ISSN 2616-5783 Vol.8, Issue 10: 52-57, DOI: 10.25236/AJHSS.2025.081009

The Sound of the Pressure Time: An Analysis of the Music and Sound Design in the Movie *Dunkirk*

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Abstract: *This article focuses on the original score composed by Hans Zimmer and the overall sound design in Christopher Nolan's film Dunkirk, analysing how it breaks with the narrative conventions of traditional war films. It argues that the film, through the use of Shepard Tones, minimalist repetitive motives, the fusion of electronic and ambient sounds, and a non-linear narrative structure comprising three distinct temporal threads, constructs a continuous sense of temporal pressure which in turn drives the narrative rhythm and shapes the audience's perceptual experience. The article explores how sound not only serves the image but becomes a central force within the narrative structure. The study demonstrates that sound in Dunkirk goes beyond atmospheric function, and through the creation of an 'aural perspective', reshapes the audience's perception of war, time, and emotion. In doing so, it establishes sound as a primary vehicle for narrative progression and emotional engagement, highlighting the narrative potential of sound design in contemporary cinema.*

Keywords: *Dunkirk, Shepard Tone, Film Music, Non-Liner Narrative*

1. Introduction

Film music not only enhances the emotional atmosphere, it also influences the audience's subjective perception of time. [1] *Dunkirk* directed by Christopher Nolan is a war film set during the *Dunkirk* evacuation during World War II. The Hans Zimmer soundtrack ingeniously combines non-linear narrative with the experience of time to create the illusion of "temporal dilation". The film uses three narrative threads spanning different time periods (one week in the army, one day in the navy, one hour in the air force) and creates the illusion of a rising pitch using Shepard Tone, keeping the audience on tenterhooks and under the pressure of the passage of time. This not only reinforces the film's warlike atmosphere but also deconstructs the musical narrative mode of traditional war films. [2]

This article focuses on the original score composed by Hans Zimmer for the movie *Dunkirk*. From the perspective of music analysis, it discusses how sound techniques such as Shepard tones, minimal repetitive motives, and the fusion of electronic sounds and ambient sounds are used to create a sense of time pressure, which becomes the main force driving the narrative rhythm of the movie and the audience's perception. In addition, the discussion will also explore how the film breaks with the traditional narrative logic of a soundtrack serving heroism through its "atonal" sound structure. At the same time, drawing on Michel Chion's two concepts of synchresis and acousmatic sound, the discussion will explore how sound in film breaks the limits of vision and guides the audience's perception of the "unseen". Through these analyses, it is hoped to reveal that in *Dunkirk*, sound is no longer just an adjunct to the picture. It can also be an important means of participating in storytelling and driving the development of plot and emotions.

2. Deconstructing the Narrative Role of Film Sound: An Overview of Theories and Methods

In exploring the narrative and perceptual functions of soundtrack and sound design in the film *Dunkirk*, this paper takes two theoretical frameworks in film sound studies as its starting point. On the one hand, we refer to Michel Chion's theory of the "sound-picture relationship", mainly in relation to the concepts of "acousmêtre" [3] and "synchresis" [4]; On the other hand, with the help of Claudia Gorbman's theory on the role of Nondiegetic Music[5] in classic film narratives in *Unheard Melodies: Narrative Film Musi*c, we analyse how the music affects the viewer's perception of narrative rhythm and mood in a subtle way.

Firstly, Michel Chion, a French scholar of film and sound theory, points out in his masterpiece *Audio-Vision: Sound on Screen* that the relationship between sound and screen is not a simple juxtaposition of coexistence, but constitutes a dynamic that interacts with each other in terms of temporality and cognitive

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structure. The term “acousmêtre” refers to a source of sound that is not visually recognisable, that is mysterious and dominant, and that is capable of guiding the audience’s emotions and exerting psychological pressure. On this basis, Chion also proposes the concept of synchresis, which emphasises that the viewer naturally synchronises the auditory with the visual, even if they are technically incongruous. This “synesthesia” is cleverly exploited in Hans Zimmer’s soundtrack practice - in *Dunkirk*, for example, the sound often builds up the mood before the image, inducing the audience to make a perceptual judgement about the events that are about to take place. Secondly, in her classic book *Unheard Melodies: Narrative Film Music*, Claudia Gorbman introduced the concept of Nondiegetic Music, defining it as a sound presence that is “heard but not realised”, i.e. the audience is under the influence of the music but is rarely aware of its manipulation. She pointed out that this “narrative transparency” is the core logic of the classic Hollywood soundtrack – music should serve the narrative, but not overpower it. However, in *Dunkirk*, this transparency is significantly broken: Zimmer’s extensive use of non-melodic, repetitive sound motives with a strong sense of presence dominates the narrative rhythm and becomes part of the film's narrative, rather than simply background music.

3. Shepard Tone and temporal dilation

Shepard Tone is a classic auditory illusion proposed by psychologist Roger Shepard. It works by superimposing multiple pure tones that are octaves apart, and using an amplitude envelope filter to dynamically adjust the energy distribution of each frequency band, so that the listener has the illusion that the pitch is constantly rising (or falling), even though the actual frequency arrangement is cyclic and the pitch does not actually change. [6] In music psychology and film sound research, the Shepard Tone has been shown to have the potential to manipulate emotions. For example, the Shepard–Risset glissando can induce feelings of tension, disorientation or unstoppable acceleration. [7] In film music, the Shepard Tone is widely used to create a sense of constant urgency in scenes. For example, in *The Dark Knight*, the Shepard Tone is combined with the Batpod chase scene, causing the pitch to rise continuously, thus driving the sense of a constantly tense rhythm. In I*nception,* the Shepard glissando overlaps with the ticking sound to express the collapse of the dream. However, in *Dunkirk*, the use of the Shepard Tone is more extreme, it runs throughout the entire film, and it becomes a central tool for shaping the overall sense of time in the film. The use of this technique is highlighted in the soundtrack of the aerial combat scenes in the film. From the perspective of a fighter pilot, the audience hears not a melodic and thematic battle music, but a rising hum, mixed with propellers, wind and electronic sounds. This sound effect simulates the pilot’s hearing angle, creating a “constant state of tension” that defies time through the Shepard Tone. As Buhler, Neumeyer and Deemer point out in the *Hearing the Movies*, “Action sequences often consist of a series of accelerandos, each marking an intensification of the action. The music’s rhythmic drive can create a sense of urgency even if the image track does not change pace.” [8] When sound breaks the rhythm of the film editing with rhythmic acceleration, the audience can establish a psychological association of “tension” through hearing.

The main soundtrack in the movie, *The Mole*, is a sustained rising sound effect created by Hans Zimmer using Shepard Tone, which keeps the audience in a state of high tension. The combination of bass strings and electronic sound effects, along with the gradually accelerating rhythm, creates the illusion of time speeding up, making the retreat seem more urgent and critical. Although there were not a lot of fighting scenes in the movie, the music still made the audience feel the cruelty of war and the soldiers' anxiety as they fled for their lives. In addition, the film’s soundtrack lacks the sense of climax and conclusion found in traditional film music, and instead keeps the film in a tense atmosphere. This continuous acoustic illusion of tension, created by Shepard Tone, weakens the audience’s perception of the unit of time and transports them into a vague experience between “stretching” and “compressing”. This change in the perception of time is due to three main factors: (1) A continuously rising pitch keeps the brain in a state of tension and anxiety, reducing attention to specific units of time. (2) The music lacks clear rhythmic sections, making it difficult for the audience to perceive the natural passage of time. (3) The constant build-up of rhythm increases the audience's concentration, which leads to a distorted perception of the flow of time under high pressure. [9]

In summary, Shepard Tone in *Dunkirk* is not only a musical composition technique, but also a means of influencing the audience’s perception of time. Combined with non-linear narrative, it keeps the film full of tension and suspense from beginning to end. Nolan and Zimmer have successfully shaped time as the central experience of the film. It can be seen that the role of film music is no longer just limited to enhancing emotions, but can also deeply intervene in the perception of time and affect the audience’s subjective perception of time. This musical technique also provides a new reference direction for the design of future film music.

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4. The combination of music and non-linear narrative in film

Christopher Nolan's films are known for their complex time structures. [10] He has used non-linear narrative techniques in a number of his works to challenge the audience's perception of time. In films such as *Inception* (2010) and *Interstellar* (2014), the layering, fluidity and displacement of time form the core of the narrative, while the film score enhances this experience through strategies such as rhythm, harmony and dynamic contrast. In *Inception*, Hans Zimmer uses different layers of rhythm to express the changing time rate of dreams. For example, the slow treatment of Edith Piaf's song *Non, je ne regrette rien* becomes a key symbol of dream time in the movie. In *Interstellar*, Zimmer used the sounds of bells and pipe organs to simulate the effect of time dilation, so that the audience could directly experience the relativity of time aurally.

These music techniques are used to an extreme in *Dunkirk*, where the film's three timelines – one week (see fig.1), one day(see fig.2) and one hour(see fig.3) – are set in the air, at sea and on land, respectively, and interspersed with narration. The editing breaks the linear chronological order, causing the audience to visually switch between scenes frequently. For example, in the film, the Air Force has the shortest timeline, and the music is dominated by fast rhythms and short notes. [11] The staccato of the strings emphasises the tension of the pilots in battle, the rising high strings enhance the sense of speed of the flight, and the addition of electronic sound effects further enhances the feeling of being there when watching the air battle. The naval timeline spans one day, and the music uses low frequencies to express the heaviness and unpredictability of the ocean. Through the combination of minimalist repetitive motives and Shepard Tones, it creates the illusion of an "endless ascent", causing the music to build up in terms of emotion without creating a clear sense of climax or conclusion. The longest timeline in the army, the music symbolises the delay of time and the anxiety of the soldiers through repeated patterns. The combination of low-pitched string instruments (such as cellos and double basses) and low-frequency electronic sound effects creates a deep sense of vibration, further strengthening the oppressive atmosphere. At the same time, through the slowly advancing sound layers, the audience can better appreciate the helplessness and torment of the soldiers waiting for rescue. In films with non-linear narratives, frequent changes in the timeline can lead to a sense of narrative disjoint. However, the music in *Dunkirk* not only enhances the emotional expression of each timeline, it also maintains an aural continuity between the different timelines, making the overall narrative more fluid and unified. [12]

Figure. 1. Screenshot taken by the author from Dunkirk, 'The Mole – One Week' (directed by Christopher Nolan, 2017).

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Figure 2. Screenshot taken by the author from Dunkirk, 'The Sea – One Day' (directed by Christopher Nolan, 2017).

Figure 3. Screenshot taken by the author from Dunkirk, 'The Air – One Hour' (directed by Christopher Nolan, 2017).

First of all, Nolan's non-linear editing style requires the audience to quickly switch between different timelines, and music plays the role of an "emotional bridge" in the process, making the transition between timelines more natural and smooth. Despite the constant switching of scenes, the music maintains the same tone, instrumentation and melodic cues, so that the audience can still feel a similar sense of tension and oppression across different timelines. Second, the use of the Shepard Tone further enhances the sense of urgency. This auditory illusion creates a never-ending effect of constant rise or fall through a series of superimposed tones, and is widely used in movies to create suspense and emotional tension. This technique not only creates a sense of time pressure, so that the audience still feels the tension when the scenes change, but also maintains the audience's sense of immersion, so that the emotional atmosphere continues across different timelines. In addition, the minimal repetitive rhythm, an important musical element that runs through the entire film, is used in all three timelines. It not only unifies the overall style of the film music, giving the soundtrack of the navy, army and air force timelines consistency, but also creates a constant sense of time pressure in the audience's mind. Even as the camera keeps switching, the audience can still feel the tension rising, enhancing the tension of the narrative. However, this technique contrasts sharply with the musical treatment of traditional war films. In many classic Hollywood war films, music often enhances character portrayal and narrative logic through a leitmotif, and has a distinctive thematic quality, such as the solemn fanfare-style leitmotif composed by John Williams for *Saving Private Ryan*, or the march-style music used by Dmitri Tiomkin in *The Longest Day*. The main purpose of this music is to strengthen the heroic spirit and sense of collective honour of war, so that the audience associates war with nationalism or a sense of justice. It belongs to the category of "functional narrative music". However, in *Dunkirk*, there is almost no clear main theme in Zimmer's music, and there is a lack of build-up to an emotional climax. instead, there is a continuous minimalist repetitive

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motif fused with ambient sounds. Gorbman mentions in her book *Unheard Melodies: Narrative Film Music* the "seven norms of classical narrative film" [13], which are broken here: Zimmer's music is not only "heard" but also has a strong sense of presence. However, instead of guiding the audience to a clear emotional attachment, it confronts them directly with the uncertainty and coldness of war.

Overall, the music, through the unification of sound, the illusionary effect of Shepard Tone, and the consistent use of repetitive rhythms, makes the film a coherent audiovisual experience despite its non-linear narrative structure, enhancing the sense of urgency in the narrative rhythm and the audience's deep involvement in the plot development. This technique not only effectively solves the sense of incompleteness that may be caused by jumps in the timeline, but also proves the key role of film music in non-linear narratives – it is not just a supplement to background sound effects, but an important part that drives the integrity of the narrative structure.

5. Invert audio and visuals

In the movie *Dunkirk*, sound is no longer a background element that supports the picture. It takes centre stage in several key scenes, creating a highly immersive viewing experience. Hans Zimmer and the sound design team did not completely distinguish between the soundtrack and sound effects but designed them as a whole by rhythmically processing elements such as wind, engine sounds, hull vibrations, and gunshots. In some passages, sound conveys narrative information to the audience even before the picture does. For example, in the scene where the rescue ship of "the Sea" line is bombed by enemy aircraft, Zimmer creates a continuous low-frequency vibration that blends with the sound of the engine, creating a "danger signal" that appears earlier than the image. Although the enemy aircraft did not appear on the screen, the audience could clearly perceive the arrival of the battle aurally. In addition, sounds such as clockwork, breathing, metal rubbing, and wind were processed into a "fuzzy sound" that is somewhere between a realistic sound effect and an electronic soundtrack. This approach makes it impossible for the audience to accurately distinguish which part is music and which part is ambient sound. This kind of ambiguous sound can be heard in multiple scenes, such as underwater escape, air combat, and waiting on the beach. This not only immerses the audience in an immersive experience surrounded by sound, but also makes them unconsciously accept the sensory rhythm dominated by sound. This "unrealistic" use of sound techniques enhances the dramatic expressiveness of the sound and breaks with the traditional method of assigning background music, soundtrack, dialogue.

This sound processing method embodies a central point made by Michel Chion in *Audio-Vision*, "By added value I mean the expressive and informative value with which a sound enriches a given image so as to create the definite impression, in the immediate or remembered experience one has of it, that this information or expression 'naturally' comes from what is seen and is already contained in the image itself."[14] In other words, in some immersive sound structures, the audience can no longer rely on the picture to judge space, time, or the rhythm of the narrative, but perceive the development of events, changes in emotions, and the approach of danger through sound and sound effects. The repeated rhythm of the clock in the film (tic-tic-tic) is a typical example. This regular and sustained rhythm not only creates and enhances a sense of urgency, but also imitates the rhythm of a person's heartbeat and breathing, so that the audience is unconsciously influenced by the rhythm of the sounds in the film. Even without the visual guidance of the POV shot, the audience can gradually enter the perspective of the character's state of mind through their hearing, and experience the tense atmosphere and psychological oppression of the war scene. However, it should be noted that the sound design in *Dunkirk* is not intended to "replace" the images, but to maintain the emotional tension and narrative rhythm through sound on the basis of weakening the images. This gives the sense of hearing more opportunities to participate in the film's progress.

The prominent use of sound technology in the film is thus a way for the director to create an immersive experience through sound while intentionally diminishing traditional visual narrative tools (e.g. dialogue, close-ups of characters' expressions, etc.). For example, the fading sound of the wind and engine noise as the fighter plane lands, and the soundtrack and breathing sounds in sync when the retreat is successful, all of which create an "aural perspective". This approach opens up the possibilities of sound in narrative structure, and at the same time reminds us that within a particular aesthetic style and framework, sound can take on more and more complex narrative structures and guide the audience's perceptions without replacing the visual. So rather than suppressing the dominance of the visual, *Dunkirk* reconfigures the traditional pattern of division of labour between audiovisual narratives, making sound one of the main threads guiding the audience's engagement with the plot.

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6. Conclusion

Through an analysis of the soundtrack and sound design in the movie *Dunkirk*, this article discusses how sound in this movie breaks away from the fixed patterns and functions of traditional soundtracks, becoming the main means of driving the narrative rhythm, rendering the emotional atmosphere, and influencing the audience's perceptual experience. The film adopts a non-linear narrative structure, which fragments the information on screen in terms of time and space. In this context, sound plays an important role in connecting the three narrative threads and unifying the rhythm and mood. Zimmer uses a combination of Shepard Tone, minimal repetitive entrances, ambient sounds and electronic sound effects to create a constant sense of tension and provide the audience with a structured psychological rhythm. In the process of analysis, this article centres on Michel Chion's theory of the relationship between sound and image, and analyses how sound guides the audience's perception in the absence of a visual image. Unlike the melodic and thematic soundtrack approach in traditional war movies, Zimmer weakens melodic expression in this film, and reconstructs the logic of traditional film music serving the picture through persistent, monotonous but constantly building sound and rhythm.

In addition, this article also focuses on the impact of sound design on the audience's sensory and psychological state. Instead of actively obtaining narrative information through the images, the audience is passively guided by the sound into a highly tense sensory state. Shepard Tone's role in shaping the emotions fills the entire film with a sense of oppression. This oppression does not just come from the direct conflict in the images, but also from the rhythm of the sound, which makes the story "feel" like it is happening. Overall, the sound design of *Dunkirk* showcases the innovation of modern film soundtracks in terms of narrative and perceptual dimensions. It not only demonstrates how sound can be combined with non-linear narratives but also reflects the increasingly important role of sound in constructing the audience experience. This example shows that film music is no longer just a background to the visuals but has gradually become part of the narrative level through the design of rhythm and structure. This change has prompted us to rethink the master-slave relationship between film music and images and has also laid a certain foundation for further exploring the relationship between sound and audience perception in future sound research. This will help deepen our understanding of sound aesthetics, audiovisual interaction and emotional manipulation.

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