. "The Pattern-Meccanico Compositions of György Ligeti." *Perspectives* of New Music. 31.1 (Winter 1993): 192-234.
- Cohen, Annabel J. "Film Music: Perspectives from Cognitive Psychology." In *Music and Cinema*. Edited by James Buhler, Caryl Flinn, and David Neumeyer. 360-378. Middletown: Wesleyan University Press, 2000.
- -----. "How Music Influences the Interpretation of Film and Video: Approaches from Experimental Psychology." *Selected Reports in Ethnomusicology*. 12. (2005): 15-36.
- -----. "Music Cognition and the Cognitive Psychology of Film Structure." *Canadian Psychology*. 43.4 (November 2002): 215-231.
- Cook, Nicholas. Analysing Musical Multimedia. New York: Oxford University Press, 1998.
- Cook, Susan C. "George Antheil's Transatlantic: An American in the Weimar Republic." *The Journal of Musicology* 9.4 (Autumn 1991): 498-520.

Cooper, Douglas. The Cubist Epoch. New York: Phaidon Publishers, 1971.

- Deliege, Irene. "A Perceptual Approach to Contemporary Musical Forms." *Contemporary Music Review*. 4. (1989): 213-230.
- -----. "Grouping Conditions in Listening to Music: An Approach to Lerdahl and Jackendoff's
- Delson, Susan. *Dudley Murphy, Hollywood Wild Card*. Minneapolis: University of Minnesota Press, 2006.
- Grouping Preference Rules." *Music Perception: An Interdisciplinary Journal*. 4.4 (Summer 1987): 325-359.
- Fraisse, Paul. *The Psychology of Time*. Translated by Jennifer Leith. New York: Harper and Row, 1965.
- Ford, Hugh. Four Lives in Paris. San Francisco: North Point Press, 1987.
- Goss, Glenda Dawn. "George Antheil, Carol Robinson, and the Moderns." *American Music*. 10.4 (Winter 1992): 468-485.
- Harrison, Charles and Gillian Perry. *Pritivism, Cubism, and Abstraction: The Early Twentieth Century*. New Haven: Yale University Press, 1993.
- Horlacher, Gretchen. "Multiple Meters and Metrical Processes in the Music of Steve Reich." Intégral. 14/15 (2000/2001): 265-297.
- Huron, David Brian. *Sweet Anticipation: Music and the Psychology of Expectation*. Cambridge: MIT Press, 2006.
- Husserl, Edmund. On the Phenomenology of the Consciousness of Internal Time (1893-1917). Translated by John Barnett Brough. Boston: Kluwer Academic Publishers, 1991.
- Imbs, Bravig. Confessions of Another Young Man. New York: The Henkle-Yewdale House, 1936.
- Jones, Mari Reiss. "Musical Time." In *The Oxford Handbook of Music Psychology*, edited by Susan Hallam, Ian Cross, and Michael Thaut, 81-92. New York: Oxford University Press, 2008.
- Kalinak, Kathryn. *Settling the Score: Music and the Classical Hollywood Film*. Madison: University of Wisconsin Press, 1992.
- Kielian-Gilbert, Marianne. "The Rhythms of Form: Correspondence and Analogy in Stravinsky's Designs." *Music Theory Spectrum*. 9 (Spring 1987): 42-66.
- Large, Edward W. and Mari Reiss Jones. "The Dynamics of Attending: How People Track Time-Varying Events." *Psychological Review*. 106.1 (1999): 119-159.

Lawder, Standish D. The Cubist Cinema. New York: New York University Press, 1975.

- Léger, Fernand. *The Functions of Painting*. Translated by Alexandria Anderson. New York: Viking Press, 1973.
- Lehrman, Paul D. "The *Ballet Mécanique* Project: Technology Catches Up with Antheil." In *Ballet Mécanique*. Milwaukee: Schirmer, 2003.
- Leman, Marc. Music and Schema Theory. Berlin: Springer-Verlag, 1995.
- Marvin, Elizabeth West. "The Perception of Rhythm in Non-Tonal Music: Rhythmic Contours in the Music of Edgard Varèse." *Music Theory Spectrum.* 13.1 (Spring 1991): 61-78.
- McAuley, J. Devin. "Tempo and Rhythm." In *Music Perception*. Edited by Mari Reiss Jones, Richard R. Fay, and Arthur Popper, 165-200. New York: Springer, 2010.
- Moritz, William. "Americans in Paris: Man Ray and Dudley Murphy." In *Lovers of Cinema: The First American Film Avant-Garde 1919-1945*, edited by Jan-Christopher Horak, 118-136. Madison: The University of Wisconsin Press, 1995.
- Moshaver, Maryam A. "Telos and Temporality: Phenomenology and the Experience of Time in Lewin's Study of Perception." *Journal of the American Musicological Society*. 65.1 (Spring 2012): 179-214.
- Narmour, Eugene. Analysis and Cognition of Basic Melodic Structures: The Implication-Realization Model. Chicago: Chicago University Press, 1990.
- -----. "Music Expectation by Cognitive Rule-Mapping." *Music Perception: An Interdisciplinary Journal.* 17.3 (Spring 2000): 329-398.
- Neuhaus, Christiane and Thomas R. Knösche. "Processing of Rhythmic and Melodic Gestalts an ERP Study." *Music Perception: An Interdisciplinary Journal*. 24.2 (December 2006): 209-222.
- Norden, Martin F. "The Avant-Garde Cinema of the 1920s: Connections to Futurism, Precisionism, and Suprematism." *Leonardo*. 17.2 (1984): 108-112.
- Oja, Carol C. "George Antheil's Ballet Mécanique and Transatlantic Modernism." In A Modern Mosaic: Art and Modernism in the United States, edited by Townsend Ludington, 175-202. Chapel Hill: University of North Carolina Press, 2000.
- -----. Making Music Modern: New York in the 1920s. New York: Oxford University Press, 2000.
- Osborne, Harold. "Artistic Unity and Gestalt." *The Philosophical Quarterly*. 14.56 (July 1964): 214-228.
- Palmer, Caroline and Peter Q. Pfordresher. "Incremental Planning in Sequence Production." *Psychological Review*. 110.4 (October 2003): 683-712.
- Patel, Aniruddh D. Music, Language, and the Brain. New York: Oxford University Press, 2008.

- Piccinini, Mauro. "Non più andrai farfallone rumoroso': 'You Will Go No More, Noisy Butterfly': Joyce and Antheil." *Journal of Modern Literature*. 26.1 (Autumn 2002): 73-89.
- Rees, A. L. A History of Experimental Film and Video. London: BFI Publishing, 1995.
- Reiser, Oliver L. "Time, Space and Gestalt." Philosophy of Science. 1.2 (April 1934): 197-223.
- Reybrouck, Mark. "Gestalt Concepts and Music: Limitations and Possibilities." In *Music, Gestalt, and Computing: Studies in Cognitive and Systematic Musicology*. Edited by Marc Leman, 57-70. New York: Springer, 1997.
- Schmidt-Pirro, Julia. "Between the European Avant-Garde and American Modernism: George Antheil's "Ballet Mécanique." *Soundings: An Interdisciplinary Journal*. 89.3/4 (Fall/Winter 2006), 405-429.
- Shirley, Wayne D. "Another American in Paris: George Antheil's Correspondence with Mary Curtis Bok." *The Quarterly Journal of the Library of Congress*. 34.1 (January 1977): 2-22.
- Sirius, George and Eric F. Clarke. "The Perception of Audiovisual Relationships: A Preliminary Study." *Psychomusicology*. 13. (1994): 119-132.
- Swain, Joseph P. "The Need for Limits in Hierarchical Theories of Music." *Music Perception: An Interdisciplinary Journal.* 4.1 (Fall 1986): 121-147.
- Temperley, David. "Meter and Grouping in African Music: A View from Music Theory." *Ethnomusicology*. 44.1 (Winter 2000): 65-96.
- Tenney, James and Larry Polansky. "Temporal Gestalt Perception in Music." *Journal of Music Theory* 24.2 (Autumn 1980): 205-241.
- Treib, Marc. Space Calculated in Seconds. Princeton: Princeton University Press, 1996.
- Turvey, Malcolm. "The Avant-Garde and the 'New Spirit:' The Case of 'Ballet Mécanique.'" October. 102 (Autumn 2002): 35-58.
- -----. The Filming of Modern Life. Cambridge: The MIT Press, 2011.
- Winter, Marian Hannah. "The Function of Music in Sound Film." *The Musical Quarterly* 27.2 (April 1941): 146-164.
- Whitesitt, Linda. *The Life and Music of George Antheil 1900-1959*. Ann Arbor: UMI Research Press, 1983.
- Whitesitt, Linda et al. *Antheil, George*. ed. Laura Macy, in Grove Music Online, http://www.oxfordmusiconline.com/public/book/omo_gmo.