Chapter 8:

Analysis of sound in electronic dance music

In this last chapter I examine correspondences between the actual *sound* of the rhythmic events and the body movements it evokes. As in my earlier analysis of rhythm, the poumtchak pattern is central to both the structure of the chapter and the analytical work. The grouping of three types of sound events presented in the previous chapter is also important to the structure here. I begin with the sounds of the poumtchak pattern, the bass drum and hi-hat, both representing the first group of "sound as discrete events." This type is also represented by the next topic, the sound on the "backbeat." A specific filter effect (the gradual opening of a low-pass filter) represents the second type, "the outcome of a certain application of effect processing," while the third type, "the outcome of a combination of several sound sources," is represented by mixing techniques related to the use of compressor. Finally, I return to the first type of sound events via synthesizer sounds that introduce variations to the poumtchak movement pattern in ways evocative of the complementary rhythmic patterns discussed in chapter 6.

Verticality in music comprises a vital analytical premise in this chapter, based on the theories discussed in chapter 4, and pitch movement within sounds is the most consistent topic in the analyses.

As in my analysis of rhythm, my main focus here is on British and French house music from the second half of the 1990s, with occasional examples from elsewhere. I also pursue historic perspectives on this topic, insofar as they manage to illuminate the effect of changes in the use of music equipment first described in chapter 2.

In the following analyses the *manner* in which the sounds are produced will also be of interest. This focus corresponds to Cornelia Fales's three domains of sound, presented in the previous chapter: the productive, the acoustic, and the perceptive. I will aim to bring all three domains into play in order to render a comprehensive description of the various sound events that are relevant here.

Analysis of the poumtchak sounds

THE DOWNBEAT: PITCH MOVEMENTS IN BASS DRUM SOUNDS

Based on my prior discussions of verticality in music, it certainly appears possible that descending pitch movements in bass drum sounds can trigger a certain body movement in the same direction. Bass drum sounds that are used to form a poumtchak pattern often involve such descending pitch movements, and they can have an effect on how various tracks are experienced.

Bass drum sounds in the 1970s

New methods of producing bass drum sounds have been gradually adapted in dance music production over the past few decades. An early disco production from the 1970s, to begin with, would most likely involve a bass drum sound that was recorded using a specific microphone onto a unique track on an analogue multitrack recorder. A descending pitch movement could be introduced to this sound by loosening a single tuning lug on an otherwise equally tuned batter drumhead or tuning the resonance head lower in overall pitch than the batter head. This was probably not a priority, however, among the numerous parameters for shaping an effective bass drum sound (width, size, depth, material of the drum, drumheads, pedal, microphone type and placement, studio equipment, acoustics, playing technique, and so on). A 1970s disco production typically aimed at producing a dense and defined sound that worked well alongside the bass guitar sound, as in the sonograms below. Both productions stand out because the bass drum sounds are more apparent in the mix than was the custom in this decade.

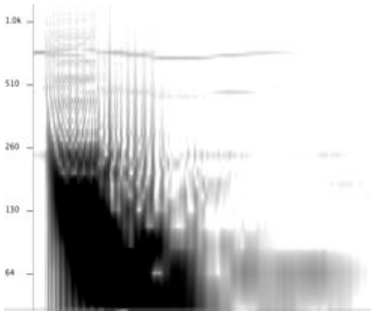

Figure 8.1: Sonogram of bass drum sound at 01:39 from Donna Summer's *Love to Love You Baby* (1975).

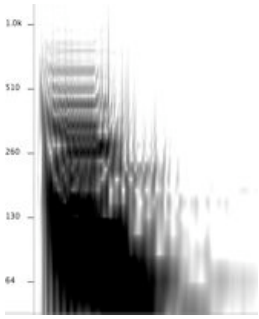

Figure 8.2: Sonogram of bass drum sound at 01:26 from Cerrone's *Love in C Minor* (1976).

Both examples seem to involve pitch movement (note the darkest areas),[589] but this is not especially noticeable when we listen to them, and, compared to examples from the succeeding decades, the movement is in fact quite insignificant.

Drum machines of the early 1980s

The Roland drum machines from the early 1980s (the TR-808 and TR-909) have bass drum sounds that are produced in various ways through analogue synthesis.[590] However, one's ability to control the sound parameters is limited relative to a conventional synthesizer. The TR-909, for example, has only four knobs with which to shape the bass drum sound: tune, attack, level, decay. The tune knob on the TR-909 works within a limited range, and figure 8.3 displays sonograms of four different settings (0 = the knob turned all the way counterclockwise and 10 = the knob turned all the way clockwise).

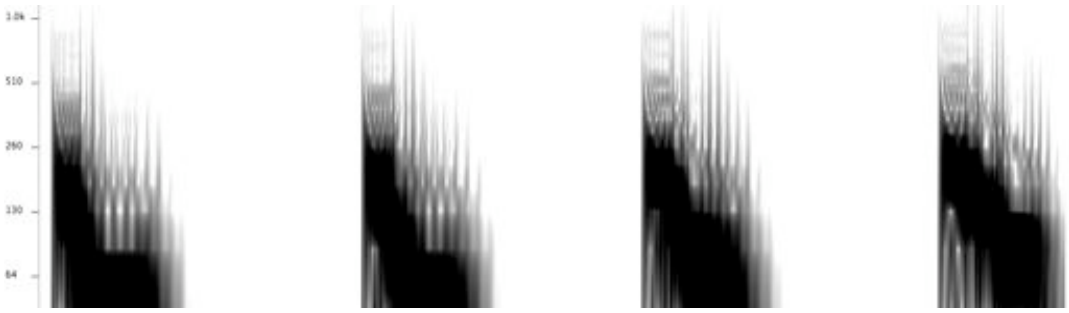

Figure 8.3: Sonogram of bass drum sounds from the Roland TR-909. Tune-settings, from left to right: 0, 3, 7 and 10 (attack: 0, decay: 0).

As is evident here, the TR-909 can produce a fairly pronounced descending pitch movement (the darkest diagonal contour). This outcome is best heard (and seen) when the tune knob is turned all the way clockwise. Though the attack and decay controllers cannot shape this pitch movement further, they can emphasize or deemphasize it to a certain extent.[591]

[589] See introduction to the use of sonograms on page 9.
[590] Using analogue synthesis, a producer can easily create a descending pitch movement in a drum sound with an inverted envelope generator whose medium short attack is set to modulate the pitch of the oscillator.
[591] The decay knob controls the AR (Attack-Release) envelope on a sawtooth-wave produced by an oscillator and shaped by a Waveshaper that cannot be controlled by any of the knobs. The attack knob controls the envelope on an additional sound produced by a noise generator (sort of a clicking sound). See Reid 2002a.

On the TR-808 there are only three knobs: level, tone, and decay. The tone knob does not tune the oscillator but instead controls a low-pass filter that at different settings reduces the high frequencies.[592]

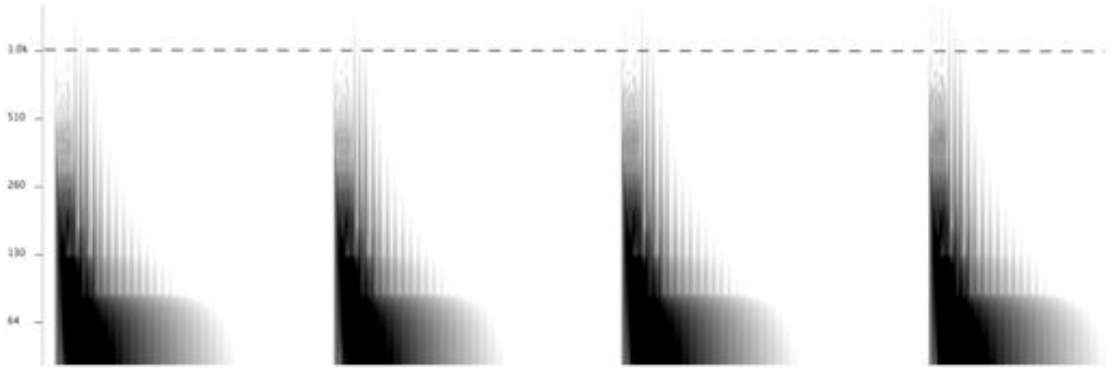

Figure 8.4: Sonogram of bass drum sounds from the Roland TR-808. Tone-settings, from left to right: 0, 3, 7 and 10 (decay: 3). Stippled line at 1 kHz assists in visualizing high-frequency content.

On the sonogram, differences among the four tone settings are barely apparent in the presence of high-frequency content at the attack (the example to the very right has the most frequencies above 1 kHz). With tone settings turned all the way clockwise, the low-pass filter reduces less high frequencies, making the sound punchier. Still, the sense of descending pitch movement is not as pronounced with the TR-808 as it is with the TR-909.

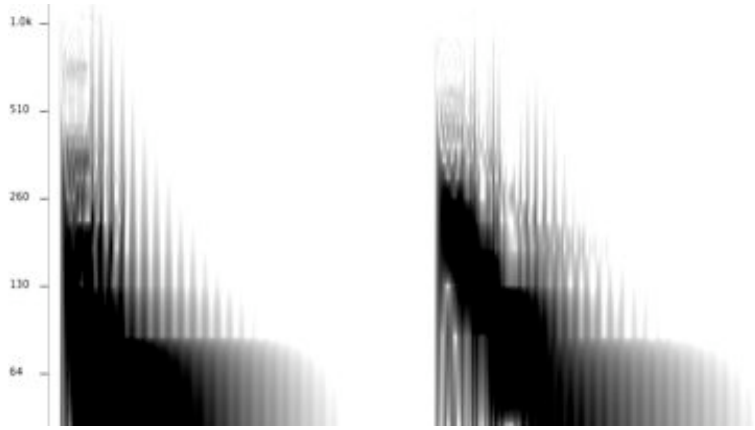

Figure 8.5: Sonograms of bass drum sounds from the Roland TR-808 to the left (tone: 3, decay: 3) and the TR-909 to the right (tune: 10, attack: 0, decay: 7).

[592] The oscillator for the bass drum in the TR-808 does not produce a continuous sound (as most synthesizer oscillators do) – instead, it produces a sound that decays to silence without the need of any envelopes. The decay knob on the TR-808 controls a feedback loop that at various settings produces a shorter or longer sound. See Reid 2002a.

On the sonograms the differences between the two sounds are obvious. The attack of the TR-909 starts with a spectral centroid around 200 Hz that falls rapidly down to below 100 Hz, while the sound from the TR-808 has a more dense and permanent spectral centroid below 200 Hz.[593] While both sounds are defined and concise, the TR-909 sound, especially when played loud, seems to suggest a downward bodily movement more forcefully than the TR-808 sound.

Bass drum sounds of the 1990s (and beyond …)

During the 1990s the options for selecting bass drum sounds increased with the advent of various pre-recorded sound archives. Producers could merge electronically produced sounds with recorded acoustic bass drum sounds and customize sounds to fit the needs of certain productions. Some producers used specific bass drum sounds as part of their artistic signatures. The Israeli 1990s production team Astral Projection (Avi Nissim and Lior Perlmutter) cultivated a specific descending pitch movement in their bass drum sound in relation to the genre "trance." In the track *Dancing Galaxy* (1997; tempo: 139 bpm) the poumtchak pattern forms the basic beat. The bass drum sounds appear as diagonal lines in the lower part of the sonogram.

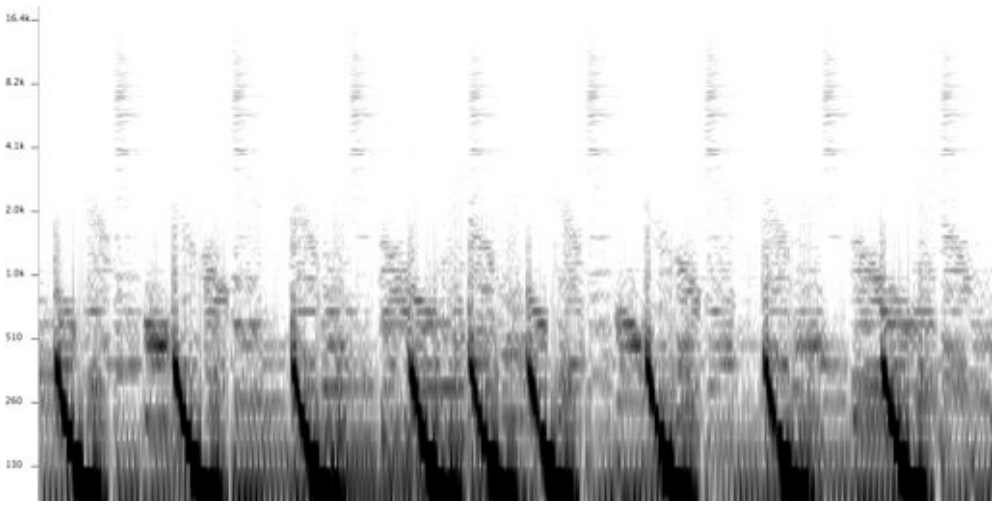

Figure 8.6: Sonogram of excerpt (eight beat cycles) from Astral Projection's *Dancing Galaxy*, 1:01–1:03.

The drum attack starts with a narrow spectral centroid around 400 Hz that falls over a period of one hundred milliseconds to around 100 Hz. Though it does not resemble a

[593] The spectral centroid is a measure used in digital signal processing to indicate the centre of mass of the spectrum.

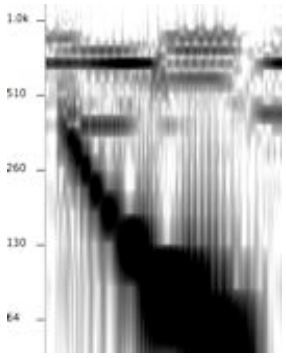

Figure 8.7: Sonogram of bass drum sound from Astral Projection's *Dancing Galaxy*.

traditional acoustic bass drum sound, its function is obviously the same and it has a definite concentration of frequencies below 100 Hz. In the mix the bass drum sound (and its pitch movement) is clearly evident. Since the pitch movement is more pronounced than the TR-909 it seems to evoke a body movement in an even stronger sense.

By way of contrast, figure 8.8 displays a sonogram of a bass drum sound from the track *What They Do* (1996; tempo: 93 bpm) by the American hip-hop band the Roots. Its concentration in the frequency area around 100 Hz and below continues (without any pitch movement) after the attack. There are also much higher frequencies at the attack (transients) in comparison to the Astral Projection example. This sound in fact resembles an acoustic bass drum sound and may have originated as one,[594] though it was probably shaped in numerous ways to suit the production.

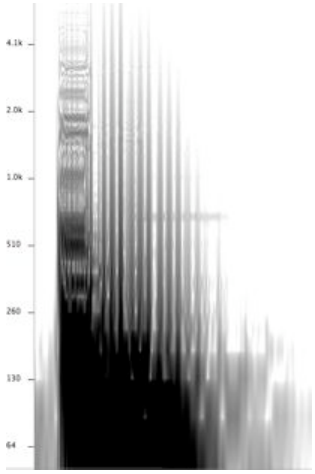

Figure 8.8: Sonogram of bass drum sound from the Roots, *What They Do*.

In British and French house music, both the TR-808 and the TR-909 were used extensively for bass drum sounds during the 1990s. But other alternatives as samplers and harddisc recording became increasingly available during this period. The Daft Punk track *Phœnix* (1996; tempo: 127 bpm) starts with thirty-two successive bass drum sound events, and the descending pitch movement is evident both in the sonogram and to the ear. The drum sound starts with a spectral centroid at around 200 Hz that rapidly descends to below 100 Hz.

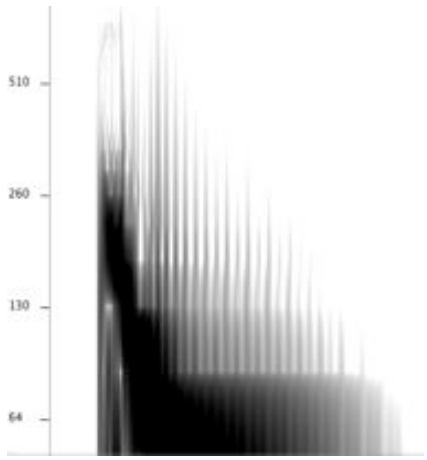

Figure 8.9: Sonogram of a bass drum sound from Daft Punk's *Phœnix*.

In the sonogram below, I have collected

[594] The Roots are famous for playing hip-hop on conventional instruments (rather than DJ desks) and may want to give an impression of "liveness" also in their studio work. But even if parts of the track were played live in studio, they might have been looped, parts might have been replaced, mistakes might have been corrected, and so on.

three bass drum sounds from various Basement Jaxx releases, picking excerpts where the instrument particularly stands out.

Figure 8.10: Sonograms of bass drum sounds from various Basement Jaxx releases: (left to right) *Samba Magic* (1995), *Red Alert (Jaxx Club Mix)* (1999), *Where's Your Head At* (2001).

The bass drum sound in the example from 1995 is tuned higher than the two others, with a narrow spectrum centroid at around 250 Hz and a descent to below 100 Hz. The two other sounds both start (at around 200 Hz) and end slightly lower and are also longer in duration. Their descending pitch movement is evident to the ear for all three but somewhat more apparent in the first.

Though there are numerous house music tracks without an apparent descending pitch movement in the bass drum, it is probably more common in the many subgenres of electronic dance music than it is in popular music in general. The sonogram below displays a bass drum sound from the original mix by the renowned American producer Timbaland (Timothy Mosley) (2001; tempo: 121 bpm) and a remix by Basement Jaxx (2002; tempo: 131 bpm) of the Missy Elliott track *4 My People*; both tracks with the poumtchak pattern as the basic beat.

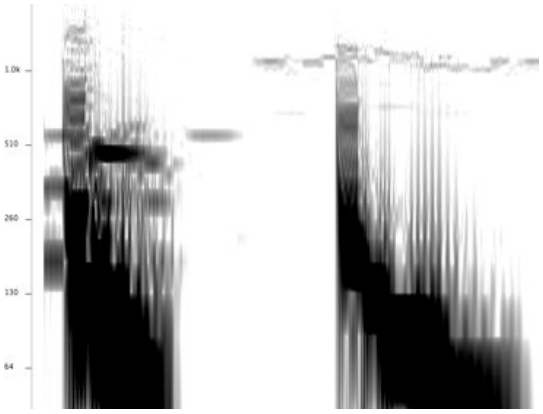

Figure 8.11: Sonogram of bass drum sounds from Missy 'Misdemeanor' Elliott: *4 my People*. Left: Timbaland's original mix from 2001. Right: Basement Jaxx's remix from 2002.

Differences concerning the descending pitch movement are quite evident in these sonograms. While Timbaland uses a rather short, dense bass drum sound without an audible pitch movement, Basement Jaxx uses a bass drum sound that recalls the previous examples. In the practice of remixing, such features attached to sounds may be part of the signature of certain producers/remixers.

Tempo

Generally a descending pitch movement in a bass drum sound should fit the tempo of the song (and the body movement that the tempo inspires). A trance track is usually faster (around 140 bpm) than a typical house track (125–130 bpm), while a hip-hop track may have a tempo below 100 bpm. At slower tempi, a pitch movement will have to be decelerated, which blurs the bass drum's "punch" and may extend the experience of a downward movement. Such bass drum sounds will not do for a house track with a tempo of around 127 bpm. The descending pitch movement will have to be faster to create the proper definite punch.

THE UPBEAT

The hi-hat sound that generally complements the bass drum in the poumtchak pattern does not incorporate pitch movement and therefore merits less discussion in this regard. Developments in sound production concerning the hi-hat sound have traced those of the bass drum sound, from a live drummer to drum machines and samplers with external MIDI sequencers and then to digital, computer-based audio and MIDI sequencers. Of interest here are issues primarily of duration, timbre/pitch, and the use of additional or alternative sounds in relation to the hi-hat.

Usually the same hi-hat sound is used from start to end in a track and its timbre and duration are preserved. But every so often this will change, depending upon other features of the mix. Hi-hat sounds are also frequently modulated by filter effects, when these are used in the high-frequency areas.

Duration

In a section from 0:46 to 1:24 in Daft Punk's *Phœnix* (1996), the duration of the hi-hat sound is gradually extended. This can be done by gradually extending the MIDI entries in a sequencer or altering the settings of the sound's "amp envelope" by, for

example, slightly increasing the decay time while the sustain level is set to zero.[595] This is not particularly common but does serve to illustrate the significance of duration in relation to hi-hat sounds on the upbeat. Over the thirty-eight seconds of this build-up section, the hi-hat sound is extended five times, every sixteenth beat-cycle (or every fourth 4/4 measure).

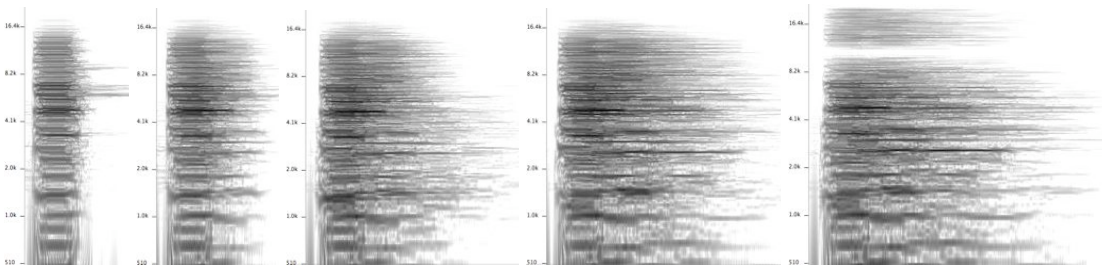

Figure 8.12: Sonograms of hi-hat sounds from Daft Punk's *Phœnix* at 0:46, 0:54, 1:01, 1:09 and 1:16.

The duration of the sound increases from about 25 milliseconds when it is introduced to about 160 milliseconds during the last sixteen beat-cycles of the period. If a certain pull upward is experienced from the hi-hat sound, it is possible that this pull is slightly intensified, or the peak position extended, each time the sound's duration is changed.

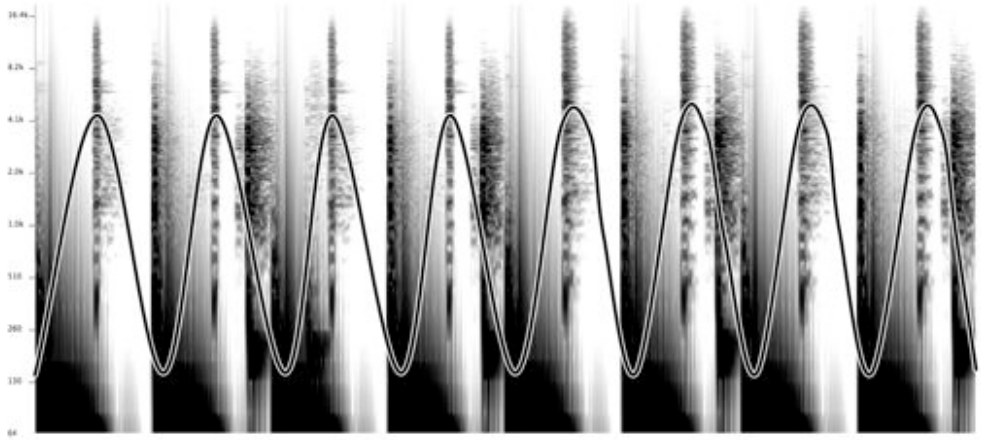

Figure 8.13: Sonogram of Daft Punk's *Phœnix*, 0:51–0:55, covering the first change in duration, with suggested movement curve (events other than bass drum and hi-hat sounds are not taken into consideration).

When a sound like the above, with the same qualities of pitch, timbre, and loudness, is repeated, even subtle changes in duration will probably attract our attention. In

[595] The "amp envelope" regulates how the sound is amplified. The decay represents the second step in the ADSR (attack, decay, sustain, release) settings of an envelope. It controls the duration between the sound's peak level and its sustained level. The Roland TR-808 drum machine only had a decay button for the open, not the closed, hi-hat sound.

relation to a movement curve, the sound with the extended duration may keep the listener/dancer at the peak of an upward movement a bit longer, in this way extending the upbeat and in turn driving the track forward via the succeeding quicker downward movement. The whole section where the five extensions of duration occurs lasts for almost thirty seconds, and these subtle changes may well produce a gradual intensified experience that is typical of the build-up sections of dance music tracks.

Timbre/pitch

Timbre and changes in pitch also accounts for variations among hi-hat sounds. In the transition from measures six to seven in the Basement Jaxx track *Jump n' Shout* that was discussed in chapter 6, the hi-hat sound changes slightly in duration and loudness but most significantly in timbre/pitch: in the sonogram below, the four entries to the left reach to about 13 kHz while the four to the right reach above 16 kHz.[596]

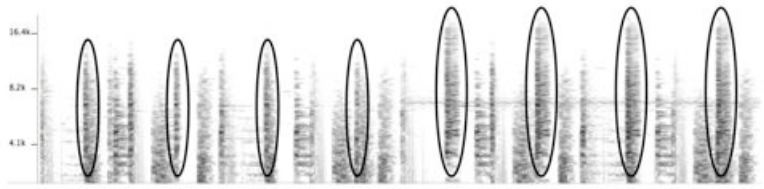

Figure 8.14: Sonogram of hi-hat sounds from Basement Jaxx's *Jump n' Shout*, 0:16–0:19.

These changes help the hi-hat cut through the dense sound mix; in the highest frequency area the hi-hat is almost alone and does not have to compete for attention.[597]

Additional vocal sounds

The last topic to be discussed in relation to the upbeat concerns other sounds that may alternate with or more commonly accompany the hi-hat sound. Samplers and sequencers make it possible to extract any sound from a musical phrase, copy it, and

[596] To what extent this change is caused by the introduction of a new hi-hat sound or the modulation of the original sound with certain new equalizer settings is hard to say. Therefore it is also difficult to decide whether this change concerns primarily timbre or pitch. A traditional acoustic hi-hat sound cannot be tuned (except moderately through playing techniques), whereas a hi-hat sound on a sampler or a synthesizer often can be tuned up and down like any other sound.

[597] The term "staging" is used by several writers (Lacasse 2000, Moylan 2002, Zagorski-Thomas 2008) to indicate how sound is made to create a meaningful setting for the listeners. With the term "functional staging" Zagorski-Thomas has applied this concept to "mixing techniques that spotlight certain functionally important musical features in ways that do not create specific musical meaning (such as highlighting an emotion or creating an illusory space) but which make the music function more efficiently" (Zagorski-Thomas 2008:204). He exemplifies this with production techniques in dance music that "strengthen attack transients and clarity" (:205). This section from the Basement Jaxx track with a boosted hi-hat may illustrate "functional staging" with regard to dancing.

paste it in somewhere else in the track. These samples or sound bits can be both instrumental and vocal sounds. In the following examples I will try to illustrate how various vocal sounds may correspond to a poumtchak movement pattern.

The first example is from the track *Five Fathoms* (1999; tempo 122 bpm) by the British group Everything but the Girl (writer/producer/DJ Ben Watt and singer Tracey Thorn).

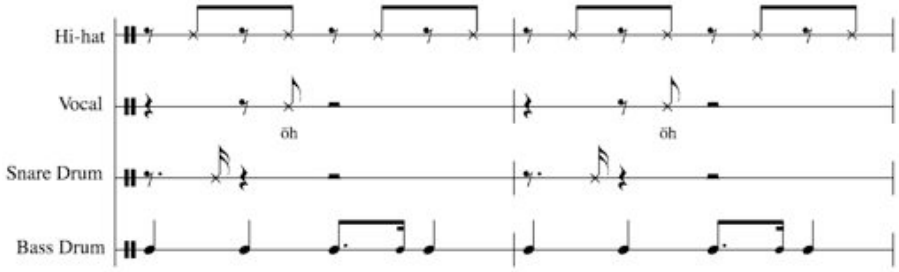

Figure 8.15: Notational representation of Everything but the Girl's *Five Fathoms*, 0:00–0:04

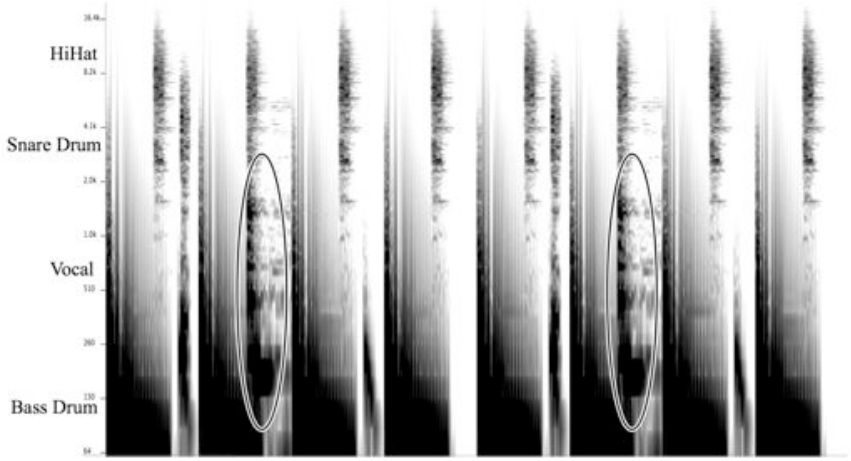

Figure 8.16: Sonogram of Everything but the Girl's *Five Fathoms*, 0:00–0:04, vocal sounds circled.

The vocal utterance on the second (and sixth) upbeat is a short groan with a somewhat mechanical vowel sound (as in "word") that is repeated throughout the track. It is placed right after a downbeat that is emphasized by a pick-up with a snare drum sound. The type of vocal sound seems quite fitting and corresponds well with an upward movement when uttered while moving. It seems to emphasize the specific upbeat when it is "performed" within a poumtchak movement pattern.

A similar occurrence appears on the track *Sucubz* (2001; tempo: 125 bpm) by the French producer Ark (Guillaume Berroyer).

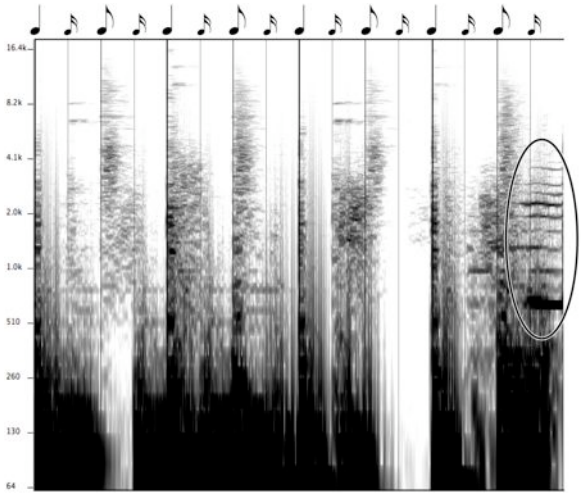

Figure 8.17: Sonogram of Ark's *Sucubz*, 3:28–3:30, placed in a grid with the vocal sound circled.

The last upbeat in a series of eight beat-cycles (two 4/4 measures) is followed by a short vocal "yeah" right before the succeeding downbeat. The event occurs late in relation to the upbeat (and closer to the following sixteenth) but is experienced as part of it. The duration of the utterance, its pitch, and its character match the poumtchak movement pattern, and performing it while moving seems not only to emphasize the upbeat but also to somewhat extend the corresponding movement since the duration of the event is longer than the others on the upbeat. The event may introduce variation to the experience of the poumtchak movement pattern.

The last example is from the Missy Elliott track *4 My People*, originally produced by Timbaland and remixed by Basement Jaxx. Both of these mixes have many vocal sounds (moans, "yeahs," and so on) on both upbeats and downbeats. Short vocal sounds exactly on the upbeat are present in both of these versions.

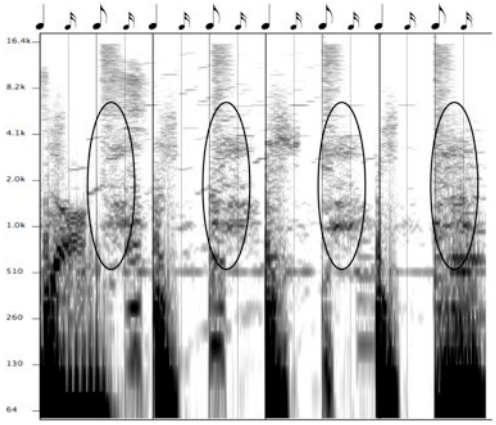

Figure 8.18: Sonogram of Timbaland's original mix of Missy Elliott's *4 my People* from 2001, 0:35–0:37, placed in grid, with vocal sound circled.

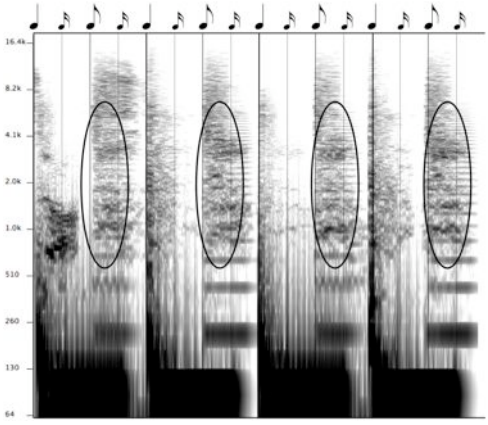

Figure 8.19: Sonogram of Basement Jaxx's remix of Missy Elliott's *4 my People* from 2002, 1:24–1:26, placed in grid, with vocal sound circled.

The vocal sound here is a short intense intake of breath. It occurs several times early in the tracks but not as regularly as in the previous examples. In both versions hi-hat sounds on the upbeat are also audible and in the Basement Jaxx remix a synthesizer joins the hi-hat sometimes. In a similar manner as the previous examples the breathing seems to match the poumtchak pattern perfectly and it may bring extra intensity to the experience when "performed" by the listener/dancer.

These vocal sounds all bring an extra dimension of participation into the music that in different manners may introduce variation and intensity to the experience of a poumtchak pattern.

THE BACKBEAT

With its central position in the standard backbeat pattern, the snare drum is probably the most important drum sound in pop/rock. In electronic dance music, at least with regard to the poumtchak pattern, this is not the case. Very often a snare drum or handclap sound is part of the basic beat, but, as discussed in chapter 6,[598] this sonic presence is rather slight relative to the bass drum and hi-hat sound. The functional role of the backbeat here seems to be the introduction of variation to the basic beat and the movement pattern it activates.

There is no standard snare drum sound in electronic dance music, but sounds that accompany a four-to-the-floor bass drum pattern are usually shaped to fit this task. Compared to other popular music genres the snare drum sound is more often boosted in low frequency areas rather than the opposite. Handclap sounds might also alternate with or even accompany the snare. Usually the sound on the backbeat (either a snare drum or a handclap) will demonstrate consistency in relation to duration, the use of reverb, its placement in the mix, and what part of the sound is boosted. These traits all contribute to the realization of a clearly defined groove.

Snare drum sounds of the 1970s

The snare drum sounds of a disco track and a rock track from the 1970s differ markedly in several ways.

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[598] See page 159.

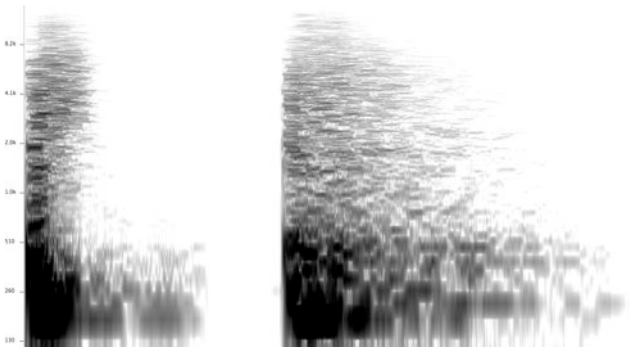

Figure 8.20: Sonogram of snare drum sounds from the disco track Candi Staton, *Young Hearts Run Free* (1976), to the left, and the rock track Led Zeppelin, *D'Yer Mak'er* (1973), to the right.

The two sounds are actually not too different when it comes to timbre, but the duration and the use of reverb make them quite distinguishable. The disco track is much shorter and dryer. A more apparent boosting of higher frequencies at the attack (transients) is also visually present in the sonogram of the disco track (the darkest area of the sonogram has a higher vertical extension). The ideal snare of 1970s disco was a very muffled sound derived from small, insulated drum rooms. Several productions from this time period have been criticized for being too dry and dull, but in relation to the dancefloor such drum sounds are easiest to move to the forefront of the mix.

The drum machines of the early 1980s

Both snare drum and handclap sounds were central to the Chicago house tracks, but the rock-derived emphasis on the backbeat gradually became less and less important. These sounds were frequently combined with bass drum sounds, mainly as part of a different basic beat but also perhaps due to the fact that 1980s analogue drum machines could not match the rock backbeat snare drum sound.

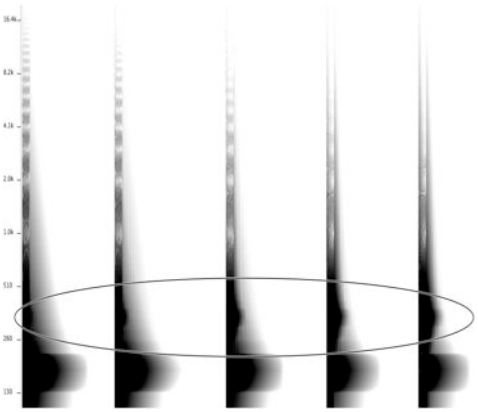

Figure 8.21: Snare drum sounds from the Roland TR-808. Tune settings from left to right: 0, 3, 5, 7, and 10 (snappy: 0).

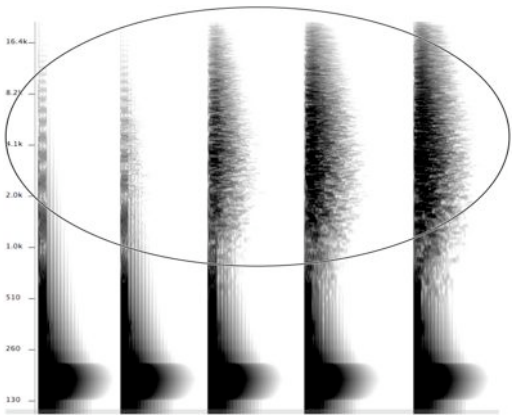

Figure 8.22: Snare drum sounds from the Roland TR-808. Snappy settings from left to right: 0, 3, 5, 7, and 10 (tune: 0).

The Roland TR-808 had three controllers for the snare drum: level, tune, and snappy. The tune controller could tune the low-frequency content of the drum within a limited range (see figure 8.21), while the snappy controller regulated the amount of white noise (see figure 8.22), thus imitating the sound from the snare wires. But it was far from resembling an actual acoustic snare drum sound.

The Roland TR-909 had a more advanced sound synthesis for the snare drum sound, with a tone controller in addition to the two controllers of the TR-808. It could better recall the short, dry disco snare drum sound and its sharp, definite attack, and it played a better part in the Chicago grooves. The handclap sounds on the two machines were quite identical and could not be modified in any way (except via the level control). Both the handclap and these snare drum sound variations from the TR-808 and TR-909 have appeared on numerous electronic dance music tracks.[599]

Snare drum sounds of the 1990s

During the 1990s, digital sounds on samplers and subsequently through harddisc recording introduced new possibilities, and better technology also offered more control over the shape of these sounds.

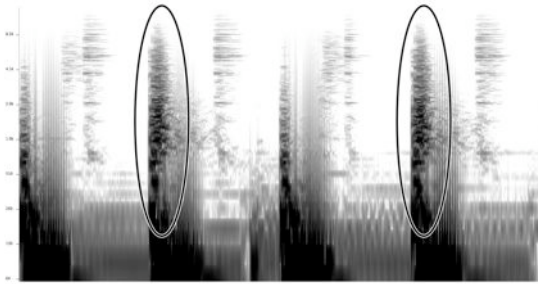

Figure 8.23: Sonogram of Romanthony's *Down 4 You*, 2:48–2:50, snare drum sounds circled.

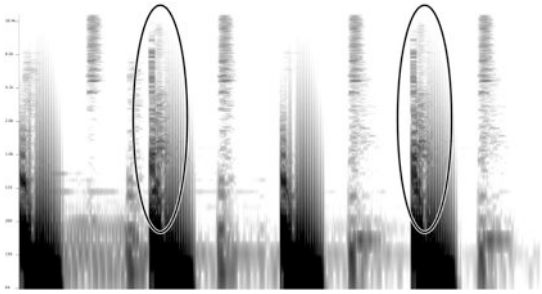

Figure 8.24: Sonogram of Shazz's *Fallin' In Love (PT. G Remix)*, 0:00–0:02, snare drum sounds circled.

The examples above illustrate two somewhat contradictory sounds on the backbeat of a poumtchak pattern, both in combination with a bass drum sound. The Romanthony track has a sound that resembles a handclap more than a snare drum, but it is fuller and more defined than a standard handclap sound (for example, from the TR-808 or TR-909). The sound seems to emphasize the downbeat but may not pull downward in the same way as the bass drum sound. Its effect on the poumtchak movement pattern

[599] See Reid 2002b for a more detailed introduction to the production of snare drum sounds on the Roland TR-808 and TR-909.

may be that every second downbeat is exaggerated but brought to a halt earlier than the preceding and following downbeats due to the high frequency content of the sound. The Shazz track uses a snare drum sound that blends in with the bass drum sound. The high frequencies seem to be attenuated, almost as if we are only hearing their reverb. The sound gives extra emphasis to the downbeat and in turn exaggerates this downward movement in a similar manner as the Deep Dish-example discussed in chapter 6.[600]

Various backbeat sounds in house music tracks introduce constant variation to the movement pattern. In the following I will focus on the sonic effects that are often present in the build-up sections of tracks.

Analysis of sound in effect processing

The analyses so far have engaged sound as "discrete events" – primarily bass drum, hi-hat, and snare drum sounds. The next topic relates to the second type of sound events introduced in the preceding chapter; sound as "a certain application of effect processing."

THE GRADUAL OPENING LOW-PASS FILTER

I will now discuss a certain type of effect processing that is often used in electronic dance music. Filtering effects reach back to DJs like Nicky Siano, who in the 1970s started experimenting with the use of equalizers in New York clubs.[601] To remove either low or high frequencies and then bring them back (gradually or suddenly) has since become a standard part of a DJ's repertoire. With the harddisc recording techniques and digital effects processing units of the 1990s, such effects have also appeared on the production stage. The most common effect in house music production is to remove the high frequencies with a low-pass filter, an effect often called the "underwater" effect or "that neighbour's stereo through the wall trick."[602] On the equipment in question, these filters are often combined with a resonance or Q-point setting that boosts the frequency area in which the filter starts its attenuation. A typical build-up effect involves a gradual opening of a low-pass filter, often combined

[600] See page 160.
[601] See Brewster & Broughton 2006:160–64.
[602] Preve 2006:95.

with a boost in the various frequency areas through the passage. The following examples will suggest ways in which this gradual opening of the filter may function in relation to movement.

Examples from Daft Punk's *Homework*

On Daft Punk's 1996 album *Homework*, seven tracks employ the effect in question, predominantly to modify certain instruments or sounds rather than the whole mix. I will first present three occurrences of this effect from this album before discussing their probable effect on movement collectively.

Four times during the track *Burnin'* (tempo: 124 bpm), a combination of sounds (at first resembling the sound of boiling liquid) starts out with only low frequencies and then gradually receives more higher frequencies until they fill the whole spectrum. Particularly prominent here is a sound with continuous events on the sub-level of sixteenths and a long sustaining tone. In the excerpt in figure 8.25, the bassline is removed and the drum sounds attenuated until the low-pass filter is fully opened, while a synthesizer sound with an alternately ascending and descending pitch movement (seen as repeating lines in the sonogram) is kept in front.[603]

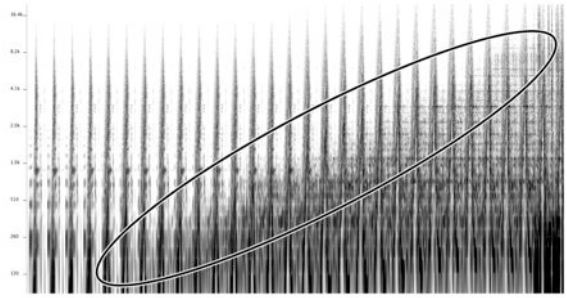

Figure 8.25: Sonogram of Daft Punk's *Burnin'*, 4:26–4:58, with the effect of an opening low-pass filter circled.

The track *High Fidelity* (tempo: 126 bpm) also has several filter effects through-out. In the passage in figure 8.26 the filter modifies all of the instruments/sounds except the hi-hat and snare drum. This excerpt is also a typical build-up section, with several instruments dropping out until the end of the passage.

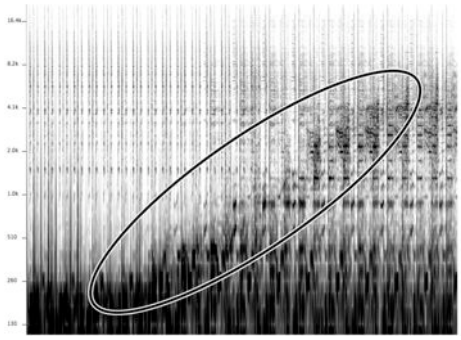

Figure 8.26: Sonogram of Daft Punk's *High Fidelity*, 4:38–5:16, with the effect of an opening low-pass filter circled.

[603] This event is further discussed on page 234.

The track *Around the World* (tempo: 121 bpm) begins with a low-pass filter on the entire mix. After thirty-two beat-cycles (eight 4/4 measures) lasting fifteen seconds the filter starts opening, a process that also lasts thirty-two beat-cycles. It ends with an ascending sound effect introducing the main instrumental riff of the track.

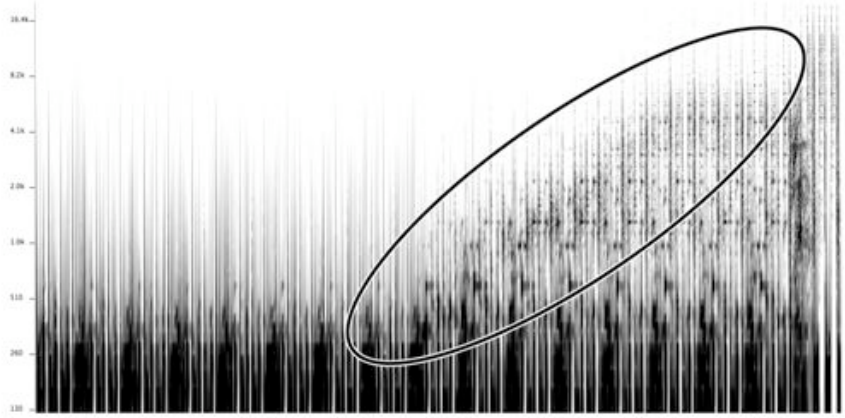

Figure 8.27: Sonogram of Daft Punk's *Around the World*, 0:00–0:33, with the effect of an opening low-pass filter circled.

How might this type of effect influence the poumtchak movement pattern? In this last example, low frequencies dominate the mix until the filter starts opening. Gradually the high frequency sounds become audible, and the alternation of low and high sounds becomes present. As the low-pass filter gradually opens, then, a pull upward by the hi-hat sounds may intensify the movements. The same effect seems to be present also in the other two examples, but the various sounds that are not modified by the filter, make the effect somewhat less convincing. In the sonogram below I attempt to illustrate how a filter effect might function in relation to movement as part of a build-up section in a track.

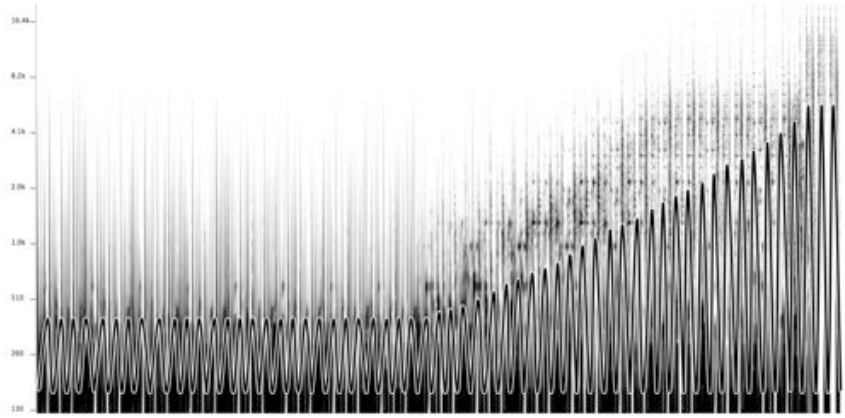

Figure 8.28: Sonogram of Daft Punk's *Around the World*, 0:00–0:33, with suggested movement curve.

The initial rhythm pattern with only low frequencies seems to activate a poumtchak movement pattern in a rather moderate way. When the filter starts opening the movements may slowly intensify throughout the passage when higher frequencies gradually are being exposed. The increased lengths of the movement curve are supposed to indicate this intensification.

Moreover, several simultaneously occurring features may be involved in activating the intensification of this build-up section. Eric Clarke links the sound of a gradually opening low-pass filter in the Fatboy Slim (Norman Cook) track *Build It Up, Tear It Down* (0:28–0:55) to the perceptual effect "of a continuous movement towards a sound source that is first occluded."[604] According to the ecological approach to perception, our knowledge of how sounds behave in the physical world is brought into the process of music listening and can thus be a source for the experience of motion: "High frequencies are absorbed and dissipated in the environment more rapidly than low frequencies, leading to the characteristic 'bass heavy' quality of amplified music heard at a distance."[605] This notion of gradually approaching a sound source may then activate intensification.

Egil Haga, in his thesis on correspondences between music and body movement, identifies several features that he argues may contribute to higher levels of movement activation: higher densities of events, large pitch variations, higher volumes (loudness), distinct articulations, bright timbres, and horizontally spread and thick textures.[606] Several of the features (density, volume, bright timbre, thick texture) are to a certain extent increasingly present with the opening of a low-pass filter. This may again contribute to the intensification of the passage.

Finally, the familiarity of the effect and the expectation it evokes is also an important factor. The usual introduction (or return) of certain instruments, a specific, intensifying groove, or a structural climax at the point when the filter is fully open all combine to answer to dancers' expectations. When moving to the music, this process is experienced as holding back and then slowly letting the movements expand until they reach their limits, which is perfectly typical of how tension and release work through the build-up sections of electronic dance music tracks.

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[604] Clarke 2005:81.
[605] Ibid.
[606] Haga 2008:183.

Analysis of sound in the total mix

Moving on to the last type of sound events introduced in the previous chapter, the next topic concerns sound as the "outcome of a combination of several sound sources." I will in the following discuss effects that concern the total sound mix.

COMPRESSION

Loudness is an essential issue for the producer with regard to radio play, club play, and the music's participation in other locations or situations as well. Any given track must seem at least as loud as the previous one; a decline in energy is not tolerable. Compressors and limiters level out the volume of the various contributions to a track and make a greater volume possible. This effect is often applied to different stages in the mixing process, on separate instruments, on instrumental groups, on the total mix, and finally in the mastering process. Compressors and limiters can operate on specific frequency bands or on the total range of frequencies.[607]

A study of dance music tracks from the 1970s through the 1990s demonstrates the importance of compression and its overall improvement. The amplitude representations below reflect a disco track, a Chicago house music track, and a British club/house music track, each separated by a decade.

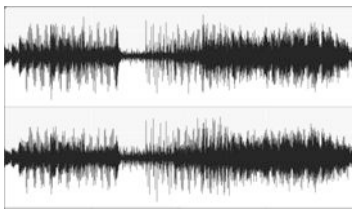

Figure 8.29: Amplitude repr. of Donna Summer's *Love to Love You Baby* (1975).

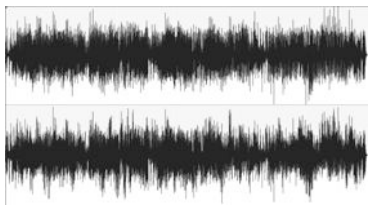

Figure 8.30: Amplitude repr. of Steve 'Silk' Hurley's *Jack Your Body* (1985).

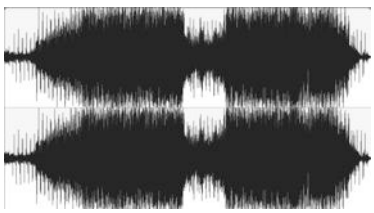

Figure 8.31: Amplitude repr. of Basement Jaxx's *Samba Magic* (1995).

The Basement Jaxx track from 1995 generates considerably more energy, which is essential to the process of moving bodies on the dancefloor. This energy is also present in the respective frequency bands.

[607] Various producers also use specific compressors or limiters to create signature effects.

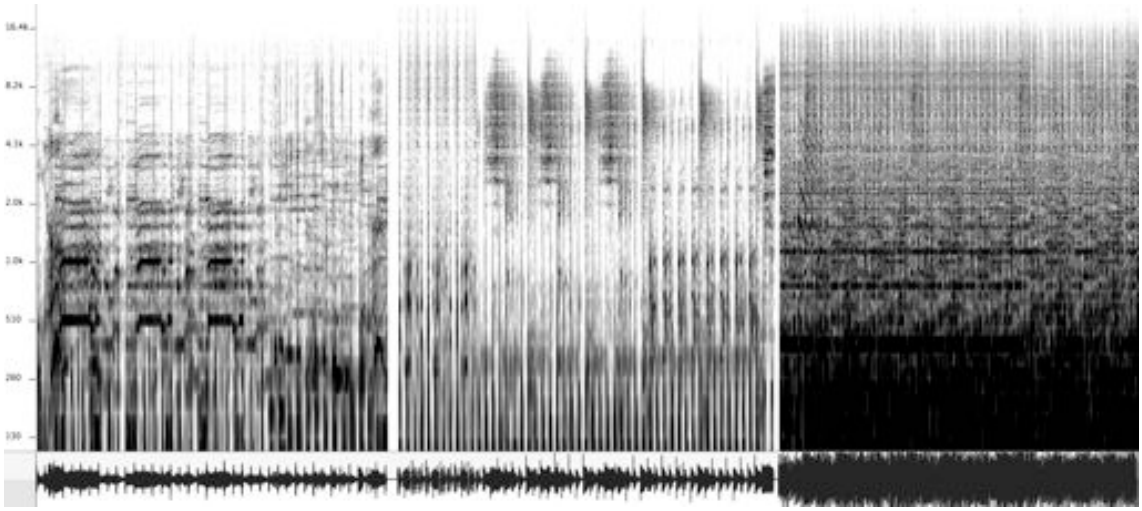

Figure 8.32: Sonogram of excerpts from (left to right) Donna Summer's *Love to Love You Baby*, 0:32–0:56, Steve 'Silk' Hurley's *Jack Your Body*, 5:40–6:06, and Basement Jaxx's *Samba Magic*, 1:36–2:01.

Again the Basement Jaxx track is comparably louder in all of the frequency bands. Improved control over the reverb of instruments has also allowed for greater volume without blurring the mix. This development in the production of dance music has been essential for the music's potential for activating body movements.

Stereo panning

The diagrams below represent the stereo panning of these tracks.

Figure 8.33: Snapshot from a stereo analyzer (Elemental Audio's *Inspector XL*) of downbeats from (left to right) Donna Summer's *Love to Love You Baby*, Steve 'Silk' Hurley's *Jack Your Body*, and Basement Jaxx's *Samba Magic*.

The Basement Jaxx track has almost all of the information centred, while the other two producers have created a much broader stereo image. *Samba Magic* is produced especially as a dance music track, while other media, like radio, were probably taken into account with the earlier productions. Sounds that are spread among different channels can cause problems on a dancefloor that is organized with a left/right speaker system, because music can be missed. And the sound pressure from the bass drum should be approximately the same wherever you are on the dancefloor, so this sound has to be centered.

The "pumping" effect

Related to more specific forms of compression is the "pumping" effect,[608] which acts upon the whole frequency range, often in a rather drastic manner. A track with a dominant and consistent bass drum sound on the downbeats can produce a regular reaction from a compressor. If the threshold, attack, and release settings are right, the bass drum sound makes the compressor reduce the gain automatically on all other sounds in the mix, but this reduction will be in effect only as long as the bass drum sound is present. Depending upon the attack and release settings, then, the gain may alternate at the same rate as the poumtchak pattern.

In Daft Punk's *High Fidelity* this compressor effect is presumably in place. The sonogram below represents the transition from a build-up section with a filter effect to the return of the bass drum sounds.

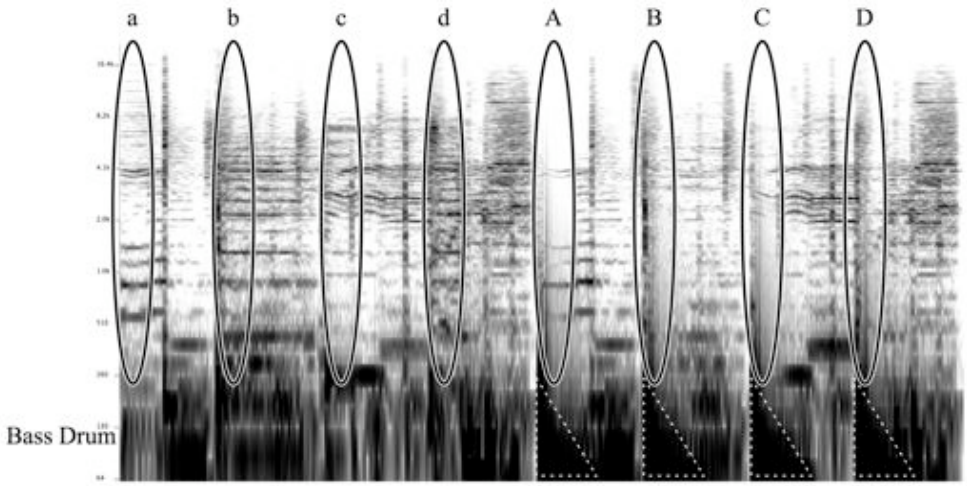

Figure 8.34: Sonogram of Daft Punk's *High Fidelity*, 5:13–5:16, with downbeats circled and bass drum sounds indicated by triangles.

The downbeats prior to the transition (marked with small letters) have plenty of sound material above 200 Hz. A short vocal utterance can be seen in circle "a" and the beginning of a somewhat longer vocal phrase in circle "c." Approximately the same sound material can be seen vaguely within the circles indicating the four succeeding downbeats (marked with capital letters), but its volume has been drastically reduced. The beginnings of the vocal utterance (in circle "A") and the vocal phrase (in circle "C") are in fact barely visible though their continuations remain as before the transition.

[608] See Snoman 2004:100 for an introduction to this specific effect.

A similar effect is present in the track *Call on Me* (2004; tempo: 130 bpm) by the Swedish DJ/producer Eric Prydz. At the very start, it is both audible and visible on the sonogram as the compressor shapes a synthesizer sound with a sustaining tone.

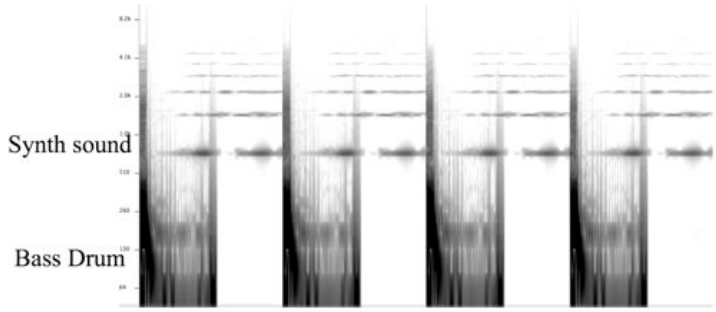

Figure 8.35: Sonogram of Eric Prydz's *Call on Me*, 0:00–0:02.

At each bass drum entry, the volume of the synthesizer sound is reduced drastically and takes on an oscillating character as the sound fills the spaces between the bass drum sounds. The compressor does this throughout the track, producing a quite audible "pumping" effect.

In relation to the aspects of verticality in music, the "pumping" effect strengthens the contrast between a low-frequency sound and a high-frequency sound. When the compressor is used in this manner, the bass drum sound dominates the mix and emphasizes its verticality in relation to movement, so that the experience of being pulled down by the bass drum is enhanced. Moreover, the "pumping" effect can be experienced as corresponding to movement or corporeality in how the character changes in a pulsating manner.

Analysis of verticality in sounds

In the last analyses of this chapter I will return to the first type of sound events – sound as discrete events. Synthesizer sounds may last from the moment when a key on the keyboard is pressed until it is released. Consequently, these events may have considerably longer durations than the sounds treated in the first part of this chapter. This offers an opportunity for longer pitch contours and more obvious occurrences of pitch movement and notions of verticality in the music.

The production of pitch movements

With acoustic instruments such as trombones, string instruments, or fretless bass guitars, it is easy to produce continuous pitch movements. Instruments where it is more problematic to slide from one note to the next (for example, pianos or guitars with frets) may still produce similar articulations, however. Either way, a correspondence between the slide and body movement is likely,[609] whether as the result of conscious production goals or coincidence. The term "glissando" has typically referred to all such types of pitch movements, while "portamento" generally has been restricted to vocals and string instruments (a stricter continuous pitch movement). "Portamento" or "glide" refer to the same effect on synthesizers.[610]

Synthesizers of the 1970s

In this sonogram of Keith Emerson's Moog sounds from 1972, the portamento effect may be seen circled at the beginning of each tone.

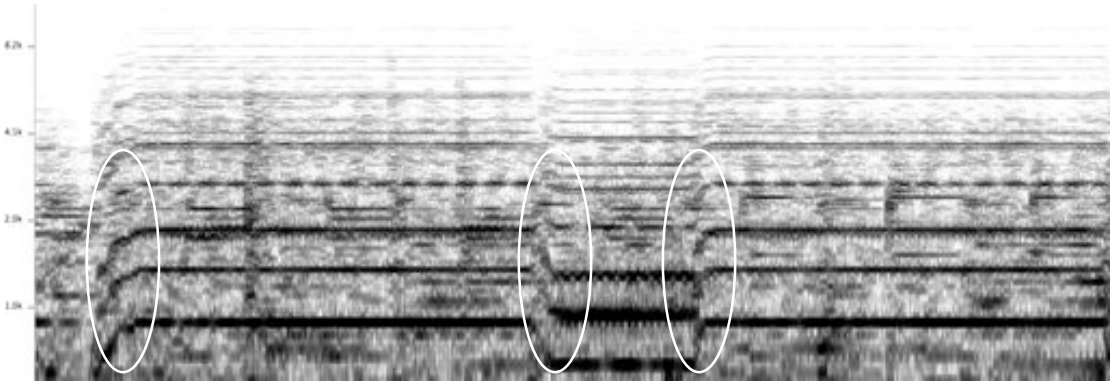

Figure 8.36: Sonogram of Emerson, Lake & Palmer's *The Curse of Baba Yaga*, 03:14–03:16, with portamento effects circled.

The extremity or obviousness of the portamento or slide effect depends upon the pitch interval it covers (and its parameter setting). The pitch movement displayed in the sonogram introducing the first tone is longer than that of the second or third because its interval is larger. In the sonogram below, Emerson alternates between intervals of one and two octaves.

[609] The bassline on the verse of Lenny Williams's *You Got Me Running* (1978), the background vocals intro to the refrain on Thelma Houston's *Don't Leave Me This Way* (1976), or the undulating string arrangements in the intro of Gloria Gaynor's *I've Got You Under My Skin* (1976) are examples from 1970's productions with pitch movement effects that may relate quite directly to body movements.

[610] Already in 1970 the Minimoog had a "glide" function that could be set to different levels by a knob on the front panel.

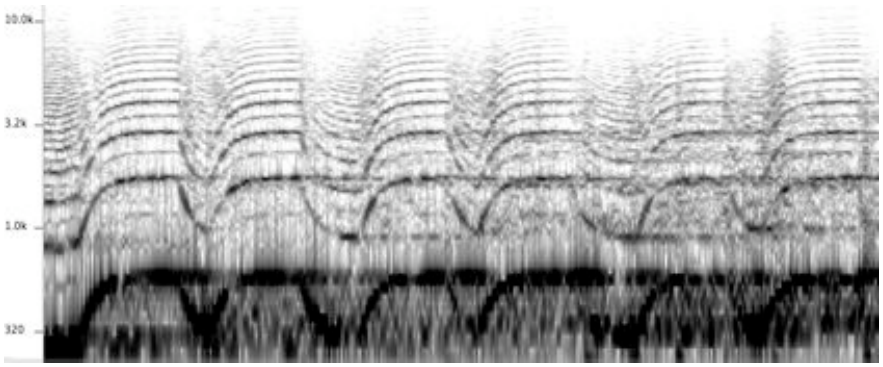

Figure 8.37: Sonogram of Emerson, Lake & Palmer's *Lucky Man* (1970), 03:40–03:43.

The "pitch bend" effect also produces sliding pitch movements, and, contrary to the portamento/slide effect, it can be controlled independently while the musician is playing. Usually synthesizers are equipped with a wheel or a joystick for controlling the pitch bend effect, so the keys can be played with the right hand while the left controls the pitch bend.

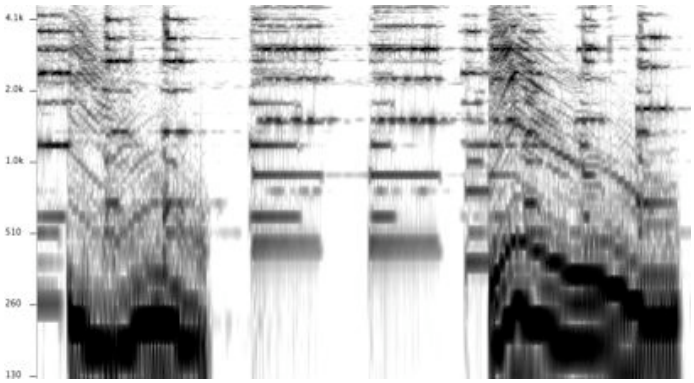

Figure 8.38: Sonogram of Parliament's *Flash Light* (1977), 0:03–0:07.

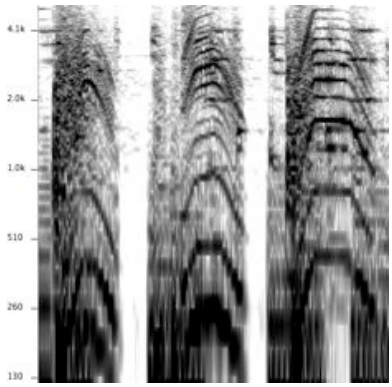

Figure 8.39: Sonogram of Parliament's *Flash Light*, 0:34–0:36.

In these two sonograms a pitch bend effect on the synth sound is clearly visible as dark undulating lines whose relative inconsistency indicates that it was done manually while playing.

The new production techniques of the 1980s

MIDI sequencers allow for pitch bend effects to be edited or programmed directly into them. The computer-based sequencers (which arrived around 1987) and their ability to visually represent such effects have made these procedures quite accessible. Synthesizer sounds can also be programmed with modulators such as envelopes, low-frequency oscillators, and so on, to further control the pitch in various ways. Thus

entire patterns of pitch movement can be composed into a sound of a certain length. Since memory storage became a common feature on synthesizers as well (about 1980), sounds with programmed portamento settings and/or certain modulators set to control their pitch could be programmed or acquired as presets when buying the synthesizer (or later on from external sound programmers). Compared to the balancing act of playing keys and controlling pitch bend, pre-programmed sounds were easier to use.

An early example of this synthesizer sound is Shep Pettibone's influential 1983 remix of First Choice's *Let No Man Put Asunder* (originally from 1977). During the last four minutes of the track, there is a short synth sound placed on the upbeat and then mixed in and out. In the sonogram below, the pitch movement of the sound is quite visible.

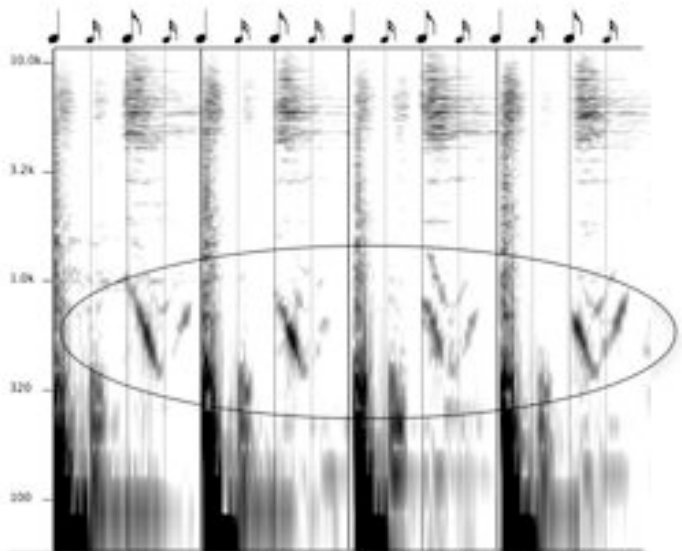

Figure 8.40: Sonogram of Shep Pettibone's remix of First Choice's *Let No Man Put Asunder*, 6:19–6:21, placed in a grid with note values, with the synthesizer sound circled.

As demonstrated by the grid here, the sound plays alongside the hi-hat, shaping the tchak in the poumtchak pattern. Even though the sound operates at the upper-middle frequency area, it fits the hi-hat sound well and contrasts with the echoed bass drum (also visible in the sonogram) and (through most of the track) the bassline. The sound's pitch movement does not seem to affect body movement in a certain direction, but its bounciness seems to encourage body bounciness as well. The event comes and goes, probably adding variation to the poumtchak pattern. In the 1999 cover version of the track by Mary J. Blige, an almost identical sound was used in the same manner.

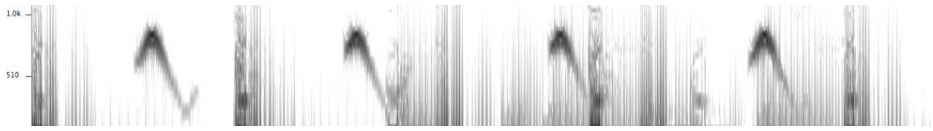

Figure 8.41: Sonogram of Mary J. Blige's *Let No Man Put Asunder*, 3:19–3:21.

There are several ways in which synthesizer sounds may produce notions of movement within a basic poumtchak pattern. As opposed to bass drum sounds, where the descending pitch movement fortifies an assumed direction of bodily movement, synthesizer sounds are less predictable. In some cases they may fortify a corresponding, synchronized movement, but they may also move in and out of such positioning, create parallel but not synchronized patterns, or even oppose the poumtchak. In the following I will focus on the tension among different movement patterns implied by the groove in various electronic dance music tracks from the 1990s.

Various examples from electronic dance music

A synth riff I find remarkably powerful forms the core of the track *Mentasm* by the American DJ/producer Second Phase (Joey Beltram) from 1991. The riff lasts four beat-cycles (one 4/4 measure) and is repeated throughout most of the track. For the first two minutes, the sound is unchanged; severe sound modulation then occurs through the rest of the track. The riff consists of a few tones tied together by descending and ascending pitch movements.[611]

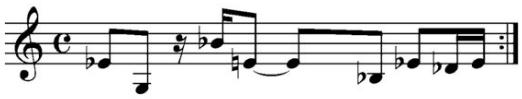

Figure 8.42: Notational representation of synth riff from Second Phase/Joey Beltram's *Mentasm*.

Stan Hawkins describes the riff as a "steaming, industrial jerky rupture,"[612] created on a Roland Alpha Juno synthesizer, which was first produced in 1986. This synthesizer has a digital oscillator capable of producing multiple waveforms, an analogue filter, and a single ADSR envelope that can simultaneously modulate the oscillator, filter,

[611] A transcription of this riff is challenging, because very few tones exists as stable pitches. In addition to what I have transcribed, there is a pedal point on E-flat and a doubling of it two octaves lower.
[612] Hawkins 2008:126.

and/or amplifier.[613] It is therefore unlikely that the envelope modulates the pitch movements of this riff, which is more likely the product of a portamento effect.

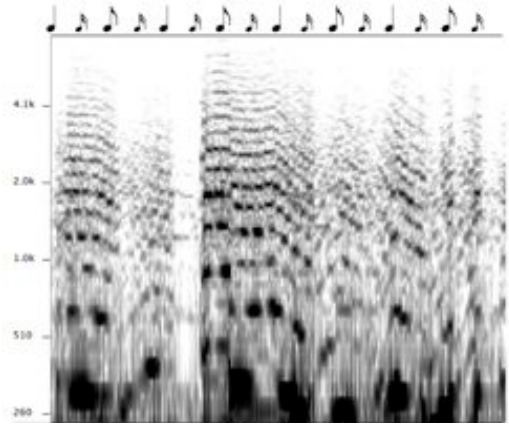

Figure 8.43: Sonogram of Second Phase/Joey Beltram's *Mentasm*, placed in a grid with note values, 0:00–0:02.

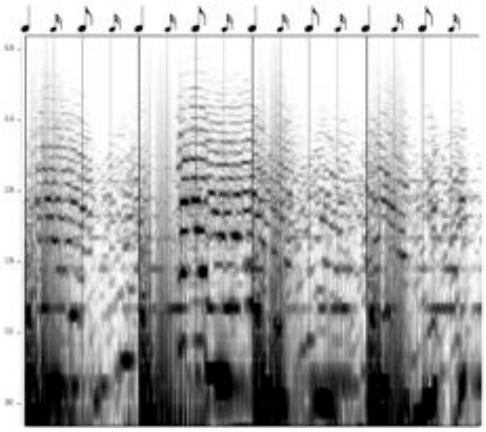

Figure 8.44: Sonograms of Second Phase/Joey Beltram's *Mentasm*, placed in a grid with note values, 0:08–0:10 (after the introduction of bass drum sounds on the downbeats).

The various pitch contours may activate corresponding bodily movements. In accordance with my discussions on musical verticality in chapter four these ascending and descending pitch movements can be experienced as notions of movement and further initiate a corresponding movement pattern. In the sonogram below I have attempted to draw a curve to illustrate a possible up and down movement pattern. The curve is shaped according to the tones in the riff, its dynamics, and its pitch movements. The descending B-flat to E interval seems to produce the most energy in the riff.

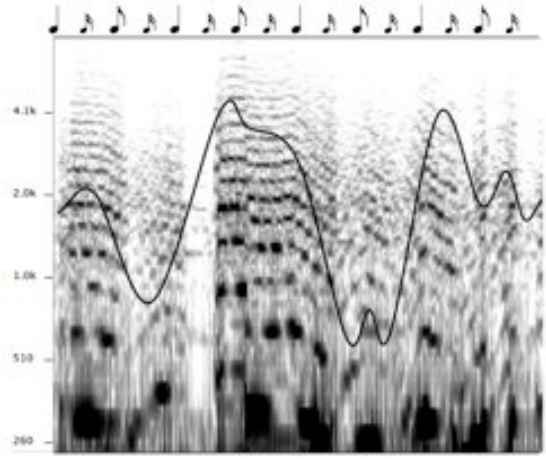

Figure 8.45: Sonogram of Second Phase/Joey Beltram's *Mentasm*, 0:00–0:02, with possible movement curve, placed in grid with note values.

[613] ADSR stands for attack, decay, sustain and release. A simple diagram of the synthesizer is available at webpage 8.1.

After sixteen beat-cycles (four 4/4 measures) with the riff playing separately, the bass drum enters on the downbeats. There is no upbeat hi-hat pattern, but the bass drum may activate a poumtchak movement pattern by itself. In the sonogram below, the two seemingly conflicting movement patterns are portrayed together.

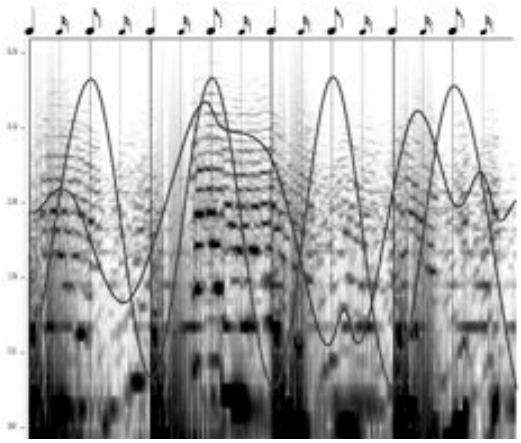

Figure 8.46: Sonogram of Second Phase/Joey Beltram's *Mentasm,* 0:08–0:10, with possible movement curves, placed in grid with note values.

Both patterns are equally emphasized and probably generate movements in a similar manner. It is therefore possible to switch from one to the other and thereby create individual movement combinations. Thus accentuated peaks (the B-flat to E interval), shifts in timing (or placement), and disturbances or tension points are produced by the interaction between the poumtchak and the riff. The drawings in the two sonograms below illustrate possible movement patterns synthesized from the sounds.

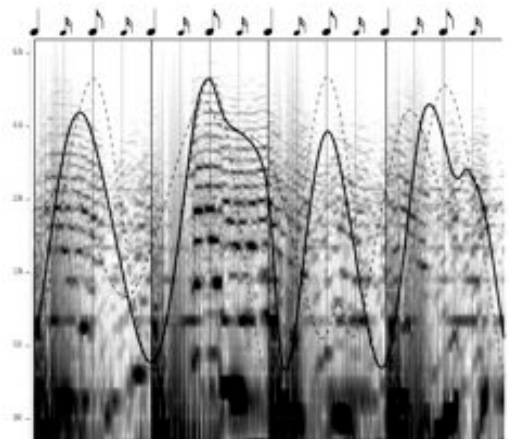

Figure 8.47: Sonogram of Second Phase/Joey Beltram's *Mentasm,* 0:08–0:10 with possible movement curve as an interacting combination, placed in grid with note values. The movement curve is dominated by the poumtchak pattern.

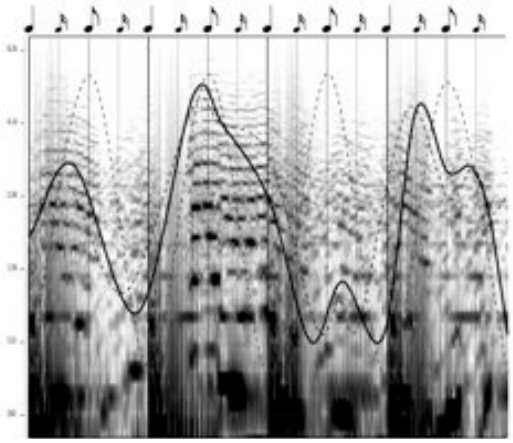

Figure 8.48: Sonogram of Second Phase/Joey Beltram's *Mentasm,* 0:08–0:10 with possible movement curve as an interacting combination, placed in grid with note values. The movement curve is dominated by the synth riff.

In both illustrations the placement of the peaks and nadirs generally avoids exact note values in the grid. Variations in energy or emphasis are illustrated by the heights of the peaks and disturbances or tension points are breaks or irregularities on the curves. In this way we can visualize how individual experiences of a groove are produced through such interacting connections and patterns. When contradictory movements are introduced successfully, it seems to produce tensions in the muscles that in turn arouse excitement. It comes to no surprise, then, that this track achieved considerable success on the dancefloors of the 1990s.

Two similar examples of interacting patterns are (again) taken from Daft Punk's album *Homework* from 1996. Throughout the track *Burnin'* there is a synthesizer sound with a pitch movement that moves radically between low and high frequency areas.

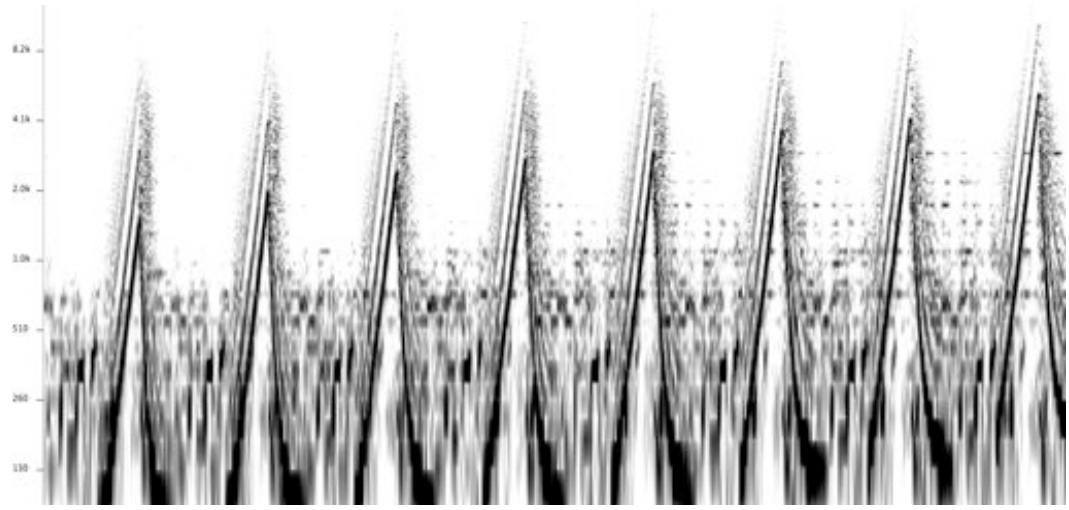

Figure 8.49: Sonogram of sixteen beat-cycles (four 4/4 measures) from Daft Punk's *Burnin'*, 4:40–4:49.

The undulating structure made by the synthesizer sound on the sonogram resembles the lines I have used earlier to illustrate the poumtchak movement pattern. It is likely that this pattern activates even more dramatic movement, because the ascending and descending motion here is continuous, not initiated by two contrasting sounds. The two patterns are not mutually reinforcing, however.

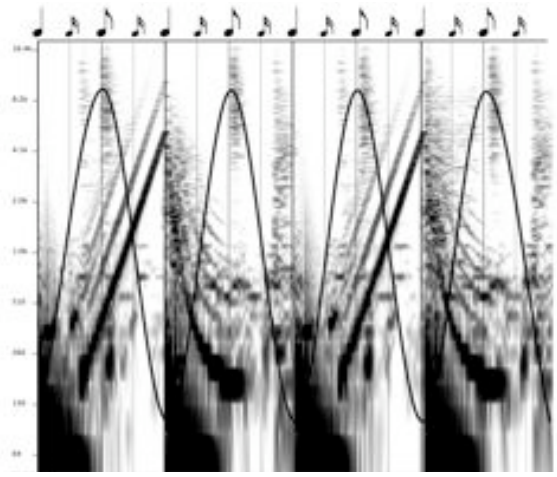

Figure 8.50: Sonogram of Daft Punk's *Burnin'*, 6:10–6:12 with a movement curve indicating a poum-tchak movement pattern, placed in grid with note values.

As is visually apparent in the sonogram, the pitch movements of the synthesizer sound do not correspond with the body movement pattern indicated by the poum-tchak. This pitch movement only occurs two times during the four beat-cycles represented by the sonogram, and its realizations are in fact opposed to the poumtchak pattern – the peaks of the synth sound are placed on the second and fourth beat-cycles. So how do they interact? It appears that the first and third up-and-down movements are increased in both strength and duration, while the second and fourth are decreased in the same way.

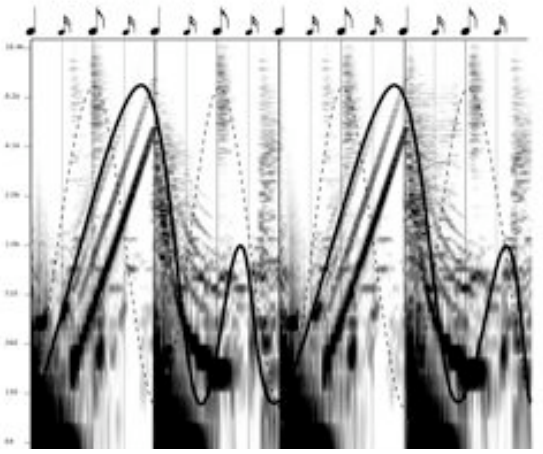

Figure 8.51: Sonogram of Daft Punk's *Burnin'*, 6:10–6:12, with a possible movement curve indicating an interacting combination, placed in grid with note values.

In the sonogram above, I attempt to illustrate a possible movement curve that is influenced both by the poumtchak pattern (the movement curve with dotted lines) and the pitch movement in the synthesizer sound. These may of course be experienced in

quite divergent ways. The main issue is the tension, interaction, and variation that sounds with pitch movements can bring to a poumtchak groove.

On the track *Rock'n'Roll* from the same Daft Punk album, there is another synthesizer sound with a definite pitch movement.

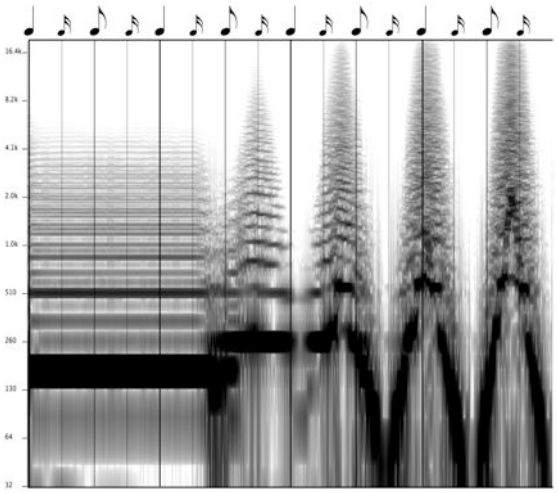

Figure 8.52: Sonogram of Daft Punk's *Rock'n Roll*, 4:27–4:29, placed in grid with note values.

The sound is faded in after thirty seconds and continues with constant modification until it is faded out thirty seconds before the end. It starts with a sustaining tone that changes into four undulating movements of increasing intensity. This course lasts four beat-cycles, and the final pitch movement ends in a new sustaining tone. The sonogram above is taken from a section where this sound occurs by itself and its pitch movements are visually quite apparent. For most of the track it is combined with a poumtchak pattern and a few other drum sounds (handclap and snare drum sounds).

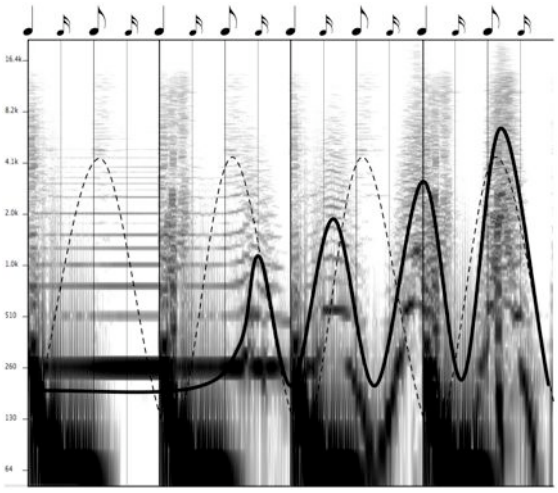

Figure 8.53: Sonogram of Daft Punk's *Rock'n Roll*, 2:39–2:40, placed in grid with note values, with one suggested movement curve following the pitch movements in the synthesizer sound and one following the poumtchak-pattern (dotted line).

I have in the sonogram above illustrated a possible movement pattern according to the pitch movements in the synthesizer sound. The three last undulations form a movement structure that closely resembles a counterrhythmic pattern, and the experience may be somewhat similar to that discussed in chapter 6 regarding this topic.[614] It is again possible (and maybe more typical) to maintain the movements evoked by the poumtchak pattern and experience the counterrhythm of the synth riff as constructive tension or conflict within this pattern. It is also possible to switch back and forth between the two movement curves.

Various synthesizer sounds with pitch movements may contribute tension to the poumtchak much the same way as complementary or counterrhythmic patterns discussed in chapter 6. But these sounds may have an even stronger relation to movement through their more direct correspondence to verticality.

Summary

My introductory analyses and discussions concerned the sounds of the poumtchak pattern. The bass drum sound can include a noticeable pitch movement, enhancing its role in activating a downward body movement. An examination of production processes from the 1970s through the 1990s suggests that a downward pitch movement in bass drum sounds has been increasingly important to electronic dance music. Various bass drum sounds, like variations in tempo, characterize different subgenres as well.

The sounds on the upbeat (hi-hat) and backbeat (snare drum/handclap) do not typically include pitch movements that might affect body movements. However, various aspects or realizations of these upbeat sounds may emphasize or intensify particular positions in the movement patterns, based upon duration or timbral quality, for example. Additional vocal sounds on the upbeats may also introduce variation to a movement pattern, especially should listeners/dancers choose to participate actively in performing these sounds. Control of timbre and reverb has been essential in the production of snare drum sounds in dance music from the 1970s to the 1990s. Snare drum or handclap sounds on the backbeat may bring variation to the poumtchak movement pattern, depending primarily on their frequency content.

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[614] See page 183.

The use of a specific filter effect, the gradual opening of a low-pass filter, creates a steady increase in the presence of high-frequency sounds that can in turn produce intensified body movements. Increasingly higher density, greater volume, brighter timbre, thicker texture, the sensation of gradually approaching a sound source, and the expectation evoked by this specific filter-effect are probably all implicated to different degrees in the intensified experience of the build-up sections where this type of effect often occur.

A comparison of tracks from the 1970s, 1980s, and 1990s supports the assumption that the use of compression has been increasingly vital for maximizing the energy level of dance tracks. This is probably due to the improved control over digital sound processing. In contrast, stereo panning appears seldom in dance mixes of the 1990s, probably to avoid the loss of any vital musical information when dancers are placed far from either left or right speakers. The "pumping" effect, where a compressor is used to deliberately reduce high frequencies on downbeats, can also influence the movement pattern. Given that verticality in music can influence the experience of dancing to it, it appears that the lack of high frequencies may intensify movement on the downbeat.

My last discussion here concerned pitch movements in synthesizer sounds. An outline of developments in the production of pitch movement on synthesizers from the 1970s through the 1990s demonstrated the new possibilities for control of these contours and intervals. Musical examples also revealed that pitch movements do not always correspond to the poumtchak pattern of the tracks and therefore affect movement in ways similar to rhythmic patterns in bringing tension and destabilization to a groove.