Anticipation and Emotional Build-Up Through Repetition:

A Structural Analysis of Hans Zimmer's Time

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Author Note

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Hans Zimmer's *Time*, featured in the final scene of Christopher Nolan's *Inception* (2010), is widely recognized for its haunting beauty and emotional depth. Built on a simple eight-chord loop, the piece gradually unfolds over four and a half minutes through subtle textural layering and dynamic expansion. Despite its harmonic and melodic simplicity, *Time* achieves a powerful emotional arc, culminating in a climax that perfectly matches the narrative ambiguity of the film's ending.

This essay argues that *Time* derives its expressive power from minimalist repetition and gradual intensification, which Zimmer uses to shape listener expectations and emotional response. In addition to a musical analysis grounded in concepts such as harmonic function, rhythmic structure, and musical form as discussed in class, the essay also incorporates computational methods to quantitatively support key observations—using audio feature extraction techniques implemented in Python. The corresponding source code is included in the appendix.

I. Harmonic Simplicity and Loop Structure

Am–Em–G–D-Am-CM7-G-D: The Harmonic Loop as Foundation

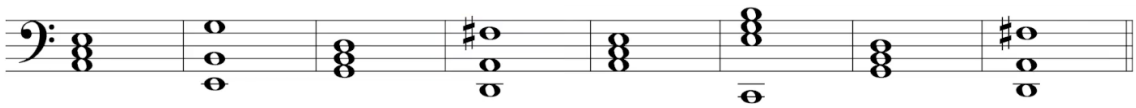

Figure 1. Harmonic loop used in Time. https://www.youtube.com/watch?v=cAgTvai3d0c

At the core of *Time* lies a repeating harmonic loop, typically voiced as **Am – Em – G – D - Am - CM7 - G - D**, which can be analyzed in Roman numeral terms as **iv – i – III – VII - iv - VI^7 - III - VII** in the key of E minor. These eight-chord sequence cycles consistently throughout the piece, without any modulation, secondary dominants, or deviations from the original progression. On the surface, this structure may appear harmonically static or even compositionally simple. Yet, it is precisely this harmonic neutrality that lays the foundation for emotional tension and immersive growth.

Functional ambiguity and Avoidance of Closure

From a harmonic standpoint, the progression avoids traditional functional syntax. There is no dominant-tonic (V–I) cadence, no pivot chords, and no leading-tone resolution. Instead, each chord flows smoothly into the next, creating an impression of harmonic continuity without any strong pull toward resolution. This avoidance of cadence allows the loop to "hover" in time—a musical reflection of the film's treatment of dreams and time dilation.

The sequence opens on the subdominant (iv) rather than the tonic, which lends the progression a feeling of ambiguity. As the chords cycle through Em (i), G (III), and D (VII), they create forward harmonic motion still without resolution. In the second half of the loop, Zimmer subtly alters the progression by replacing Em with CM7 (VI^7), introducing harmonic variety within an otherwise stable framework. This substitution deepens the emotional shading of the cycle while maintaining its continuity. Zimmer's harmonically neutral loop shifts structural emphasis away from harmonic resolution and toward parameters like rhythm and texture.

Static Harmony and the "Plain-Static" Form

The unchanging harmonic background of *Time* is best understood through the lens of what we have defined as a plain-static harmonic structure. In this model, chords change, but they do not function toward resolution or destabilization; instead, they exist in a kind of horizontal neutrality. There is motion, but no direction. No harmonic event overcomes or prepares another. This is quite different from sentence structures or period phrases that create and resolve tension.

The plain-static model aligns particularly well with *Time* because the loop is not presented as a goal-driven harmonic journey but as a harmonic frame. Over the course of the piece, this frame remains fixed while everything else—texture, dynamics, and orchestration—evolves. Thus, harmony acts not as a vehicle for tension and release but as a stable reference point against which change is measured.

This aligns with class discussions on improper versus functional harmony, where the plain-static form is understood as non-goal-directed harmonic motion—lacking cadential force but rich in interpretive

flexibility. The persistent neutrality of the loop offers what Rohrmeier terms a “structural canvas” for other dimensions such as rhythm and texture to unfold hierarchically above a fixed tonal base.

II. Temporal Structure and Gradual Intensification

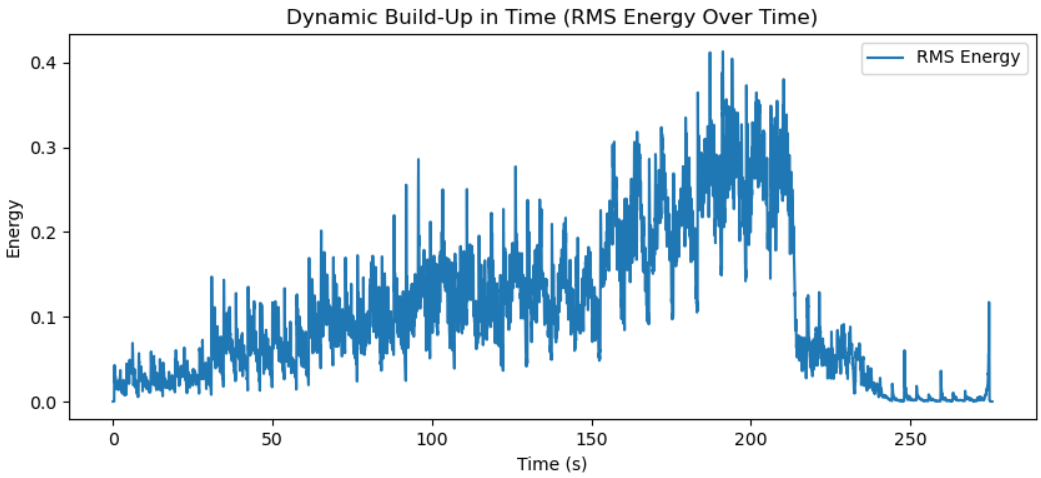

Figure 2. RMS energy over time.

To empirically examine the build-up effect that will be described below, a root-mean-square (RMS) energy curve was extracted from the music. As shown in *Figure 2*, the energy steadily increases over time in a manner that matches the gradual orchestration layering described in the formal analysis. This quantitative pattern reinforces the subjective perception of intensification and aligns with the definition of rhythmic-static form, wherein tension accrues without metric change.

Layered Orchestration as Narrative Device

Although the harmony in *Time* remains constant, the music never feels stagnant. This sense of movement and growth is achieved through the gradual evolution of instrumental texture. The piece begins with a soft piano motif, arpeggiating the chords in a sparse and reflective manner. new layers are introduced incrementally: first cello, French horn, and trombone, followed by drums and soft strings, then eventually the full orchestra with pulsing low-end and cinematic percussion. At its peak, an electric guitar solo emerges—an unexpected timbral shift that adds urgency and intensity. Afterwards, at the climax’s

resolution, the orchestration suddenly contracts, leaving only the piano and violins—returning the listener to the fragile simplicity of the opening texture.

This additive orchestration technique mirrors cinematic narrative development. Just as a film slowly reveals its emotional depth and complexity, *Time* builds its structure organically through orchestration. This approach reflects the use of timbre as a formal axis. Rather than serving purely coloristic or expressive roles, changes in instrumentation function as structural events—marking stages in the piece's formal unfolding. This temporal strategy allows Zimmer to generate climax and release without thematic or harmonic development—a rare feat in film music.

The progressive addition of instrumental layers is quantitatively reflected in the onset strength curve extracted from the music. As shown in *Figure 3*, onset intensity increases progressively over the course of the piece, peaking near the emotional climax. This confirms the perception that new instrumental layers—including strings and percussion—are gradually introduced over a repeating harmonic loop, contributing to a steady build-up in textural density and dynamic energy.

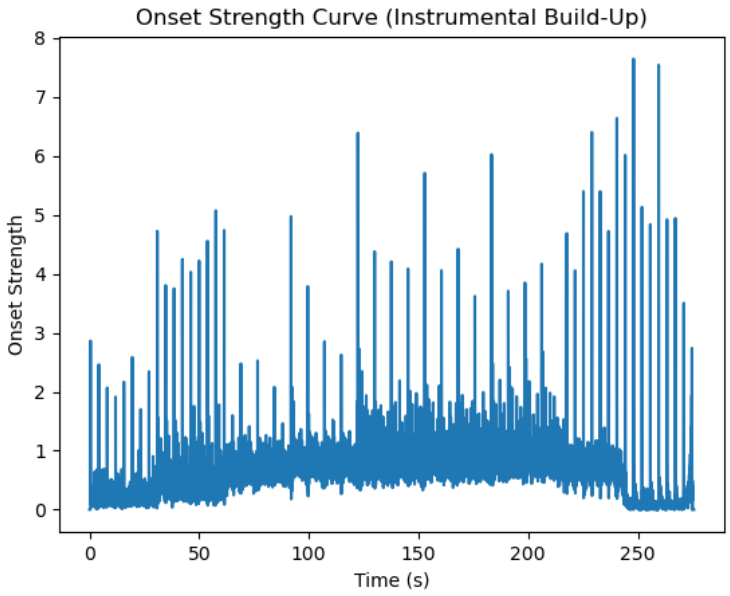

Figure 3. Onset strength curve.

From the perspective of formal design, this gradual intensification reflects the concepts of overarching process and structural buildup, where form is shaped not by sectional contrast but through

"continuous transformation"—a technique also seen in canon, algorithmic composition, and minimalist music.

Rhythmic-Static and Formal Evolution

While the harmonic and melodic content remains static, form unfolds through the accumulation of instrumental and rhythmic variation. The piece centers on a single repeating chord loop, devoid of thematic contrast or motivic variation. Yet this restraint becomes its strength: each new instrumental voice —first piano, then strings, then percussion—gradually expands the sonic field without altering the harmonic framework.

This approach reflects what we've defined as rhythmic-static form: a fixed meter and unchanging tempo that nonetheless produce a sense of forward motion. Despite its harmonic stasis, the piece evolves perceptually, creating the illusion of acceleration without modulation. Through repetition and subtle change, Time generates emotional weight not by progressing toward a destination, but by intensifying the present.

Metrical Grid, Cognitive Entrainment

This perceptual shift relies on the listener's alignment with a stable metrical grid. As Justin London (2012) explains, cognitive entrainment allows listeners to synchronize with an internalized pulse, shaping their perception of time and motion in music. In *Time*, Zimmer leverages this steady framework to create emotional momentum: subtle increases in rhythmic density are perceived as acceleration, not because the tempo changes, but because they interact with our metrical expectations. The regular pulse thus becomes a canvas for expressive tension.

III. Predictability, Expectation, and Emotional Response

Theories of Musical Engagement: Repetition as Cognitive Structure

David Huron, in *Sweet Anticipation*, argues that musical emotion often arises from the interplay between expectation and realization. This notion aligns with Bartkowiak's (2010) argument that music in science fiction films often employs familiar structures not to mirror action, but to ground viewers in a

known emotional space, enabling them to better engage with unfamiliar, but recognizable territory. Zimmer's *Time* follows a similar strategy—offering a stable harmonic loop that fosters immersion through subtle transformation rather than thematic novelty. In *Time*, Zimmer leverages this dynamic by repeating a predictable chord loop that the listener quickly internalizes. This schematic predictability allows attention to shift toward subtle changes—such as the entrance of new instruments or dynamic shifts—which take on heightened expressive weight.

Elizabeth Margulis, in *On Repeat*, complements this view by showing how repetition fosters psychological absorption and emotional depth. As the loop becomes familiar, the listener becomes increasingly attuned to its evolving textures, experiencing each new layer as significant precisely because it emerges within an already-internalized framework. Together, these perspectives highlight how *Time* transforms harmonic stasis into emotional momentum—not through contrast or resolution, but through the cognitive and affective power of repetition.

This effect is supported by experimental findings as well. A study on emotional response to musical repetition (Margulis et al., 2015) showed that while repeated passages maintain or diminish emotional arousal, listeners exhibit stronger affective and structural responses to moments of contrast or variation. These results empirically reinforce Margulis's theoretical claims, suggesting that repetition both anchors emotional continuity and heightens the salience of formal transformation.

Cinematic Context: Ambiguity and Immersion

The structural features of *Time* are not merely abstract musical devices—they are tightly interwoven with the film's narrative design. In the final scene of *Inception*, Zimmer's repeating chord loop plays as the spinning top wavers ambiguously between dream and reality. The music offers no resolution, just as the image does not: both suspend the audience in a state of heightened attention and uncertainty. Because the chord progression is familiar and unchanging, the listener becomes attuned to subtle expressive cues, deepening immersion. The unresolved harmonic loop thus mirrors the unresolved narrative loop, allowing music and image to converge into a singular experience of open-ended anticipation.

Expressive Timing and Emotional Illusion

Time also uses subtle timing strategies to control perceived motion. These include microtiming, such as the slight stretching of phrases in the climax, or the use of delayed entrances to increase anticipation. At the peak, the full orchestra holds long, swelling notes that create a feeling of suspended time. This use of expressive timing—akin to rubato—illustrates what we have discussed in class as the distortion of the beat grid, particularly at the phrase level. Subsymbolic timing cues, such as micro-deviations in phrasing, work beneath conscious perception to shape emotional response, allowing listeners to experience suspended time without breaking metrical continuity.

The emotional illusion created by this timing is powerful. There is no actual harmonic resolution, but the listener feels something has resolved—an emotional closure crafted entirely through dynamic shape and orchestral pacing. In doing so, Zimmer aligns with class discussions on temporal perception, anticipatory schemas, and the way expressive tools shape listener experience beyond tonal syntax.

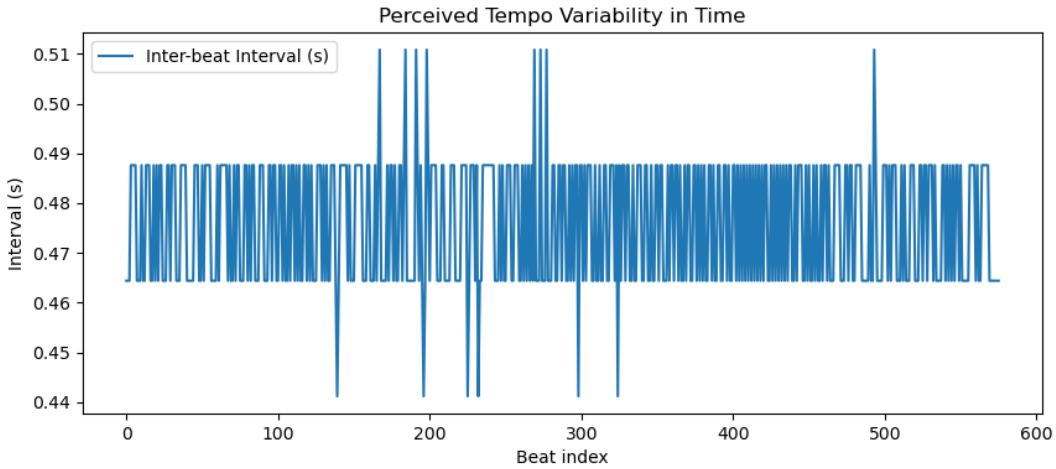

Figure 4. Estimated tempo curve based on inter-beat intervals.

To further support this observation, a tempo curve was estimated from the music using inter-beat intervals derived from onset strength analysis. As shown in *Figure 4*, the global tempo remains broadly stable, with most inter-beat intervals clustering around 0.47 seconds. However, brief deviations—particularly near the structural climax—indicate subtle tempo stretching or expressive rubato. These local fluctuations are not perceivable as tempo changes in the strict sense, but they align closely with the

listener's perceived sense of temporal suspension. This supports the analytical claim that Zimmer's expressive timing enhances emotional immersion without altering metric consistency.

This interaction between expressive timing and perceived form mirrors the "expressive distortion of the beat grid" as we have discussed, where rubato and microtiming serve as tools to shape phrase-level contour and affective intensity without disrupting the metrical structure itself. Such deviations can be interpreted through the lens of expressive timing as a formal parameter, contributing to temporal tension within a fixed rhythmic frame.

Conclusion

Through a eight-chord loop, Zimmer constructs a deeply immersive and moving musical experience. The power of *Time* does not lie in its harmony or melody, but in how those static elements are animated through texture, timing, and repetition. By applying class concepts such as plain-static harmony, rhythmic-static development, and expectation theory, we observe Zimmer's compositional strategy tapping directly into cognitive and emotional structures. *Time* demonstrates that in music—as in narrative—what matters is not just what changes, but how it changes, and how that change is perceived. In the end, the piece offers a profound lesson in restraint: that music can move us by showing us how deeply we can feel when we remain in place.

Ultimately, Zimmer's piece exemplifies how form can emerge through repetition, expectation, and transformation rather than traditional tonal syntax. This approach echoes analytical models that prioritize texture, rhythm, and expectation as form-defining forces—offering an alternative path to structure that resonates with many of the conceptual frameworks discussed throughout the course.

This perspective also invites a broader reflection on what music is for. As emphasized in the final lecture, music should not be understood merely as a source of pleasure or emotional release. It is equally a space for exploration—a way of encountering something new, meaningful, and often unexpected. Unlike static or purely subjective experiences, music challenges us to listen actively, to reflect, and to engage. *Time* becomes more than a film cue—it becomes an invitation to think, to feel, and to experience differently.

Appendix

```python
import librosa
import matplotlib.pyplot as plt
import numpy as np

y, sr = librosa.load("HansZimmer_Time.wav")

hop_length = 512
frame_length = 2048
rms = librosa.feature.rms(y=y, frame_length=frame_length,
hop_length=hop_length)[0]

frames = range(len(rms))
t = librosa.frames_to_time(frames, sr=sr,
hop_length=hop_length)

plt.figure(figsize=(10, 4))
plt.plot(t, rms, label='RMS Energy')
plt.title('Dynamic Build-Up in Time (RMS Energy Over Time)')
plt.xlabel('Time (s)')
plt.ylabel('Energy')
plt.legend()
plt.show()
```

Source code for RMS analysis

```
import librosa
import matplotlib.pyplot as plt
import numpy as np

y, sr = librosa.load("HansZimmer_Time.wav")

onset_env = librosa.onset.onset_strength(y=y, sr=sr)
times = librosa.times_like(onset_env, sr=sr)
plt.plot(times, onset_env)
plt.title("Onset Strength Curve (Instrumental Build-Up)")
plt.xlabel("Time (s)")
plt.ylabel("Onset Strength")
plt.show()
```

Source code for onset strength analysis

```
import librosa
import matplotlib.pyplot as plt
import numpy as np

y, sr = librosa.load("HansZimmer_Time.wav")
onset_env = librosa.onset.onset_strength(y=y, sr=sr)
tempo, beats =
librosa.beat.beat_track(onset_envelope=onset_env, sr=sr)

times = librosa.frames_to_time(beats, sr=sr)

plt.figure(figsize=(10, 4))
plt.plot(np.diff(times), label="Inter-beat Interval (s)")
plt.title("Perceived Tempo Variability in Time")
plt.xlabel("Beat index")
plt.ylabel("Interval (s)")
plt.legend()
plt.show()
```

Source code for tempo analysis

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