Spectromorphology Hits Hollywood: Black Hawk Down-A Case Study

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Abstract

Black Hawk Down, (Academy Award for sound, 2001) directed by Ridley Scott with film score by Hans Zimmer and Sound Design by John Title, makes extensive use of spectral morphology to integrate the helicopter sound into the total sound design including music. Spectral and amplitude characteristics of the chopper blades traverse seamlessly between the sound effects montage and the traditional orchestral sound score. The helicopter sound, in fact, becomes a sonic character in its own right. The spectral characteristics of the helicopter are developed in the aural realm from the onset of the film, until the very end (in a rounded morphological structure) in tandem with the human character development in the dramatic/narrative realm. In addition, the periodic rhythm of the helicopter theme is used as a tension-creating device through synchronicity with music, and conversely a-synchronous alignment. Tempo and rhythmic counterpoint contribute throughout to the success and awareness of the dramatic narrative on all levels. The spectromorphological identity of this theme will be traced through the exposition (first 20 minutes of the film), and its subsequent development will be shown. Aural and visual analysis will be used to substantiate perceptual sonic characterizations, while sonogram graphs will show scientific evidence in support of these psycho-acoustic perceptions.

1 Introduction

Sound in film often exists in two distinct layers beyond the narrative dialogue: music and sound effects. There is certainly overlap between the two, but these two elements more often than not, remain aurally, and more importantly, functionally separate and distinct. In the 2001 Academy award winning film Black Hawk Down, these two elements blend into a seamless continuum. Intersections are so complete that the traditional notion of musical “themes” must be broadened on all levels from traditional melodic, ethnic and orchestral musical types, to include sound object types. One of four themes used throughout is the sound effect of the Black Hawk helicopter. This helicopter theme is carefully prepared from the outset through subconscious allusion within the sound design as a whole, until it is presented as a diegetic sound effect-present to the characters in the picture. Schaffer (1966) and Chion (1994) define a sound object as: removing associations of a sound from its source through “reduced listening” to focus on the sonic (spectral) qualities of the sound, and its morphological characteristics and transformations with other sounds.

Throughout the film the helicopter sound object transforms into orchestral and electronic musical material through a process referred to in electroacoustic music as spectromorphology which Smalley defines as “...an approach to sound materials and musical structures which concentrates on the spectrum of available pitches and their shaping over time.” (Smalley, 1986) The main morphological characteristics of the helicopter are Doppler shift, wide spectrum with emphasis on high frequencies, and amplitude modulation. The amplitude modulation or the periodic rhythm of this helicopter theme is used as a tension creating device through synchronous transformation with music, and conversely a-synchronous use. Development, or morphology, of the helicopter timbre is also a large component of the sound design.

The musical material in Black Hawk Down consists of four types: ethnic music, orchestral music, rock music, and sound object music. All four are presented within the first five minutes of the film as distinct components, and throughout the film merge and combine on many levels. The first three are relatively traditional in their use of note-based material presented by orchestral instruments or derivatives (such as electronic instruments and, by extension, ethnic instruments). In short, they are based in the Western tonal developmental style. There are traditional leitmotif themes, as well as stylistic themes such as “rock music” which signifies the coming of action. This stylistic eclecticism reflects the general post-modern aesthetic of the later part of the 20th century, of combining diverse material into a unified whole—in short borrowing whatever stylistic devices fit the need of the music, narrative, or drama.

The fourth music type, based on the helicopter sound, is present throughout to exploit less obvious intersections between the visual action on the screen and the action we
hear. The resultant complexity requires that our definition of theme be expanded to include an element that originates from a diegetic sound effect source, but is not limited to that use. The helicopter theme is ideally suited for this purpose because of its inherent rhythm (from abstract amplitude modulation and concrete 16th note subdivision of the pulse), and its timbral complexity. The film is structurally framed by this helicopter sound as I will show in examples from the beginning (or exposition) and the ending recapitulation.

2 The Exposition: prototypes

2.1 Sound awareness (rhythm)

In the very opening, we hear wind, which, on an obvious level, signifies the dry desert but also at a less obvious level, the moving air of the chopper blades. This association is confirmed by very subtle accents which create a pulse temporarily rhythmicising the wind for three beats at 13-15 seconds.

Sound example 1: 0.00:00-25 (25")

There is one other example of this “pulsed” or accented wind at 56 seconds.

2.2 Sound awareness (synchronicity and timbre)

At 2:26 we hear a rhythmic wind sound. The pulse fades in with the title sequence “In late August, America’s elite soldiers, Delta Force, Army Rangers and the 160th SOAR are sent to Mogadishu to remove Aidid and restore order.” The way this entrance is created is significant for two reasons. First, the two sound layers (rhythmic wind, and orchestral music) are in different tempi: they do NOT synchronize, creating a rhythmic tension in the sound design, forecasting the disastrous outcome of the raid which the film is about. Second, the wind sound is altered through filtering so that initially the high-frequencies which identify it as a “helicopter” are absent (corresponding to the blue colorization of the images). We hear this abstract pulsing sound, much like we see the images: both a veiled “reality” through colorization. These high frequencies are gradually faded back in, to give us the unmistakable sound image of the Black Hawk Helicopter.

Sound example 2: 0.02:10-53 (43")

2.3 Sound Awareness (timbral morphologies)

The first “Western” orchestral sound we hear is the violins oscillating G/D at 1:35, eventually becoming g minor, that underscores a title “The world responds. Behind a force of 20,000 U.S. Marines, food is delivered and order is restored.” At 2:10 the solo cello begins by playing three note motives around G minor which becomes a full blown solo melody just after the previously mentioned helicopter pulse enters. When we cut to the title “Black Hawk Down” the combined rock, orchestral and ethnic music begins to have a pulse as the cello cadences on a D-C glissando. This pulse is subdivided by 16th notes maracas and is the first concrete example of transformation between the helicopter sound and the orchestral score. A metallic scraped gong sound immediately precedes the first helicopter visual, aurally transforming the attack impulse of the timbral envelope on the first visual entrance. On the visual entrance of the helicopter the orchestral music slides up a half step (C-C#) linking the pitch of the orchestra to that of the sound effect. There are also “out of tempo” birds that we hear accompanying the first helicopter shot.

The orchestration and tonality not only link the sound effect of the helicopter with the visual, but also gives us all of the information we need about how the helicopter sound will interact within the total design of the film including music. It will be an autonomous character in the unfolding of the drama on a pure sonic level not functioning simply as a sound effect corresponding to the visuals of a helicopter.

Sound example 3: 0.02:53-03:05 (10")

2.4 Sound awareness (synchronicity/asynchronicity)

The net effect here is to create a subconscious connection and interdependence between the sound effect layer and the music layer, and to also function as a tension creating device and to obliterate any distinct boundary between elements within the sound design. The crowning evidence of this unity comes when we finally cut to a close up of Sgt. Eversman (the main character of the film) in the helicopter. For the first time we hear the close-up sound of the helicopter, from his perspective, and it enters in tempo with the music. It is heard in a sextuplet subdivision and the orchestral music slides up an additional half step (to D-the tonic) in unison with the sound effect. I will begin this sound example at the same place as the previous in order to hear the entire pitch slide from D to C in the solo cello and back from C to D in the combined sound effect/music montage. I would like to show a sonogram of this example which graphs frequency (x axis), time (y axis), and amplitude or volume (darkness).

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The percussion subdivision continues throughout the rest of this scene providing sonic continuity as the camera perspectives and sound effects shift and cut, reminding us constantly of the helicopters presence. In effect, the helicopter rhythm has already become an integral part of the musical fabric. In one additional close-up, this time inside the helicopter, again the rotors of the chopper are in tempo with the music. As the action and chaos around the Red Cross food truck increases, so does the tempo of the orchestral score. The rock music pulse signifies the coming of “action” just before Aidid’s militia open fire on civilians, and again, we cut back to the helicopter as the US soldiers watch this unfold. As the soldiers are told they cannot intervene, the helicopter sound moves out of synch with the orchestral score, auralizing the frustration of the soldiers at their inability to act. The distinct tempo shift occurs in the cut at time mark 4:39: the music tempo is a quarter equals 108 while the helicopter shifts to ca. quarter equals 116. This sequence ends as a Somali militiaman mimics shooting the helicopter with his finger as we hear the same metallic gong scrape it began with. This orchestra sound effect has significance later in the film when the helicopter is actually shot down.

Sound example 5: 0.03:15-42 (1’35”)

In the first 4:50 of the then, the sound design sets up the template for how the helicopter sound will function throughout the film: as a device which seamlessly connects the music with the action through rhythmic linkage and timbral morphology.

One final element of the 20:00 exposition, is a clear synchronicity between the helicopter sound and the music. At 13:30 seconds, the helicopter lands on the beach and we cut to the inside as the rock music enters. The music and the helicopter are in synchronisation (the helicopter subdivides the rock beat in sextuplets), underscoring the relative lightness of the upcoming events of the pig roast back at the barracks. This synchronicity becomes more significant as the action unfolds.

Sound example 6: 0.02:55-03:14 (20”)

### 3 Recapitulation: rounding the structure

As I said before, the helicopter sound and its transformation frames the film, so I would like to show its presence at the end of the film. As the last troops run the Mogadishu Mile back to the UN base, we hear the helicopter theme, but played by cello tremolo in *sul ponticello*. The link with the helicopter theme is through two elements: rhythmic (tremolo subdivision) and timbral: higher metallic sound of *ponticello*.

Sound Example 8: 0.02:06:30-51 ( 21”)

The spectromorphological structure of the sound designs is rounded at 2:10:30, near the end of the film. A helicopter fly over links a visual cut from the hospital where General Garrison is wiping up blood on the floor, and a triage area where Captain. Steele is going to visit a dying solder, Ruiz. As a sonic link, the helicopter fly-over seamlessly transforms into the orchestral score through both pitch and timbral linking. The fly-over is from left to right, and begins a whole step up in pitch from the orchestral pedal point, and through Doppler shift slides into a unison (A to G over a D pedal point) then seamlessly fades into the distance leaving us with both a timbral and tonal resolution into the orchestral score open 5ths. This closes the tonal and timbral structure opened at the beginning when the sound design slides from C to D at the first helicopter entrance.

Sound Example 9: Play 2.10:25-40 (15”)

Some final helicopter remnants persist throughout the conversation between Eversman and Hoot. At 2:11:55 another fly-over (very distant) punctuates the dialogue and phrase structure of the music, and at 2:12:35 a very subtle flutter of wind gives the final presence of the Black Hawk, as Hoot leaves to go back into action. These final helicopter sounds link the sound effects of a cut to the battlefield staging area where soldiers are preparing to go back into action, with the music score. This in effect is the reverse of the opening where the helicopter is linked to wind.
4 Development (combat preparation): timbral morphology and synchronicity

4.1 Timbral morphology

Timbral morphology and synchronicity of sound effects and music between the helicopter and the orchestra, comprise the main interest and power of what I call the development section, and I would like to show some of the most poignant of these. Morphology between the helicopter sound and the music begins at 27:20, during Chalk 4’s briefing with Eversman. As the soldiers are packing their gear, the quasi rock music plays with an 8th note subdivision of a noisy cymbal like sound, signifying the “warming up” of the helicopter.

Sound Example 10: 0.27:20-50 (30”)

The helicopter sound becomes a sonic character at 31:40 while Eversman is talking to Hoot outside the barracks. There is no helicopter in the visual, and yet we hear the helicopter. This, at first glance does not seem out of the ordinary since there are undoubtedly helicopters around, until we realize that the specific helicopter sound we are hearing is the sound from inside the helicopter. Notice also at the end of this example how the drums emphasize the 16th note sextuplets of the helicopter character as we cut to the Vacaro Market in Mogadishu.

Sound Example 11: 0.31:40-32:18 (38”)

Further morphological infiltration of the helicopter sound occurs at 33:22 as McKnight is briefing the Humve column. Here the chopper blade sound is orchestrated in the percussion (as before) but also in the string section as well. The tonality is also A (the dominant of D), and during the briefing, there is a very subtle high whiney sound, the sound of a helicopter warming up, which glissandos from A to D. This is significant because during the entire scene, we see helicopters in the background, none of which are running yet. This very subtle detail maps the sound onto the psychological and physical profile of the battle plan: the support of the Humve column (on the ground) by the helicopters in the air: all signified by the high sound of the warming up helicopters and the visuals in the background. Toward the end of this example, the sound effects, rock music and orchestral sounds merge.

4.1 Synchronicity

As Chalk 4 is loaded into the helicopter, General Garrison comes by to wish them luck. At this point, the helicopter sound effect is sounding 16th notes at around $q = 132$. This is heard in 4/4 meter because of the Doppler shift in frequency making every other pulse accented (caused by rotor blades approaching and leaving the listener). As the scene progresses, the helicopter speed stays the same, but the rock music fades in at around $q = 96$. The net effect is a metric modulation in which the 16th notes of the helicopter are reinterpreted metrically as 16th note sextuplets in the new rock music tempo.

Sound Example 12: 0.33:22-34.00 (34”)

The next segment of music is one of the most significant because of the suspension of reality through sound. The electroacoustic montage that ensues at 37:32 cuts between the busy activity of Aidid’s militia and the men inside the helicopter. The sound that accompanies the soldiers in the
helicopters represents internal time, or the suspension of
time (emphasized by a literal countdown inside the
helicopters). The sounds of this sequence are comprised of
many combinations of sound effects, rock music, orchestral
music, ethnic music, and abstracted sounds from the
helicopter and other sources including bird song (38:09-
cello harmonics with reverb as the helicopters fly out over
the ocean). Here the helicopter sounds is present in all its
forms, real and orchestrated.

As you watch with the video, notice that not all visual
cuts correspond directly with aural cuts. The sound in this
sequence provides much of the continuity as we bounce
between multiple locations. By this point, the helicopter has
become a distinct sonic theme expressed in many different
guises. The most significant of these is the morphology
between the cello tremolo and the helicopter sounds, which
is the logical development begun in the very opening when
the solo cello ethnic melody announces the helicopter
entrance. Here the merging of the solo cello, helicopter,
ethnic, and rock music forecasts the coming engagement of
US and Somali troops.

Video Example 2: 0.37.32-40.00 (2'28"

5 Development II (engagement):
synchronicity and morphological
climax

In the second development section, significant
intersection of the helicopter sound and it’s tempo, and the
underlying psychology of the drama, culminate in the first
climax of the film, when the Black Hawk gets shot down.
The ethnic rock music begins when we see Somali Militia
preparing to fire a Rocket Propelled Grenade. The
helicopters flying over are flutters that are not in (or out of
tempo) with the music. When we cut to the inside of the
helicopter, the rotor blades are in tempo with the ethnic rock
music. This sonically suggests that the rocket will hit the
helicopter a few seconds before we actually see it happen.

At 51:33, the scraped tam-tam sound from the beginning
(heard when we see the helicopter for the first time) is used
to transition between the actual helicopter 16ths and a snare
drum when the visuals cut to General Garrison back at HQ,
and back to the spiraling helicopter. This keeps the 16th
note subdivision going even when we are visually away from the
helicopter which carry’s the dramatic tension.

The emergency beeper inside the helicopter is out of
synch with the music/helicopter sounds, reinforcing the
eminent catastrophe. Also significant is the C# pitch of the
beeper, and the ensuing abstracted “reverse” orchestra hits
on B, C#, and D. The following example is framed by the
C# beeper. This C# is the last pitched sound we hear before
the actual crash (suggesting dominant-A-tonality).

Sound Example 16: 0.51:52-15 (23”)

Abstractions of this helicopter sound ensue following the
crash. These abstractions include the slow air-moving of
the ceiling fan back at the interrogation room, the 16ths in
the violin that sonically take us back to the action, and a
high clicking percussion sound which is the sonic glue that
morphologically cements the violin 16th notes with the
chatter of gun fire when we cut back to the ground troops.

Sound Example 17: 0.53:13-54:00 (45”)

One final example worth noting is the tempo difference
between the aerial view inside the orbiting helicopter (q =
100) giving re-con information, and the ground troops
advancing to the crash site (q = 138).

Sound Example 18: 0.54:47-55:10 (23”)

Video Example 3: 0.50.50-55.10 (5’)

The closing of this first development section takes us
back to the base, while the 1st Humve column is returning
with dead and wounded. A helicopter landing ushers in the
16th note rotor blade theme, which continues as the dead and
wounded are unloaded, and as Hoot looks over the inside of
the Humve. The presence of the helicopter sound here is
strictly as a sub-conscious reminder of the crashed helicopter and the credo “leave no man behind.” Once again, the snare drum 16th usher us back to the battle. Video Example 4: 1.03.18-1.04:03 (45’)

As the battle continues until the dead pilots are extracted, the gunfire begins to integrate into the musical fabric as well. Based on the relationships and development with the helicopter theme, my hope is that viewers can discover these relationships on their own, as they are to numerous to point out in this time frame.

6 Conclusion

In Black Hawk Down, the visual, aural and narrative/dramatic layers are much more fully integrated. As a result, the aural environment goes significantly beyond the use of literal sound matching images to portray physical reality, and music which traditionally supplies emotional content. In Black Hawk Down, the psychology of the drama is much more fully explored through the combination and transformations between music and sound effects. This is done largely through the elevation of an object (the helicopter) to a character in the drama through its sonic properties and identification. This object is transformed in the drama through character development, much like the human character development, but is carried out largely in the sonic realm rather than the visual/narrative realm. This sonic development is implemented through morphological techniques used by electroacoustic composers for decades. Through this extension of character development to “inanimate objects” sound is, at the least, more fully integrated eliminating seams between distinct visual and aural layers within the film. At the extremes sound is elevated to a level closer to the narrative and visuals within the drama. And, because its sound is ideal for rhythmic and morphological treatment, the helicopter plays a central role in the film as a sonic character, giving the sound design, and film as a whole, an inherent unity between material and idea.

References


Rudy, Paul, “Spectro-morphological Diatonicism: Unlocking Style and Tonality in the Works of Denis Smalley Through Aural Analysis.” Journal SEAMUS, Spring 2003, and in eContact!
