Table of Contents

Table of Contents I
Abstract 1
Chapter I - Musical Structure 1
The Beat 1
Tempo 3
Rhythm 7
The relationship between music, movement and animation 8
CHAPTER II – Early Sound in Film 8
Silent pictures and the theatre house organist 8
Steamboat Willie and Musical Timing in Animation 11
The Click Track is Born 15
Steamboat Willie – 1928 – Short Analysis 17
Chapter III - Warner Brothers & Merrie Melodies 21
Carl W. Stalling - Composer 21
Treg Brown – The Sound Effects Master 24
Chapter IV - The Refinement of musical timing 25
The Animated Feature 25
The Little Whirlwind – 1940 28
Chapter V - Animating to a Musical Score 31
Pre-Established Music 31
The Rabbit of Seville 34
Chapter VI - Limited Animation Production and Stock Music 36
Limited Animation 36
Chuck Jones – How the Grinch Stole Christmas 38
Musical Timing – Conclusion 46
Appendix A – Works Cited in narrated Video-Musical Timing in Animation 48

WORKS CITED.....50

David Shepstone

Student # N00213825

Professor Damien Byrne

MA in 3D Animation

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A Brief History of Sound and Musical Timing in Animation Production

Abstract

Musical timing in animation production synchronizes a character's movements to the music and sound effects created for a cartoon. This paper is a historical review of how sound synchronization and musical timing production methods evolved from the silent era in film through the golden age of animation and discontinued by the latter half of the twentieth century. There is a review of the various contributions of specific individuals such as Walt Disney, Carl Stalling and Chuck Jones in the development of musical timing and how this process evolved and changed over five decades. The paper will review various music theory concepts and how they play a role in the production methods of musical timing for animated content.

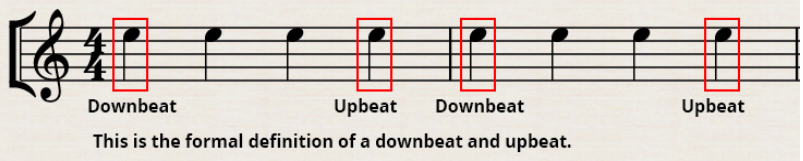
Chapter I - Musical Structure

The beat

What is a beat, and how can we apply that concept to a visual medium such as animation? What we first need to define is the simple beat and how this applies to musical timing in animation. A beat as defined by Encyclopedia Britannica states that "the unit division of musical time is called a beat. Just as one is aware of the body's steady pulse, or heartbeat, so in composing, performing, or listening to music one is aware of a periodic succession of beats" (Beat).

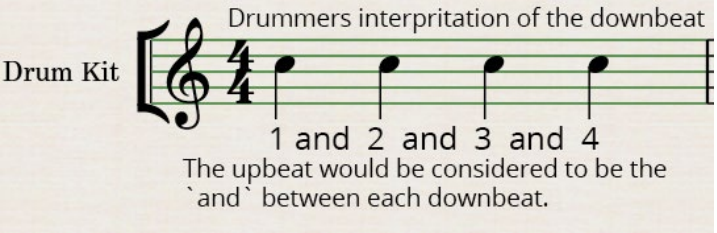
A beat defines the structure of the composition across a specific time range, this could be a musical score, or we can apply the same concept to a visual medium, such as animation. In music, a beat defines the underlying structure of the song. Think of this as something that you can tap your foot to as you listen to your favorite piece of music.

Merriam-Webster dictionary describes a downbeat as "The downward stroke of a conductor indicating the principally accented note of a measure of music, also: the first beat of a measure" (Downbeat). The downbeat is the strongest beat of a measure. The upbeat therefore is the last beat of a measure; this is the weakest beat. Merriam-Webster dictionary describes the upbeat as "an unaccented beat or portion of a beat in a musical measure *specifically*: the last beat of the measure" (Upbeat) (ex 1).



Ex. 1: Formal interpretation of a downbeat and upbeat musical notation.

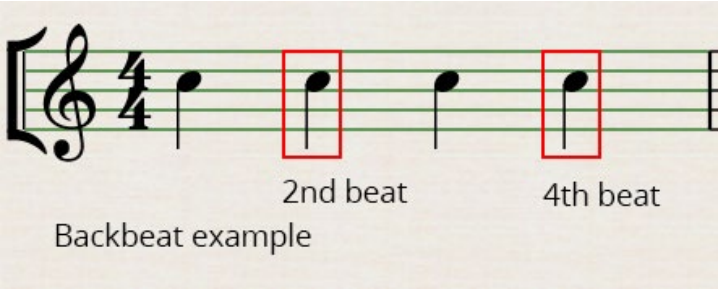
This formal meaning can differ depending on the understanding of who you are speaking with. If I requested a drummer, for instance, to play on all the downbeats, they would typically understand this as playing each beat of a bar. In 4/4 time that would mean that the drummer would play four beats to a bar of music. The drummer would play the upbeat between the quarter notes, such as 1 *and* 2 *and* 3 *and* 4 (ex 2). The `and` would indicate an upbeat or the halfway point between two beats in a measure.



Ex. 2: Common interpretation by a Drummer of a downbeat and upbeat

The backbeat is another term used when describing the overall beat structure of a composition. The backbeat formally refers to the accent on the second and fourth beat in a 4/4 time. Merriam-Webster dictionary describes the backbeat as "a steady pronounced rhythm stressing the second and fourth beats of a four-beat measure" (Backbeat). (ex 3)

Backbeat example:



Ex. 3: Musical definition of a backbeat.

The backbeat is another tool used by animators when they want to accent a specific action on screen. An animator could use the backbeat to hit the accent or exaggerated pose in a scene to communicate the story to the audience. Animators would frequently use the upbeat in action to anticipate a movement and set the extreme pose or story pose of the scene on the backbeat.

TEMPO

Tempo is the next musical tool that needs to be examined before discussing musical timing in animation. Merriam-Webster dictionary defines tempo as "the rate of speed of a musical piece or passage indicated by one of a series of directions (such as largo, presto, or

allegro) and often by an exact metronome marking" (Tempo). Tempo is the Italian word for speed. When you read sheet music, you will typically see a tempo indication at the start of the measure, such as *adagio*, *andante*, or *moderato*. Modern sheet music typically has a metronome marking instead of the formal Italian names. The tempo will influence the feeling or style of a piece of music or animation. "For example, there are some styles of music which have specific tempos – e.g. romantic ballads tend to have a fairly slow tempo, whilst disco music tends to have a fast tempo" (Dunnett). (See fig. 1)

Fig. 1. Tempo chart breakdown in beats per minute. (accessed via www.musictheoryacademy.com/how-to-read-sheet-music/tempo).

Tempo in animation is defined by a select number of beats per minute that is easily divided by halves. The most common tempos used in musical timing for animation would be 30, 24,20,18,16,14,12,10,8 or 6 frames per second. The chart below indicates the most common tempos used in animation and how this number can be calculated. (See table. 1)

Table 1

Metronome Scale. Commonly used BPM converted to frames per second for animation.

Metronome Scale (BPM)	Frames per second
48	30
60	24
75	20
82	18
90	16
105	14
120	12
160	10
182	8
240	6

When a director would establish the tempo for an animated shot, they would determine the number of frames per beat required for the action to take place. Typically, the animator would receive a scene package that would state what the desired tempo would be for the shot, such as 12 frames per beat. The animator would need to set the metronome on his desk to 12 frames per second or 120 bpm to hear the rhythm for that shot. This would also allow the animator to count the beats and determine the length of the shot.

If we would like to calculate the beats per minute or bpm based on a specific number of frames per beat, we would use the following formula (See table 2).

Table 2

Formula to convert frames per beat (FPB) to beats per minute (BPM).

Formula	Number of seconds in one minute ÷ (frame per beat ÷ frames per second) = BPM
Example	60 ÷ (12 FBP ÷ 24 fps) = 120 BPM

If the animator would like to use an existing musical score in an animated shot, that score will typically come with a predetermined beat structure or bpm. For an animator to build the actions of the shot around the predetermined bpm they need to calculate the number of frames per beat. To calculate this number, we use the following formula (See table 3).

Table 3

Formula to convert beats per minute to frames per second.

Formula	(60 seconds * 24 fps) ÷ Beats per Minute = frames per beat
Example	1440 frames ÷ 120 bpm = 12 FPB

Tempo would be used to establish the mood of a sequence or scene in animation. For instance, if *Mickey Mouse* was walking down the street, the tempo could be set to 16 frames per second or 90 bpm which gives the walk a happy and calm feeling as he strides down the street. Perhaps *Mickey* was in a dark forest slowly creeping through the woods; this might be put on a tempo of 24 fpb or 60 bpm to indicate a very slow and cautious walk.

In animated films of the early to mid-twentieth century, such as several Warner Brothers cartoons, the director and the musical director would work together to develop the tempo of an entire cartoon. They would use bar sheets to indicate the tempo of the shots and sequences, along with all the action required for each shot. This would create a simple, cohesive structure and synchronization between the music, sound effects, and visual actions on screen. (See Fig. 2)

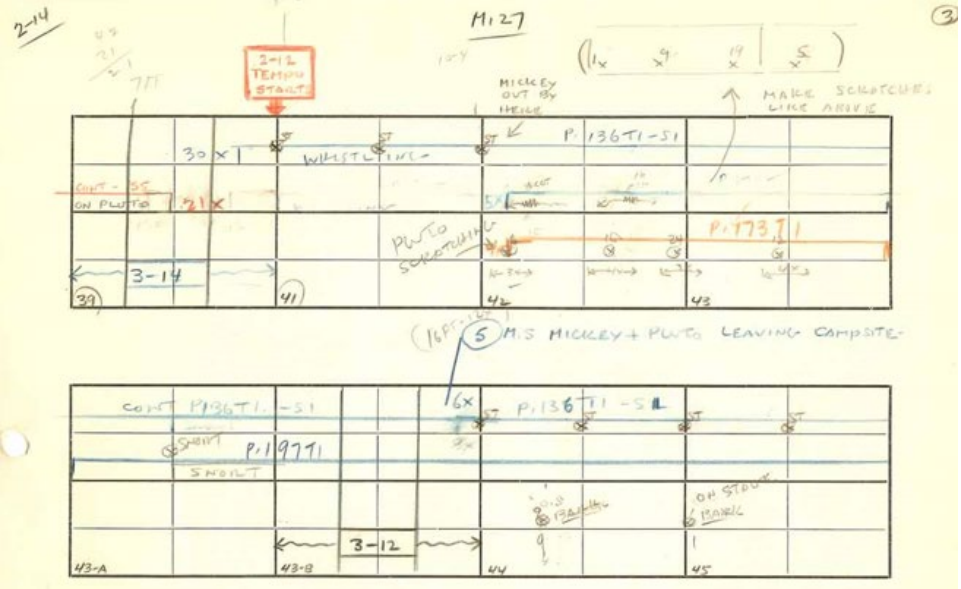


Fig. 2. The Pointer production bar sheet example. Walt Disney. 1938. (accessed via https://ftp.afilm.com/blog/2227ThePointer_barsheet3.jpg)

Rhythm

Rhythm is another tool that is used in musical scores and animation. A rhythm as defined by Merriam-Webster dictionary states "a regular, repeated pattern of sounds or movements" (Rhythm). It is not the same as a beat, and it is the flow of movement or music through time. A beat has an equal amount of time between each one, whereas rhythm doesn't have to be equally distributed. We use the beat to create the rhythm, but that is the extent of their relationship. To paraphrase Michael Thaut, rhythm in music is the core element that binds the sounds and patterns into structural, organizational forms (p. 4). Rhythm is what creates the appealing flow of movement or sounds through time. An excellent demonstration of rhythm in music would be the opening lyrics to the song *We Will Rock You* by Queen. If you listen to the first 25 seconds of this song, the feet stopping on the ground and the clapping of the hands set up the simple beat structure, equal organized beats through time. The lead singer, Freddie Mercury, starts with the lyrics, "Buddy, you're a boy, make a big noise playing in the street, gonna be a big man

someday" (May). The lyrics play around the simple beat structure, creating patterns through time, setting up the song's basic rhythm.

Rhythm creates exciting patterns of movement and sound through time. In animation, this can be used to create an appealing movement connected to all the visual and audio elements on the screen, bringing a connection that you wouldn't have if the movements were just randomly placed throughout the scene.

The relationship between music, movement and animation

The relationship of the beat structure, tempo, and rhythm to a visual artform such as animation is the structured flow of appealing movement through time. All these elements work together to create something visually appealing. We can look at this in a straightforward way for anyone to understand; if you listen to a song that has no structured beat or rhythm, the music will not be enjoyable to listen to; it will sound random and choppy. Animation is no different; the animation will look visually unappealing if there are randomly placed movements of a character's performance through time without consideration of the beat structure, tempo or rhythm. Musical timing in animation is a tool that can be used to create the character's movements and the flow of scene transitions into an audio and visual dance through time on the screen.

Chapter II – Early Sound in Film

Silent pictures and the theatre house organist

From the very beginning of the film, there has always been a musical accompaniment. The synchronization of music and visual content got its start in the silent picture era of filmmaking. The organist in the theatre house would use prearranged musical scores or a combination of well-known musical pieces to help the flow of visuals on the screen connect with

the audience. Silent picture actors knew how to utilize this method to create visual gages and set the timing to read clearly to their audience. We need only look at the work of Buster Keaton or Charlie Chaplin to see this mastery at work.

In the early days of film, silent pictures were accompanied by live music in the local movie houses. These silent pictures could have music accompaniment in a variety of ways. Patrick Miller describes these various methods as “improvisations performed by a pianist or organist” (p. 582), “pre-arranged musical extracts performed by a keyboard player, chamber ensemble, or orchestra” (p. 582), this style of music integration included many selections of classical music. There were also the “pre-arranged musical extracts usually performed by an orchestra” (p. 583). The director and the musical director usually prepared these scores to have a more consistent and cohesive sound accompany the pictures.

Let's start with a straightforward example. In the 1920s, Max and Dave Fleischer created the first animated cartoon that contained an animated bouncing ball that would track the tempo and beat of a song by displaying the lyrics of the music on-screen so that the audience would be able to sing along with the film. The ball would animate overtop of the lyrics, indicating the beat and tempo of the song. This would help the audience follow along with the lyrics and sing along with the film. In 1924 the Fleischers released the sing-along called *Oh, Mabel*; this was a success with the audience as they happily followed and sang along with the song's lyrics as the animated bouncing ball on-screen followed the tempo and beat of the music. It was said that this technique was so successful that the theatre stopped the projector, rewound the film, and replayed it a second time, according to Dick Huemer, (Jenkins p. 8) who was the lead animator for the Fleischers at this time.

The theatre house organist was well versed in a variety of material that they could use for feature-length films and cartoons. There was a selection of pre-packaged content to help organists prepare content for a picture, one of those books was the *Motion Picture Moods* by Erno Rapee (Rapee). The author of this book put together a collection of well-known music and organized the songs into single-word descriptive phrases. This enabled the organist to quickly play a song that generally aligned with the picture's mood that was being projected. If the film was a comedy that could play something that had a more comedic timing to it, rather than a generic piece of music that may not be appropriate for the picture's mood. This wasn't a perfect solution to the problem, as stated by Daniel Goldmark in *tunes for toons,* "Such simplified approaches had practical advantages, but they could also lead to scores consisting of only a few melodies" (p. 14).

This approach to musical accompaniment didn't allow for any harmonious synchronization between the visuals and the musical beat. Each house organist could perform the music that they felt was appropriate for the film's mood, but there was no actual connection between the animated content and the musical beat. This performance style can lead to a very disjointed relationship and cause the picture to feel like the actions on screen were random. For there to be a solid synchronized audio track, the beat structure of the music and the visuals would have to work together. This disjointed feel is evident in the first two Mickey Mouse cartoons, Plane Crazy and The Gallopin' Gaucho. In these two films, the sound was added to the short films after the animation was completed. Watching these two cartoons doesn't feel as smooth or structured as Mickey's third cartoon, Steamboat Willie.

Steamboat Willie and Musical Timing in Animation

Steamboat Willie was the third Mickey Mouse cartoon from the Disney animation studios, but this one was special. This one was going to be structured to have a synchronous beat between the music and the characters' movements.

Walt Disney knew that cartoons had become less prevalent than in the early 1920s, and the distributors were not as energetic about a new cartoon series as they once were. The film industry was still absorbing the technological impact of sound pictures in the mid-1920s. Pre-recorded sound in films had become the next advancement in motion pictures. The silent era of filmmaking had come to an end, and all the studios had to decide how they would transition into this new technology of pre-recorded sound for films. Several animation studios at the time didn't see the advantage of this technique and decided not to invest in converting their existing animation pipeline to incorporate sound into their pictures. This would quickly catch up with them as the studios would close due to a lack of work. We can compare these transitions to many other technological transitions through history, the companies that decide not to move with the times will get left behind for the new players on the block.

The first "all-talking" feature, *Lights of New York*, was due to be released in July of 1928, and *The Jazz Signer* had premiered the year prior. Disney knew that sound was the next step for cartoon production (Barrier p. 58), but the technology had not been developed to produce a well-synchronized cartoon at this time. There had been earlier attempts to create sound cartoons, such as Max Fleischer's cartoons, earlier in the 1920s with the De Forest process, but the result was a poorly synchronized picture. As Michael Barrier stated in the book *The Animated Man: A Life of Walt Disney,* "But it was a long leap from such limited uses of sound to a cartoon with a fully integrated soundtrack, one in which animation was synchronized with music and sound effects.

Disney's key insight was that such integration, and not sound alone, would be essential to a sound cartoon's success" (p.58).

Wilfred Jackson had started working as an animator at Disney Studios on April 16th, 1928 (Barrier p.58). Wilfred wasn't a musician by any account. Still, he did have a basic understanding of musical theory and was more versed in music than any other employee at the Disney studios at that time, including Walt. Wilfred was able to help Walt time out the entire picture with a simple mouth organ and a metronome to create the synchronization of the sound and image. Wilfred invented an early version of what was to become the "bar sheet" in animation production (Barrier p.59). The bar sheet enabled the composer to create the music for production before the animation was completed, knowing that each action would align properly to the animated content. Each scene of the film was timed out to a tempo and beat structure, all the actions were planned around that system and the information was transcribed onto exposure sheets for the animators. Each sequence would have a tempo and beat structure setup for the action. In the case of Steamboat Willie, these beats had been derived from the musical pieces that Disney wanted to incorporate into the film (Barrier pp. 60-62). The film starts off with Mickey whistling the last two measures of the song *Steamboat Bill* (Shields), a musical score written in 1910 by the vaudeville group, *The Leighton Brothers* and Ren Shields.

Disney brought in a select number of audience members and friends, and family to view the picture in a half-completed state. Walt wanted to see how the audience would react to the synchronization of sound and picture. They placed several animators and Wilfred and Walt in a separate room and piped the sound into the projection room. The audience was astounded by the synchronization of action and sound. Walt had a hard time believing that the reaction was so strong, so they started the picture over with Walt in the audience and showed it for a second

time. He was amazed at the response he had gotten from the audience and was convinced that they needed to move forward with a tightly integrated sound cartoon for Mickey (Barrier p. 60).

The silent version of Steamboat Willie was complete by late August of 1928. Walt got onto a train and headed to New York City to record the final soundtrack for the picture (Barrier p. 60). On the way to New York, Walt stopped over in Kansas City to meet up with an old friend, Carl Stalling. Stalling worked at the *Isis Theatre* as an organist when Walt was working for the Kansas City Film Ad company in the early 1920s (Barrier p. 60). He had brought along the first two silent Mickey Mouse cartoons for Stalling to compose the music score accompanying the silent films in the theatre. Stalling was happy to produce the music for these silent pictures. Still, they would never be as successful as Steamboat Willie because the pictures didn't have a synchronized soundtrack, the musical score that Stalling produced for these pictures sounds more like background music and nothing more (Barrier p. 61). Stalling would be an industry giant in sound cartoons during the 1930s, '40s and '50s, but he did start his film career working for Walt in 1928. Stalling would join Walt in L.A. in 1929 to produce music for several Disney short films, including *The Barnyard Dance, The Opry House* and more (Barrier p. 65).

Musical timing would become the basis for creating early animated pictures with sound synchronization due to the limitations of sound recording methods at the time. During the early days of audio recording for film production, all the audio components, including narration, sound effects, and music, would have to be captured simultaneously. The technology didn't exist at this point to capture individual tracks for post-production editing. These limitations in the sound recording methods were one of the driving factors for musical timing in animation. These methods gave them the ability to synchronize all the different components of the audio with a simple beat that each musician or sound effects artist could follow.

During the recording of the soundtrack for *Steamboat Willie* in New York City, Walt had hired a seventeen-piece orchestra along with three effects men (Barrier). The first recording of the soundtrack did not go well; the synchronization was not working as Walt had intended. He had attempted to project a bouncing ball that would play alongside the film to help the musicians keep in time with the picture. It turned out that this method would be too distracting for the orchestra; they were not able to focus on their music and follow along with the bouncing ball animation. Walt knew that he needed to keep the orchestra in sync with the picture as the performance was recorded. A second recording session was set up at the end of September 1928, but this time Walt had superimposed a ball bounce onto the print of the picture itself and had the orchestra turn away from the projection for only the conductor could see the film. The conductor, Carl Edouarde, was not impressed that he had to follow a bouncing ball to keep time with the cartoon actions, but he did make an effort to conduct the orchestra in close synchronization with the tempo of the ball. The second recording was much more successful. The first fully synchronized Mickey Mouse cartoon was ready for distribution. Walt and his brother Roy would later patent this system of the bouncing ball technique that they had used during the recording phase of production (Barrier p. 62).

The techniques in sound synchronization that Walt and his team developed would lay the foundation for the future use of musical timing in all of Disney's animated short films for many years to come. Technological change is often the driving force in adopting new methods and techniques, and animation was no different. The need for accurate synchronization of all audio components in animated content drove the future development of musical timing in animation.

"Steamboat Willie premiered at the Colony Theatre on Sunday, November 18th, 1928, and ran for thirteen days" (Barrier 66). The premier was a huge success and would eventually

attract many other distributors to form a deal that would show the Mickey Mouse shorts in many different theatres across the nation.

The success of *Steamboat Willie* as the first accurate, fully synchronized sound cartoon was the beginning of Mickey Mouse as a household name and the beginning of musical timing for animation as it came to be known. Walt knew that he wanted to move forward with tempo-based music and visuals in his new animated shorts. The following short that Walt would work on was *The Barn Dance* starring *Mickey Mouse*. Walt's long-time friend and colleague, Stalling, would join Disney in creating the next couple of Mickey shorts. Stalling ultimately worked on 19 different cartoons for Walt between 1928 - 1930. Stalling had decided to join Disney at his studio in L.A. to create the soundtrack for *The Barn Dance* and *The Opry House*; both Mickey cartoons were established with a musical tempo. Disney wanted Stalling to match the action with the music; instead of the music dictating that action, the two men didn't see eye to eye in this respect. Finally, Walt told Stalling that if he made the music work on the Mickey shorts work, then he would produce a musically driven series (Barrier p. 68). This ended up becoming *The Silly Symphonies*. Walt had been convinced of musical timing in animation by the summer of 1929. Michael Barrie quotes Disney as saying that he "decided upon a policy that from now on all the action [in the *Mickey Mouse* cartoons] will be set to a definite [rhythm] and we will have no more straight action to a mere musical background" (p. 70). The *Mickey Mouse* cartoons would be synchronized to music like the *Silly Symphonies* would be.

THE CLICK TRACK IS BORN

There were three patents that Disney filed in 1931, establishing a click-track mechanism for sound synchronization. The first patent was granted to Roy E. Disney on June 6, 1933 (Disney, R.), the bouncing ball method of synchronization. Followed by the click-track invention

given to William E. Garity on July 25, 1933, and finally, the “Method and Apparatus for Synchronizing Photoplays” granted on December 26, 1933, to Walter E. Disney, Wilfred E. Jackson and William E. Garity (Disney W).

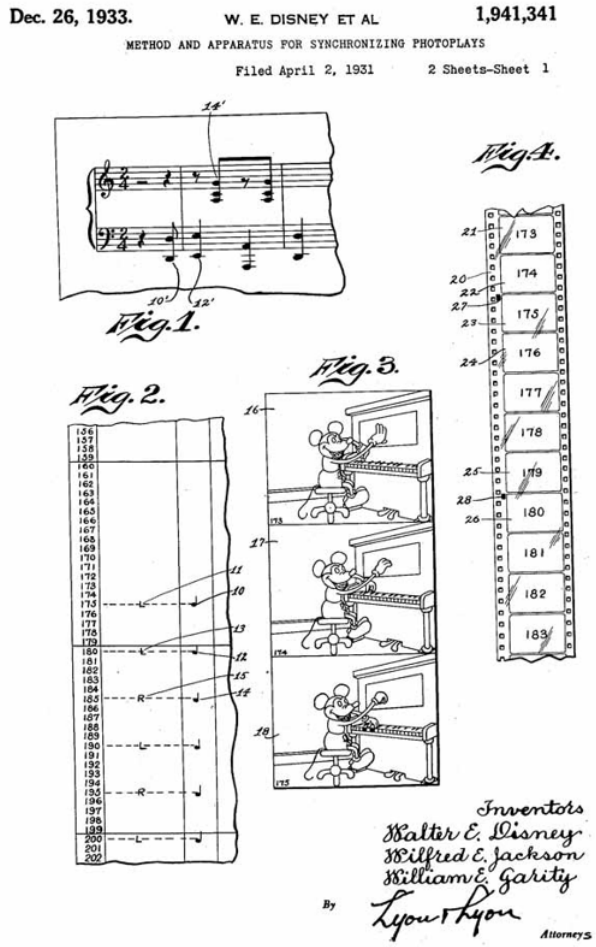


Fig. 3. Method and Apparatus for Synchronizing Photoplays. (Disney W) (accessed via United States Patent and Trademark Office).

The click-track was the beginning of highly synchronized cartoons starting in the late 1920s. This method was created by setting up a pre-established tempo for the animators to synchronize the animation and the musicians to create the accompanying musical score. The animation and the music could be created at the same time. The musical director and the film director would establish a tempo for each film sequence by planning each action in detail. When

this planning was complete, the information would be placed onto a set of bar sheets for the musical director and transcribed onto the exposure sheets for the animators to match the visuals with the sound as described in the patent that Walt Disney was granted (Disney W).

When the studio was ready to record the musical score for the cartoon, they would set up an apparatus called a click-track. The device would create an audible beat for each musician when they were recording the soundtrack. This beat would hold the pre-established tempo for the cartoon, as long as the musician stayed in sync with the audible tempo, the finished work would match the actions animated in the cartoon.

The beats were created by a device that read individual markings on the audio portion of the 35 mm film strip. When a marking passed the aperture plate, a photoelectric cell would be activated, creating an electrical current and thus transmitting a clicking sound to the musician wearing a headset (Disney W. 145).

This was the start of synchronized sound, a musically driven animation content. Disney's breakthrough in synchronized cartoons was adopted by most competing studios in the 1930s, creating a golden age of innovation and refinement for musical timing in animation.

Steamboat Willie – 1928 – Short Analysis

The third *Mickey Mouse* short film was the first truly synchronized sound cartoon that Walt Disney produced. This picture represented a breakthrough in the technical ability to sync sound and visual content. Let's look at the cartoon itself to deconstruct the achievements in this picture and how musical timing was one of the building blocks in the creation of this short.

This picture starts with Mickey Mouse at the wheel of an old steamboat, whistling along to a popular tune of the early 1900s called *Steamboat Bill* (Shields). The sound effects are perfectly synchronized to the character's movements.

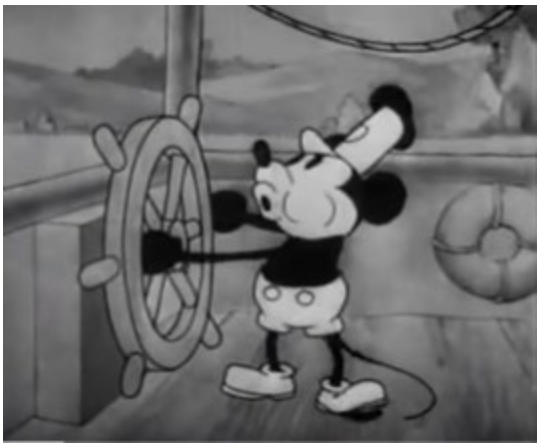


Fig. 4. Mickey Mouse in "*Steamboat Willie*". 1928. (00:30).

The exposure sheet below, (See Fig. 5) from *Steamboat Willie* indicates the beat structure that was used in the opening song of the film. The black dots in column two, highlighted in yellow, indicate the beat structure of the music that the animation is synchronized to.

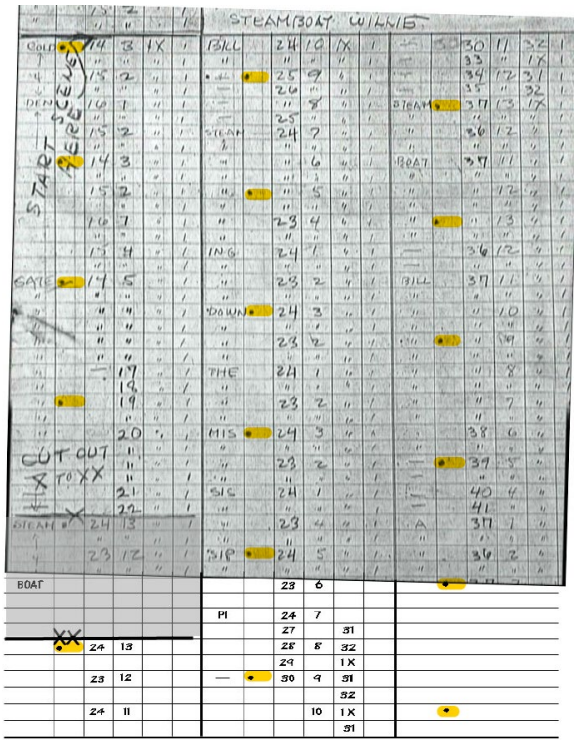


Fig. 5. Exposure sheet from "*Steamboat Willie*". 1928. (Perk) (accessed via https://ftp.afilm.com/blog/SteamboatWillieXSheetPlus.jpg)

This early version of an animation exposure sheet (See Fig. 5) is set up in simple columns and rows to track individual frames of the animation. The first column indicates the action notes and dialogue for each animation frame. The next column to the right on this early exposure sheet indicates the beat structure for the animation. In this example, they used an eight-frame beat or 180 bpm. To the right of the musical beat column, you will see four additional columns that indicate the various layers of cellulose acetate or cels as they are referred to for the character animation. The director developed these sheets for each scene of the animated picture.

Steamboat Willie is the first example of a cartoon that was animated to a pre-established tempo. The tempo that was used in this film was 8 frames per beat.
The tempo of the sequence was planned out using the bar sheet method that Wilfred Jackson designed for this picture. When the action was planned out on the early version of a bar sheet, this information was transcribed onto exposure sheets by Walt Disney for the animators to complete the character animation.

In the first shot of Mickey Mouse steering the boat (time code 24 seconds), notice that he is tapping his foot to the 8 frames per beat or 180 beats per minute. This synchronization continues throughout the entire picture. Each action that Mickey or any of the other characters perform throughout the short is based on this simple 8 frames per beat structure. You can see how the animator is using this basic beat and dividing it into equal parts depending on the required performance for the shot. For example, if we refer to the shot when Peg-leg Pete first enters the scene (time code 51 seconds), you can follow the division of beats through each action. Pete grabs onto Mickey's waist and starts to pull his torso back towards him on the upbeat. The action of pulling Mickey's torso towards him takes 32 frames in total, from the initial grab to the final pullback in the action. Pete holds his waist in place for 16 frames, then

starts to pull his torso towards him, this action takes another 16 frames, hitting the final pose at 32 frames or an equal division of 8 frames per beat. (See Fig. 6)

Fig. 6. Scene from *Steamboat Willie*. (Disney 00:52)

We can continue to see this simple 8 frame beat used throughout the film. Many of the animated cycles, such as the parrot's laugh or Mickey's tapping foot, are all set to the 8-frame beat. The ability to map out the musical timing and have the actions build around this beat structure gave the studio the tools it needed to create the synchronization of the animation and sound components for the short film.

The second piece of music that was used in *Steamboat Willie* was *Turkey in the Straw* (Turkey in the Straw). This song became popular in the early 1900s, it was an early American folk song. Turkey in the straw was also set to 180 bpm or 8 frames per beat, this worked very well for the musical portion of the animated short. In the scene when Mickey is playing the drums on the pots and pans (time code 4:50:20), the drumming is again cycling on an 8 frame beat. You can also see this same beat in the duck's head bounce cycle on the screen right of this shot. The hammer that beats on the washbasin (time code 5:00:25) breaks down this beat into a cycle of 4's, an equal division of 8, this was accomplished by simply dividing the 8 frame beat in half. As long as the animator works within the established tempo, the animation will feel like it is synchronized to the music.

Wilfred Jackson, Walt Disney and Ub Iwerks formed the basic process for musical timing in animated cartoons. Wilfred Jackson is the person that helped Walt break down the beat of each song into a simple sheet music format or an early version of what would eventually be called the bar sheets. This technique gave Walt the ability to synchronize each action of the animation to a beat structure, and in turn, utilize this information to create a final recording of synchronized sound and animation.

This was the first truly synchronized sound cartoon that was ever created, and musical timing was part of this technique. Walt and his team pioneered musical timing, and this had a substantial impact on animation for the next thirty years.

CHAPTER III – WARNER BROTHERS & MERRIE MELODIES

CARL W. STALLING - COMPOSER

Carl Stalling was instrumental in the development of musical timing for animation. He started his career as an organist in the local Isis Theatre house in Kansas City (Barrier 60). In Kansas, he befriended Walt Disney in the early 1920s when Walt was working for the Kansas City Film Ad company (Barrier 60). The two men got along well, and Disney knew that Stalling was an excellent musician and composer based on his work at the Isis Theatre.

When Walt wanted to produce the background music for his first two Mickey Mouse short films, “Plane Crazy” and “The Gallopin` Gaucho,” he knew that Stalling would be an excellent choice as the composer. This is the beginning of Stalling’s work as a music director for animated films. He started working for Walt in 1928 and continued his career with the Disney studios until January 22nd, 1930 (Barrier 77). Stalling and Walt had many arguments about how the music should be composed for the Mickey Mouse shorts, but in the end, Walt agreed to let

Stalling work on a new series based around music if he would make the composition fit the actions that he wanted in the Mickey Mouse shorts (Barrier 68).

> In the wake of Steamboat, it was Stalling who created the scores for about fifteen successive short films. The composer scored the first Silly Symphony, The Skeleton Dance (1929), though the idea was originally inspired by a classical composition, the Danse Macabre by French composer, Camille Saint-Saens. (Care)

Stalling worked for Van Beuren animation studio in New York right after he left the Disney studios, but he ended up with very little creative work to do in his role and decided to leave for other opportunities (Goldmark 13). Stalling would work on and off over the next six years for Ub Iwerks at his new studio, where they produced such short films together as Flying Fists and The Village Barber. These were part of the Flip the Frog series that Ub Iwerks had produced for MGM. Stalling also continued to produce music for Disney on a freelance basis between 1930 and 1936. During this time Stalling also worked with another influential name in animation history, Ben "Bugs" Hardaway. Ben had also worked for Iwerks in the early '30s and was now in the employment of Leon Schlesinger. Ben had decided to recommend Stalling as a perfect fit for the short films produced by Schlesinger in 1936, and he became one of the music directors at Warner Brothers cartoon studio. Stalling would stay in the employment of Warner Brothers until he retired in 1958.

Stalling would become the perfect fit for Warner Brothers cartoons with his background in popular music selection for the silent films as a theatre organist (Goldmark p. 16). He would be given the ability to utilize the Warner Bros. music catalogue of licensed music that he would employ in his creations for the cartoon shorts. He was sometimes criticized for his overuse of popular music in his compositions, stitched together with original short pieces, but this was what

the studio needed to brand its style of comedy in the early animated shorts (Goldmark p. 11). The Merrie Melodies became one of the most beloved cartoon series of all time, and Stalling's musical compositions are one of the most memorable parts of these cartoons.

Stalling would work with all the legendary animation directors of Warner Brothers cartoons, including Friz Freleng, Chuck Jones, Tex Avery, and Bob Clampett. Each one of these directors where Master of Musical timing for animation, and Stalling was their right-hand man for many of these historical short films. Chuck Jones refers to Friz Freelang's mastery of tempo timing in the book Chuck Amuck.

> "Live-action directors find it difficult to believe what directors at Warner Bros. cartoon division were called upon to do: pre-time and pre-edit a picture to within eight frames (one-third of a second) of its ultimate length before going to the camera or the animator. That's what we had to do, and the master of this arcane art was Friz Freleng. (Jones p. 104)".

Stalling would work closely with each of these directors in the early pre-production stage of the short film. The director would sit down with Stalling and figure out the tempo for each piece of the action for the cartoon. Stalling would take this information on the finalized bar sheets and create the musical score for the film as the animators would complete the final animation. The result would be a beautifully synchronized piece of animation, music, and sound effects, this is partly the reason why these shorts are still remembered and watched today. Stalling was a pioneer in musical timing, starting at the Disney studios and moving over to his final professional home at Warner Bros.

Treg Brown – The Sound Effects Master

Treg Brown was credited as an editor, but he was a sound effects editor and a master at the job. He was also a trained musician; he could play several instruments and read musical compositions. Brown understood the concept of musical timing in animation and was a crucial player in masterfully injecting the proper sound effects into the Warner Brothers cartoons.

Brown started his career as a travelling musician, playing in nightclubs. He played with several different musicians and bands, such as the Rod Nichols band and Benny Meroff. During the depression in the 1930s, he was looking to make a better living ("Crash! Bang! Boom! The Wild Sounds of Treg Brown" 01:17-02:15). He was first offered a job with Paramount Pictures as a music editor. He worked there for a short time, allowing him to work with such people as Cecil B. DeMille. He produced several sound effects for Paramount Pictures in the early 1930s, such as Cleopatra.

Brown was a perfect fit for cartoon sound effects because he understood music, and at that time, all cartoons had been produced with musical timing as the framework of the picture. He was able to read and understand what and how the action should work based on the bar sheets that were provided to him during production. Brown was able to bring a high level of polish and feature film production methods to his new home at the Warner Bros. cartoon studio.

Like Stalling, Brown had access to the sound effects library that the Warner Bros. studio had from the live-action films being produced. This gave him a wealth of material to pull from for the cartoons. Before Brown's work at the studio, most sound effects were created with musical instruments, like the techniques that were being employed at the Disney studios by Jimmy MacDonald ("Jimmy MacDonald" 02:00). Brown began to use anything he could to make the sounds more enjoyable, such as actual car skids when characters were trying to skid to

a stop. The introduction of these realistic sound effects into the cartoon fantasy world brought comedy into the wacky world of the Warner Brothers cartoons. Friz Freelang said, “That’s why we got sounds effects that were so unusual because Brown would try anything. The more off-beat they were, the funnier they were ("Crash! Bang! Boom! The Wild Sounds of Treg Brown" 03:30-03:44).”.

Brown and Stalling had an excellent working relationship, and they were able to build the music and sound effects to work in harmony with each other. Brown, unfortunately, isn’t a well-known name, but without his sound effects, we wouldn’t have the crazy sound effects and comedy that we get from the Looney Tunes series.

Brown was able to utilize the methods of musical timing as part of an integral part of his working methods. Musical timing is what gives Brown’s amazing sound effects the rhythmic feel that was needed in the Warner cartoons. This sense of rhythm is lost in most modern films today. We hit sound effects when the script calls for one, but the sounds don’t have an underlying rhythmic structure as they did with Brown’s work.

CHAPTER IV – THE REFINEMENT OF MUSICAL TIMING

THE ANIMATED FEATURE

When the Disney studios animated its first feature film in 1937 with “Snow White and the Seven Dwarfs”, Walt knew that musical timing needed to be preserved and incorporated into the picture.

The features demanded more refinement than what was used in the early Mickey Mouse cartoons. The work was still developed in a similar way but with a few changes to the process. In the book, *The Illusion of Life,* the two authors describe the feature film timing process in the following way, “Most animation of the features was not done to a prescored track, and with the

emphasis on acting and mood the scenes were better supported by a free tempo type of music than by the rigid beat. In those cases, the musician would ask for a dummy score to be made up showing him what he had to match and where things happened. A music check was made of the whole section with all the accents, the footsteps, jumps, staggers, displays of emotion, or strong looks." (p. 294).

Each sequence was planned out with an appropriate tempo by the director and the music director. They would prepare the shot folders with specific instructions for the animator, such as: "Scene Description: Animals playing; fox in water; hound dives in, splashing water all over his friend.

Tempo: Set metronome on 12 beat.

Footage: Undetermined but keep brisk and busy." (Johnston p. 290)

As you can see by this description, the director would clearly label each shot with a chosen tempo based on the pre-established tempo derived by the composer. The animator would then build the animation around a beat of 12 frames per beat or 120 beats per minute.

In the case of a prescored piece of music for a sequence, then the shot description would have the tempo of that piece of music for the animator to build out the acting for the scene. An example of this would be in *Snow White and the Seven Dwarfs* when the dwarfs are working in the mine, singing *Heigh-Ho.* This sequence was animated with a pre-established musical tempo of 2/14's, this meant two beats per measure of 14 frames each. If you watch this sequence and follow the timing, you will see that all the major key poses hit on a tempo of 14 frames per beat.

The animation composer would sit down with the piano and a Moviola to work out the background music for the different sequences of the film. Using a click-loop technique, the composer would view the different sequences in a rough treatment or storyboard form and

develop the various tempos that helped build the mood of the sequence. Bob Thomas describes this process in his book *Walt Disney: The Art of Animation*, "The click-loops are kept in a series of cubbyholes above the piano. They are numbered in eighths, from 6, 6 ⅛, 6 ¼, 6 ⅜, etc. up to 30. What does all this mathematical mumbo-jumbo means [sic] to the animation composer? Simply this: musical beats must be measured by the film frame, so the animator will know when to draw the action that corresponds to the beat." (p. 88)

The composure would also try and vary the tempo up through the different sequences. Paul Smith, a composer for the Disney studios said that he would vary up the beat in a scene to keep it from becoming too mechanical, he might start a sequence with a tempo of 9 and then switch it to a 9 ⅜. (Thomas p. 88).

The musical approach to animation was continued in the studio through the golden age of Disney animation. This technique was passed onto younger animators at the Disney studios in the mid to late part of the twentieth century, one of those animators was Don Bluth, Bluth started as an inbetweener at the Disney studios in 1955. Bluth discusses this type of animation in his book *The Art of Animation Drawing*. He discusses how music and animation are closely related, showing how rhythm can be incorporated into your animation. Bluth describes this relationship in the following way "We measure our lives by the clock in patterned recurrences of second, minutes, hours, days, weeks, months, years, decades, and so on. Dancers move to a count, musicians play to a count, poets write to a count, and believe it or not, animation also has a rhythm by which it is metered" (p. 38). Bluth was taught animation by the nine old men of Disney Studios, and he continues to describe and teach these methods even today. The method that Bluth describes in his book is the same method of animating that is described in *The Illusion of Life* by Frank Thomas and Ollie Johnston. The animator builds a scene around a tempo that

fits the desired mood or action of the animation. If you are animating a chase scene for instance, then you may want to develop your animation key poses around a fast tempo, such as a beat of 8's. This approach helps to bind the action to the musical background that the composer will build for that sequence. This level of animation and music synchronization was unique and built a cohesion of picture and sound throughout the film.

The nine old men of the Disney studios would continue this technique up through the mid-1970s until they finally retired from the animation industry. As time moved forward and the style of animation evolved through the later part of the twentieth century, the studio began to adopt a more naturalistic approach to animation, instead of a musical structured format.

THE LITTLE WHIRLWIND – 1940

The short film The Little Whirlwind from Disney studios in 1940 is a great example of musical timing in animation.

The picture starts off with Minnie Mouse pulling a cake out of the oven that she has just baked; the smell is so appealing that it physically draws Mickey towards the kitchen window where he tries to convince Minnie to share the cake for his help in cleaning up her yard.
The musical timing is perfectly integrated into this animation. Let's start by looking at the general structure of timing at the start of this short.

Minnie is animated to a tempo of 60 bpm or 1 beat every 24 frames, this gives the animation a very slow and thoughtful mood. As she pulls the cake from the oven, sniffs it, and then walks it over the counter, *Minnie* is almost dancing over the counter in this shot. The music in the background is perfectly choreographed to the animation, making the movement feel elegant.

As the smell of the cake wafts out the window, it continues to move in a dance-like action across the yard and over the fence where *Mickey Mouse* is walking up the path. The camera changes to a wide shot on Mickey and the entire mood of the cartoon changes to a more bouncy, happy vibe. The tempo is adjusted here, to 90 BPM, or 1 beat every 16 frames. If you study the animation here, you can see that Mickey is not simply in a common walk cycle studios use today, but he is walking and dancing to his own tune. This makes for a very entertaining animation and clearly develops the mood and performance of the character through his walk.

When Mickey becomes hypnotized by the smell of the delicious cake, the tempo changes to 48 bpm or 30 frames per beat. This creates a very slow dramatic feeling, setting up the disappointment in Mickey when the window gets slammed in his face and he falls to the ground. Interestingly, the action of Mickey floating through the air and doing a cartoon take when the window closes hits on the beat, but when Mickey land on the ground, this action is off the beat. The animator would use offbeat timing such as this to purposely catch the audience off guard. If an animator always hits his action on the beat, the motion becomes repetitive and not as entertaining to watch.

In the next few scenes of Mickey drooling over the cake through the window and trying to get Minnie's attention, the action shifts to a very common 120 bpm or 12 frames per beat. This beat is used quite often as it is the standard tempo of a march and is easily divisible by twos to help the animator plan the action. A 12 frame beat still creates a fun and energetic tempo for the scene's performance.

As the film move on to Mickey cleaning up the yard for Minnie, the tempo picks up speed, to144 bpm or 10 frames per beat. This tempo creates an upbeat mood and crisp action. If we look at the performance applied to the character, the moves are choreographed to a dance-like

appearance. This is the main difference between naturalistic animation and tempo-driven work, the animation is not simply moving in a naturalistic manner, but the animation is rhythmically driven, creating a highly choreographed and entertaining mood for the audience.

In the next sequence of events, the audience is introduced to the little whirlwind that wants to play with Mickey and cause havoc with the yard work that he is attempting to complete. The tempo stays on a little more of a quickened pace at 144 bpm until Mickey breaks into a dance with the leaves now dropped into his overalls by the little whirlwind. As Mickey breaks into dance the tempo changes to 120 bpm, matching the prescored music for that short piece of the action.

The little whirlwind calls upon his leaves with a whistle and a marching tune starts off the action. The tempo continues at 120 BPM or 12 frames per second as this matches the marching walk of the leaf's animation perfectly. The tension in the short continues to build, Mickey decides to take revenge on the little whirlwind. He captures the whirlwind in a pouch, ties it up and starts a boxing match with the bag.

The film breaks into a chase sequence now, with Mickey chasing the little whirlwind over the hill driving up the tension. The tempo of the film switches to 180 bpm or 8 frames per beat as we move into a chase with the little whirlwind's father/mother, the big whirlwind chases Mickey back into the yard and destroys the yard in the process, taking revenge on Mickey for attacking his little whirlwind. Many chase sequences in animated shorts of this era used the 8 frames beat to create a feeling of speed and tension in the film. Tom and Jerry by MGM is a prime example of this type of timing, many of those shorts used the 8 frame beat structure for their chase sequences.

The film ends with a tempo change of 120 bpm or 12 frames per beat as Minnie comes out the door to bring the cake to Mickey and finds the yard destroyed. In the end, Mickey gets the cake thrown into his face, the tempo slows down one more time to an 80 bpm, we end on a very happy Mickey as he gets his cake and enjoys the cherry on top.

This film is a perfect example of musical timing as it creates a complete cohesion of movement and music, creating a dance rather than a simple naturalistic motion.

Chapter V – Animating to a Musical Score

Pre-Established Music

Pre-scored music has always played a large part in animation. If we look at early sound in animated short films such as *Steamboat Willie* (Disney), Walt decided to use a prescored piece of music by the name of *Steamboat Bill* (Shields) as the main background music that Mickey Mouse whistles along with as he steers the boat. This music was a popular selection at the time and would create a sense of familiarity for the audience to whistle along with Mickey.

Animation and music came together as a natural fit in the early twentieth century. Walt produced many films that all had a strong relationship with many forms of music. As animation matured over the early years and the animated feature became possible with Snow White and the Seven Dwarfs, Disney had his eyes on a much greater connection between music and animation. *Fantasia* was Disney's way of showing how animation could contribute to not only simple tunes and silly gags, but it could create a beautiful piece of art with strong connections to musical masterpieces.

Many classical scores do not adhere to a strict beat. This made it difficult to work with as they would be written in a "free tempo", or tempo rubato. To put this in simplistic terms, the tempo of a score can change in a section of the music, and then it could return the to original

tempo after the rubato passage is over. In animation, this can influence how the animator reflects the tempo in the movement of the characters.

If we look at a classical piece of music that was used in fantasia, we can break down the approach that the animators took when animating this classic. The music *Dance of the Hours from the opera* "La Gioconda" is a beautiful and fun musical score. The music has a tempo roughly of 88 BPM, but the tempo will vary throughout the music, it will speed up in certain sections and slow down in other sections. With a varied tempo such as this, the animator can't rely on a rigid beat to build his performance.

In the book *The Illusion of Life*, Frank and Ollie describe how difficult it was to work on a picture such as Fantasia. "In Fantasia, most of the music was "Free Tempo" and did not adhere to a strict beat, which created awkward conditions for the use of the bar sheets. With one bar being 42 frames and the next 47 and the next 45, there was no way of getting a consistent measurement for a chart." (p. 293)

In a prescored piece of music such as *Dance of the Hours,* the varied beat was transcribed onto the exposure sheets for the animators could adjust the action as required to synchronize with the music. Musical scores can also come with human error in the exact match of the beat. Eric Goldberg also took on the task of animating a musical score in *Fantasia 2000*. Eric points out in his book, *Character Animation Crash Course* that these human errors can create an exposure sheet with a beat that may be off by a frame or two throughout the score. He demonstrates a varied beat with the example of an x-sheet indicating how you may need to adjust your animation from being animated with twos to ones to synchronize with the beat structure (See Fig. 7).

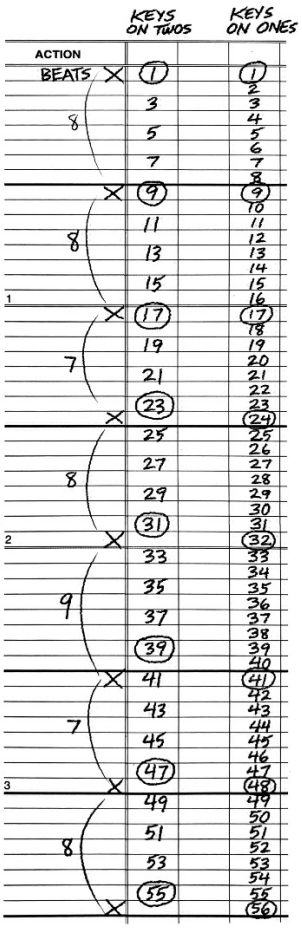


Fig. 7. X-Sheet demonstrating a varied pre-scored beat. *Goldberg*. 2008. p177

When animating a pre-scored piece of music, the animator must plan the entire animation frame by frame prior to any work being completed to determine where each beat of the song is going to play. This will give the animator the confidence that the action is going to sync properly to the final composition.

Understanding the musical structure of the piece that you are going to animate to is vitally important. This can help you determine where and how each action should take place in the planning phase of the animator's work. When Eric was animating and planning *Carnival of the Animals* for *Fantasia 2000,* he carefully determined the structure of the song, where all the beats landed and how he could utilize this information to plan his work. As Eric explains in his

book, (Goldberg p. 180) this gave him the ability to not only determine the actions for synchronization to the music but also to determine the number of characters required for the short. “example, the structure for the opening measures, as the flamingos are out walking, goes: 1, 2, 3, 4 – trill – 1-2-3-4-5-6. Armed with this knowledge, I now knew I needed six flamingos, who would walk in lockstep for four steps (1, 2, 3, 4), leap and spin in the air (trill), and fall back down into the water (1-2-3-4-5-6).” (p. 180).

Working on a pre-scored piece of music has many hurdles that need to be overcome by the animation team, but the result is a beautiful synchronization between sound and image.

THE RABBIT OF SEVILLE – 1950

The Rabbit of Seville, directed by Chuck Jones is an excellent example of an animation that is perfectly synchronized with a pre-scored piece of music. *The Barber of Seville – Overture* by Gioachino Rossini is the perfect selection for a chase sequence between two characters, Elmer Fudd and Bugs Bunny. The tempo for this piece is roughly 180 BPM, which works out to 8 frames per beat, this was a very common musical timing that was used in the 1940s and 1950s for many of the early “chase” style cartoons. If you look at any of the early cartoons such as *Tom and Jerry* by MGM, you will see that they all use this 8-frame timing in the animation. This timing tends to keep the action fast-paced and snappy for cartoon gag-driven animation. This timing was often used in the Warner Bros. shorts for this reason. If we compare this with the Disney style of animation, there is much more variation in the timing, they will quite often shift the timing to a slower tempo to describe a slower action or to create drama in a scene. If we refer to the analysis of *The Little Whirlwind* by Disney, you will notice that the first scene of that short starts off in a much slower tempo of 60 bpm, while *Minnie* is baking the cake.

In *Rabbit of Seville*, the short starts off in a chase between Elmer Fudd and Bugs Bunny. Bugs Bunny is being chased through the hills, as the gun blasts go off, you can see that they are already playing with the 8 frames beat between gunshots. Bugs enter the theatre and slams the door. As *The Barber of Seville* overture begins, Bugs slides out onto the stage and hits a clear and beautifully silhouetted pose to start the musical, as he sings his own version of the opera, with lyrics such as, “how doooooo, let me cut your mop, let me shave your crop, daintily, daintily”(Jones 01:40-01:51). Cutting to a wide shot, we see Elmer trying to sneak out of the theatre, but Buggs takes the opportunity to pull Elmer into the conflict of the story, setting up the chase sequence.

The film continues, building the chase sequence to a larger and larger climax throughout the picture. The tempo is consistent throughout the animation. The animators stay on 8’s for the entire short to match the tempo of the prescored music.

The shots quite often cut on the upbeat of the measure; this enables the animator to hit the main pose of the following shot on the downbeat in the next measure. This is an effective tool to emphasize the main downbeat and grab the audience’s attention as they cut the next scene.

When bugs begins to pour various products onto Elmer’s head (See fig. 9) the beat of each main action in bugs movement matches the beat exactly on 8’s. The deadpan star of bugs and the rhythmic movement create a comical setup and slapstick humour.

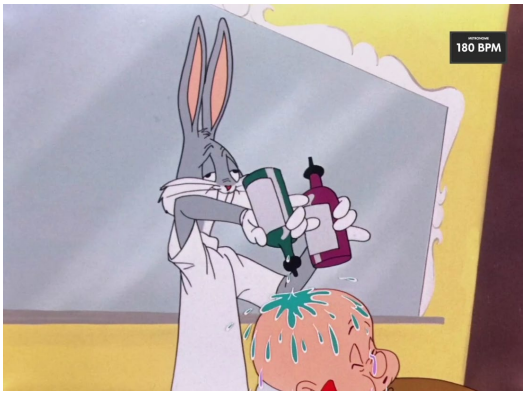


Fig. 8. Bugs and Elmer. *Rabbit of Seville*. 1950. (Jones 03:22)

As the chase escalates near the end of the picture with Elmer and Bugs getting larger and larger weapons, and skidding to a stop, the beat is very clearly followed here. Each skid to a stop hits the downbeat on 8's precisely.

This film is a prime example of the mastery that Chuck Jones and Carl Stalling brought to the Warner Bros. pictures.

CHAPTER VI – LIMITED ANIMATION PRODUCTION AND STOCK MUSIC

LIMITED ANIMATION

In the mid to late 1950s when the introduction of television animation became popular, the production studios were looking to cut costs and simplify the creation of animated content for production requirements. TV brought with it shorter production schedules and a different approach to animated content. The animated shorts weren't only seen as a tool to create cartoons on the front of newsreels in the theatres anymore for entertainment purposes, it could also be used as a tool to sell toys and much more to its audience, it became less of an art form and more of a marketing tool. The studios needed to scale down the number of staff to save money and create a process that could create animation in a reusable way. The studios adopted the practice of utilizing music libraries to avoid the overhead of creating original musical content for each episode in a cartoon series. This, in turn, would also eliminate the need for an in-house composer, such as Stalling. The studio was able to save money on creating original music with expensive recording sessions and move to a cheaper and simpler approach. They would move to stock music or what they use to call needle drop music.

Limited Animation was born, a technique invented in the 1950s and refined by the new animation production company *Hanna-Barbara,* founded in 1957.

The limited animation process was designed to create animated content with fewer artists by reducing the need for every character and every frame to be redrawn, cleaned up, inked, and painted in a production. The character would be broken up into different moving parts, such as arms, mouth, eyes, legs and more. This would give the artist the ability to hold a still drawing for the body of a character and simply animate the mouth and head motion to deliver the dialogue needed for the scene. As this style of animation was driven by the dialogue and not a musical beat, the need for full animation was not necessary to deliver the story to the audience.

Let's look at a typically limited animation production, The Flintstones (See fig. 9). This style of animation follows a naturalistic approach to animation. The storyline is driven forward by the dialogue, like a tv sitcom of the 1950s and 60s. You can compare The Flintstones to The Honeymonners of the same period. There was no need to have a strict synchronization of sound and image for this style of animation, as the dialogue pushed the story content forward in a successful manner.

Fig. 9. "*Meet the Flintstones"*, opening title, Hanna Barbara productions. 1961. (00:15)

William Hanna and Joseph Barbara didn't start out using limited animation and library stock music. The animation producers started working in the animation industry in the late 1930s for MGM studios to launch the *Tom and Jerry* cartoons in 1939. Tom and Jerry utilized the musical timing method in a very successful way. Hanna and Barbara received several Oscar nominations over two decades and won seven Oscars over the course of the Tom and Jerry cartoon series. (Natale).

With the high demand of producing a weekly episode for a cartoon series, the production methods that had been refined over the previous four decades were transformed into something that would fit into a tight production schedule for the new medium of television. This is not to say that the work being produced by companies such as Hanna-Barbara was in any way poorly done. They had enormously successful and brilliant cartoons, such as *The Flintstones* and *The Jetsons*, along with memorable characters like *Huckleberry Hound* and *Yogi Bear*.

The demands that were put on animation studios at this point forced new inventions and new methods of producing cartoon content. This did not allow for the same type of perfection in timing and musical compositions that were produced in the previous decades.

Musical timing was beginning to be pushed out of production at this point. That is not to say that the process was completely forgotten at this time, but the new style and approach to animation didn't allow for the continued practice of musical timing as it had been used in the past.

CHUCK JONES - HOW THE GRINCH STOLE CHRISTMAS

In the 1960s there were very few productions that continued to use musical timing as a production tool. Many of the new animators at the time were moving forward with the new

techniques in animation, such as limited animation and using more of a naturalistic style of movement. Many new tv shows where driven by dialogue instead of a musical beat.

Chuck Jones, in the latter part of his career, pursued a new project that interested him, as a co-producer and director a for a television Christmas special, based on the story by Theodor Seuss Geisel or "Dr. Seuss" as he was known.

How the Grinch Stole Christmas was first published in 1957. The story was very popular at the time and was an excellent choice for an animated Christmas special. Jones had worked alongside Theodor when he was a Captain in the US Army Air Forces in 1943 (Jones, Chuck Reducks p. 263). He was placed in charge of the Animation and Documentary arm of the First Motion Picture Unit, under command by Colonel Frank Capra. (Jones, Chuck Reducks p. 263). During this time, they worked out of the Fox Studio on Sunset Boulevard and Western Avenue, nicknamed "Fort Western" at that time. Jones and several ex-Warner workers and Disney artists began working on the "Private Snafu" animated short films for the Army (Jones, Chuck Reducks p. 263). Jones was impressed with Theodore and enjoyed their time working together on these short films. Jones was convinced at that point that the Dr. Suess stories would make an excellent animated short film, but he wouldn't get the chance to produce one of the stories until the 1960s.

Jones had left Warner Bros. in 1962 and began work as a contracted producer and director for MGM studios (Jones, Chuck Reducks p. 259). The style of animation that Jones was used to directing was not available anymore, they were not producing theatrical shorts when television came onto the scene and this left Jones wondering what his next job was going to be. He was an animator from the golden era of animation, his style of directing and his approach to animation did not fit into the new studio model for television content.

Major Theodor Suess Geisel retired from the Army after the war and decided to leave Hollywood to pursue a quiet life away from the movie industry (Jones, Chuck Reducks p. 266). Dr. Suess had allowed some of his written works to be produced into animated cartoons after the war, but he was not compensated well and didn't even receive proper credit in the work that he contributed, he felt like Hollywood had treated him poorly and was very reluctant to allow any more of his work to be produced by Hollywood studios(Jones, Chuck Reducks p. 266).

Jones was very interested in producing the book *How the Grinch Stole Christmas* by Dr. Suess into an animated Christmas special, it was a difficult job in persuading Ted to allow the work to be produced, but in the end, he agreed to work with Jones and let the story be produced. At that time in 1966, the producer was required to get funding from a sponsor prior to going to the network, instead of today's model where the producer would pitch the concept directly to a network for funding. Jones had taken the completed storyboards to twenty-six different advertising agencies before he could find a buyer. To his surprise, he found a sponsor in *the Foundation of Commercial Banks,* as Jones said "You have to be kidding! The bankers bought a story in which the Grinch says, "Maybe Christmas *doesn't* come form a store"??!!" (Jones, Chuck Ruduck p. 276). With the funding secured, they were ready to go into production, he had secured a $315,000 budget for the picture and MGM studios was in support of the project.

Dr. Suess stories, including *How the Grinch Stole Christmas* has a natural rhythmic nature to the narration, this would be an ideal marriage between musical timing and animation, and Chuck Jones was the king of animation timing. They began to build out the characters and find the voice talent required to tell the story. The ideal person to be the Narrator of the story was Boris Karloff, "The recordings he had done of the Kipling stories and many others established him not only as of the ideal actor but, in my mind and Ted's as the *only* one" (Jones, Chuck

Reduck p. 272). They also used Boris as the voice of the Grinch, simply by manipulating the recorded track of the narration to have a lower pitch to his voice. The voice of Cindy-Lou would be played by June Foray, who had voice acted in many prior roles for Jones and other animation studios over the years. With the narration complete and the storyboards ready, it was now time for the director and the music director to prepare the bar sheets and start producing the animation.

Jones started to setup the basic timing for the film based on the completed storyboard. He had an ideal music director to work with on this project, Eugene Poddany. Eugene had worked for Warner Bros. alongside Stalling and Jones in the Golden age of animation. Eugene worked together with Jones and Stalling on the 1951 short film, *The Wearing of the Grine* and had over a decade of experience scoring animated films. (Animation Resources p. 03) The two men sat down together and began to time out the picture, with a metronome and a stopwatch Jones would act out the scenes and break down each action on a set of bar sheets (See Fig. 10) for the composer could build out the music in sync with the completed animation. Every motion in the picture was broken down into a specific tempo and beat structure. When this was completed, Jones transferred the timing information over to a set of exposure sheets for the animators to begin their work.

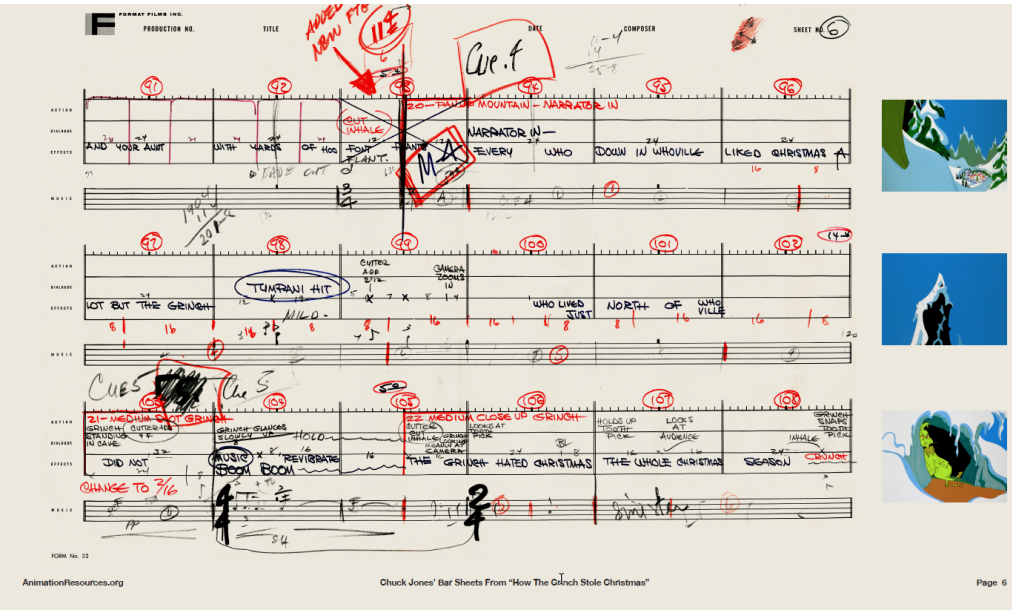


Fig. 10. Bar Sheet from *How the Grinch Stole Christmas*. Page 6, (Animation Resources) (accessed via https://animationresources.org/refpack032-chuck-jones-bar-sheets-musical-timing-rediscovered/)

As you can see in this bar sheet (See Fig. 10), the picture was set up in various tempi depending on the action required for the sequence. Each bar or measure in the picture is given a number, this makes it very easy to reference when working on the picture. If you refer to measure number 107 (See Fig. 10), you will see how the tempo changes to 2/16s from 2/12s, this is done to suit the action of the next sequence. The number (2) refers to the number of beats per bar and the (16) refers to the number of frames per beat, so in this case, there would be 32 frames per bar for the sequence. In each measure, Jones has indicated the number of frames each action will need on screen. If we look at bar 104, (See Fig. 10), you can see how Jones has indicated the action and established the frame count for each move to sync up with the beats. In this case, he has written the action note as follows "Grinch Glances slowly up" (Animation Resources p. 06), he has indicated on the bar sheet that this action will take 8 frames to complete because this tempo is set to 2/16s or 90 bpm, the action can play within that beat structure. The first lookup action by the Grinch will happen on a division of 2 within the 16-frame beat structure, in this

case, frame 8 of the bar, this will have the action end on the first “upbeat” of the measure. This type of detailed planning was completed for the entire picture before any animation was ever completed. For a complete overview of how a bar sheet was constructed, you can view a breakdown of this process at: Musical Timing in Animation.

When the animator received the scene package with the storyboard panels, the completed layout, main character layout poses by the director and the exposure sheets with the tempo and beat structure broken down, they would be able to break down the remaining action and animate the scene. Jones as the director would provide the animator with very clear drawings that would indicate the main key poses that he wanted to see in the action on a specific frame. This style of animation can be very restrictive for the animator, it doesn’t allow for much exploration of acting and action compared to a more naturalistic approach that is used in studios today, but the director also had full control of the picture down to individual frames, there was less time wasted in this style of production, as you didn’t have as much trial and error happening with the animator’s process. This is not to say that the animators had no say in how the action would play on the screen, but it did give the animators a very clear direction for the shot, which was important in a time-constrained production. At this point the animator would set up the metronome to the bpm that was indicated on the exposure sheet and plan out the remaining poses and actions that needed to take place in the shot. When the basic story poses along with the extremes in the action were completed by the animator, they would be pencil tested and shown to the director for approval of the animation.

If there was a change that needed to take place in the film, possibly a shot added here or a shot removed, it would be easily managed by simply adjusting the tempo in that sequence to adjust the overall timing of the film. Because this process is not a linear timeline, it makes it

much easier to work with, there is no sliding of scenes in the timeline, the director would simply correct the length of the film by adjusting the tempo in that sequence. This makes the process of musical timing a very flexible way of working.

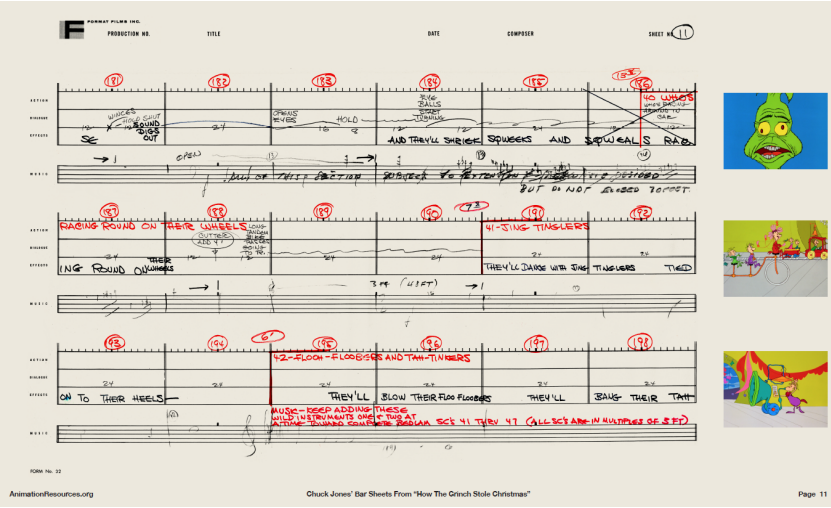


Fig. 11. Bar Sheet from *How the Grinch Stole Christmas*. Page 11, (Animation Resources) (accessed via https://animationresources.org/refpack032-chuck-jones-bar-sheets-musical-timing-rediscovered/)

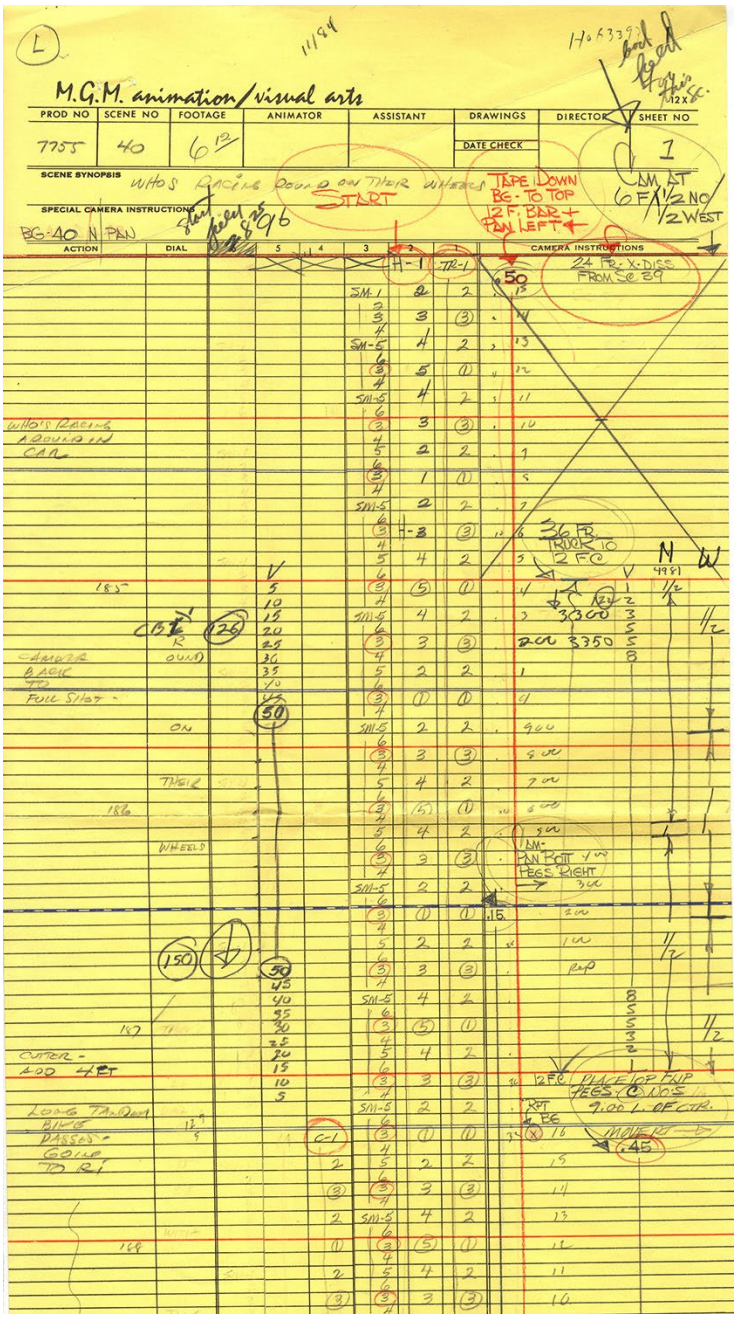


Fig. 12. Exposure Sheet. How the Grinch Stole Christmas. (Robert) (accessed via https://directedbychuckjones.tumblr.com/post/188391298517/exposure-sheets-and-storyboards-from-the-animated).

You can see the exposure sheet information (See Fig. 12) represented in the bar sheet (See Fig. 11), on measures 185, 186, 187, 188. The measure numbers are written in the action column of the exposure sheet for the animator's reference. This section of the animation has a

tempo of 2/12s, which means that there is a beat every 12 frames of the animation with a bpm of 120. If you look at measure 188, you will see that Jones has the tandem bike entered the scene on the last upbeat of this measure, it hits a 6 frame upbeat, halfway between the last 12 frame beat before the next measure. The SM-1 level on the exposure sheet (See Fig. 12) indicates a 4-frame bounce cycle for the train. Every little detail in the action is planned out in exquisite detail.

The picture was completed and ready for release on December 18th, 1966. This would be a successful short film for Jones and unfortunately, it was one of the last pictures ever created using the technique of musical timing. The film is a classic and excellent example of musical timing in animation.

Musical timing – Conclusion

Musical timing has been used in films such as Fantasia 2000 by Disney Studios, but most of the work completed today is done in a more dialogue-driven, naturalistic approach to animation. In contrast to how animation was completed in the golden age of animation, today the animator is still given a scene package, but it has nothing to do with the musical composition, it is simply the dialogue of the shot, a storyboard panel and the overall time required for the shot. This does give the animator more freedom to create the acting choices for the scene, but there is less cohesion between music, sound effects, and the animation in the picture. That is not to say that the work completed today is in any way inferior to the work completed in the past, but it is a significant change to the style of animation, and maybe we should consider bringing some of these methods back into practice today.

Rhythmically driven animation is beautiful to watch on the screen. If we only have animated films that are driven by the narrative and nothing else, the work tends to feel like a live-action picture, but animation can be so much more than this. With the advancement of

technology in animation and the rise of computer graphics, animated films have lost a sense of fun and artistic licence. Animation can bring stories to life in a way that no other medium can, and I believe that musical timing enhances the overall look and feel of animated content. Musical timing brings the audience into a picture not only through the visuals but also something that can only be felt inside, just like music makes a person want to get up and dance. Rhythm is part of the human experience and animation can provide that experience. Computer Animation can bring images to a point of realism that animators of the past would have never dreamed possible, but just because we can make content that looks like the world around us, we shouldn't lose the techniques that created the fantasy worlds such as Peter Pan or the Looney Tunes. Musical timing could easily be integrated into the modern computer animation pipeline by simply designing our stories around a rhythmic structure, I believe this is something that is worth exploring.

The animation industry is now at a point where anybody can create content that has the drive and the tools to create their own work. Technology has not only made it more cost-effective for production companies to create content but also for individual artists.
Musical timing now could come back into animation production, maybe not in a television series created by large animation production companies but in the home office of each artist. This is one possible future for the development of musical timing in animation. It is time to review and revise the older methods of musical timing and implement them into modern animation production.

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