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Shaping rhythm: timing and sound in five groove-based genres

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Abstract

Shaping events at the microlevel of rhythm is an important aspect of many groove-based musics. In the present study, we explore the interconnectedness of musical parameters such as timing, attack shape, timbre and relative intensity in creating groove through investigating musicians and producers' discourse in five genres (jazz, samba, electronic dance music, hip-hop and traditional Scandinavian fiddle music). Through semi-structured interviews, we found both genre-specific accounts of how such musical features interact at the microlevel of rhythm and a cross-generic focus on inducing movement by shaping sound and generating rhythmic friction. The study empirically substantiates the multiparameter nature of musical performance and experience, and that particular genre-typical configurations of temporal and sonic features are needed to create the experience of groove. It thereby adds to the scholarly discourse on groove, which has often taken a more general and time-oriented view of rhythm.

Shaping events at the microlevel of rhythm is an important aspect of many groove-based musical styles, and studies of the microtemporal aspects of rhythm (that is, microtiming) started to influence musicological discourse as early as the 1960s (see, for example, Bengtsson *et al.* 1969). Its role was theoretically emphasised in the 1980s and 1990s (Keil 1987), and many empirical studies within music theory, music psychology/cognition, ethnomusicology and jazz have since investigated the perceptual and aesthetic effects of microtiming on groove. In the present study, we expand the perspective to all aspects of microrhythmic variation, asking (a) which microlevel features do expert musicians and producers report using to shape performance and/or production in different musical genres, and (b) what do they experience as their effects?

Groove is a musical term commonly used among musicians, enthusiasts and music scholars to describe 'a pronounced enjoyable rhythm'.[1] This definition captures both the ways in which the term is used (as a noun) to describe a characteristic rhythmic pattern typical of a musical style (i.e. swing groove, rock groove, funk groove), and (as is reflected in the adjective 'groovy') the particular 'pleasurable urge to move' (Janata *et al.* 2012) emanating from such patterns when they are performed in the optimal manner. The denominator 'groove-based music' is primarily associated with styles derived from African-American performance traditions, such as jazz, R'n'B, soul, funk, disco and hip-hop, and especially with their rhythmic qualities (Câmara and Danielsen 2018), but is now commonly used to describe such aspects of musical genres far beyond the African American tradition. However, while groove as an aesthetic/stylistic practice is a prominent feature of all of the styles in focus in this study, some of them tend to use other terms, such as 'Balanço'/'Suingue' in samba (Bøhler 2013) or 'Takt' in Scandinavian *Springar* (Johansson 2022).

The theoretical starting point for the current work is that experienced rhythm involves an interaction between actual sounding events and 'virtual' reference structures (Danielsen 2006, pp. 46–50), such as meter, pulse, subdivision, etc., which the perceiver projects onto sounding events. Experienced (perceived) microrhythm also emerges through such interaction of (actual) features in the physical signal and the internal (virtual) reference structures we apply to make sense of them. Regarding aspects of microrhythm, micro here indicating events at the sub-metrical level, *timing* refers to when a rhythmic event starts and/or ends in relation to a contextually relevant beat position reference – that is, early, late or on the beat. *Duration* equals the length of the sound – that is, whether it is short or long in relation to its virtual (structural) reference value (e.g. a sixteenth note) or in relation to preceding/succeeding sounds. *Shape* concerns how the energy of the sound unfolds over time (the sound's amplitude envelope) – in the present context we are particularly interested in whether the attack is percussive (sharp) or more gradual (soft) as the latter has been found to produce a later perceived timing (Danielsen *et al.* 2019; Gordon 1987; Villing 2010; Vos and Rasch 1981; Wright 2008). *Timbre* means the overall sound colour (aside from intensity and pitch). This is not a rhythmic feature in itself but may influence the perceived timing of a rhythmic event (Danielsen *et al.*, 2019; Hove *et al.* 2007; Seton 1989). *Relative intensity* refers to the overall energy of an event – that is, how loud it is – in relation to other rhythmic events.

Overall, the study concerns the ways in which interactions among these microphenomena of rhythm are perceived and produced in different genres and the extent to which each genre has a particular microrhythmic design that is, in turn, reflected in our informants' discourse. An overall aim is to move beyond existing scholarship's traditional focus on microrhythm as timing and investigate the relevance of all the above-mentioned microlevel aspects and their interaction for understanding the aesthetic practices involved in musical rhythm. This effort also entails acknowledging that there are significant overlaps and interrelationships between micro- and macrolevel features of rhythm in musical practices and discourses. Firstly, given that microlevel features are repeated, combined and layered to form higher-level structures, the

[1] Merriam Webster Dictionary Online, 'Groove', available at https://www.merriam-webster.com/dictionary/groove, accessed 2 April 2022.

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boundary between these levels is blurred and context dependent. Secondly, aesthetic ideals related to rhythm and groove typically do not concern particular microrhythmic features as such but rather the effects achieved through the use of such features. To clarify, then, while our study focuses on rhythmic shaping at the microlevel it also includes considering how such performance decisions interrelate with and impact groove and sound features at higher levels.

The study consists of semi-structured interviews with expert musicians and/or producers in five musical genres/genre cultures in which rhythm is constituted as a key aesthetic marker: jazz, samba, electronic dance music (EDM), contemporary R'n'B/hip-hop, and traditional Scandinavian fiddle music. An emphasis on rhythm, combined with pronounced differences in overall stylistic features, makes these genres particularly suited to comparison. In this paper, we examine in particular the relationships and interactions between microlevel temporal and sonic features in the five genres, focusing on what the performers/producers regard as crucial features of a good groove or feel within the given genre, and what they do to achieve this. The latter effort implies exposing those microrhythmic aspects that are actively shaped and emphasised within each genre, compared with those that are not directly or intentionally controlled but rather passive side effects of active choices. We also discuss the extent to which the latter, less prominent musical features are constitutive of the microrhythmic design of the respective genres by exploring the implicit elements of our informants' discourses.

Previous research into the relationship between timing and sound

Traditionally, Western musicological research into rhythm has contented itself with a notion of rhythmic structure that is derived entirely from those aspects of it that can be captured by music notation (Cooper and Meyer 1963; Lerdahl and Jackendoff 1996). It has generally ignored issues of microrhythm. However, over the past 30 years, studies of temporal aspects of microrhythm (timing and duration) in both classical and groove-based musics have grown in number and scope (see, for example, Bengtsson and Gabrielsson 1983; Clarke 1985, 1989; Butterfield 2010; Desain and Honing 1989; Friberg and Sundström 2002; Iyer 2002). Similarly, in ethnomusicology a number of studies have explored the nature and role of microtiming in various musical cultures. Prominent examples include Alén (1995) on Tumba Francesa; Clayton (2000) on North Indian Raga; Gerischer (2006) and Haugen and Danielsen (2020) on samba; Jankowsky (2013) on Tunisian Stambeli; Johansson (2010a, b) and Kvifte (2004, 2007) on Scandinavian folk music; Polak (2010) and Polak and London (2014) on Malian Jembe music; Berliner (2009), Doffman (2009), Hodson (2007), Monson (1996) and Prögler (1995) on jazz; Danielsen (2006) on funk; Stover (2009) on diasporic African music/salsa; and Bjerke (2010), Brøvig-Hanssen *et al.* (2022), Danielsen (2010, 2012, 2015) and Zeiner-Henriksen (2010) on contemporary dance music. Some of these studies also address aspects of the relationship between sonic qualities such as timbre and intensity and the perception of rhythm. This is also where the present study adds to the existing literature by exploring the groove-formative interaction between temporal and sonic features in more detail, including how musicians and producers across different genres understand and make use of such features.

In music psychology, systematic investigations into the interaction between aspects of sound and timing at the microlevel of rhythm have been lacking. While several works touch upon the influence of sonic features on perceived timing

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(Danielsen *et al.* 2015a; Goebl and Parncutt 2002; Hove *et al.* 2007) or timing on the shaping of sound (Câmara *et al.* 2020a, b; Danielsen *et al.* 2015b; Goebl 2001; Palmer 1996; Repp 1996; Sloboda 1983), and certain potential interactions between them (Danielsen *et al.* 2019; Melara and Marks 1990; Tekman 2002), little empirical research has addressed this interaction in full. A few pioneering works in music psychology (Fraisse 1982; Woodrow 1909), as well as some more recent empirical research (see, for example, Tekman 2002), have addressed the relationship between perceived dynamic accents (increases in intensity) and perceived duration. However, much of this experimental research has relied upon manufactured sounds – that is, clicks or tones devoid of associations to musical context or genre. In studies using real music, contextual factors and genre values, any of which can influence how timing is heard, have been neglected as well. By and large, the physical onset of a note, tone, or beat has been regarded as equivalent to its temporal position. However, while this is how the temporal position of a note is conceptualised in contexts such as music notation, most music analysis, and the visualisation of music in music software, it does not necessarily adequately represent how the position is perceived. In fact, several studies of so-called perceptual centres (or p-centres, see Morton *et al.* 1976) of sounds have found that the onset of a sound is *rarely* its perceived location (Danielsen *et al.* 2019; Gordon 1987; Villing 2010; Vos and Rasch 1981; Wright 2008).

Importantly, investigations of the perception of microlevel features of music should be framed by, and discussed as, part of the larger field of the cultural study of music. One aspect here is that genre affiliations impact more than simply how microrhythm is produced. As has been shown in several rhythm perception/cognition studies with a cross-cultural design (cf., for example, Cameron *et al.* 2015; Danielsen *et al.* 2021; Jacoby and McDermott 2017; Polak *et al.* 2018; Will 2017), the very perception of such musical aspects – that is, how they are heard – is influenced by the listening habitus of the beholder. This means that investigations zooming in on the moment of performance and perception must be reckoned against an abiding concern and interest in musical discourses,[2] cultural contextualisation, and shared patterns of meaning-making (Agawu 2003; Clayton *et al.* 2013; Rice 2017). As Toynbee (2000) reminds us, this also includes disputes over such meanings. Accordingly, musical genres should be considered not static systems of classification but dynamic formations that undergo constant renegotiation (Keil 1994; Moore 2001).

These perspectives have implications for our study. Above all, they suggest that musical discourses (broadly defined) are constitutive of what a genre is and is not, as well as the context for interpreting what informants do and say. The latter condition implies that concepts and statements are coded in ways that are not necessarily compatible across genres. For example, among our informants, key terms such as groove, timing and sound are conceptualised differently and derived from different understandings of the music-making process. Accordingly, when we synthesised our findings, we aimed to establish a meta-discourse that allows for comparative and contrastive analysis. It should also be noted that the terminology used during the interviews was tailored to the specific genre in question and that there was little

[2] In this context, the term discourse is broadly defined, referring to both linguistic and non-linguistic (including musical) practices through which meanings are established and negotiated. On the other hand, when addressing 'our informants' discourse', we use the term in a narrower sense to refer to how the musicians and producers respond to our questions during the interviews.

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Table 1.. Overview of genres and instruments

Genre	Instruments/roles
EDM	Producers
Hip-hop	Producers
Jazz	Vocals, trumpet, saxophone, guitar, bass, drums
Samba	Vocals, percussion, guitar, drums
Scandinavian folk music	Hardanger fiddle, langeleik, Jew's harp

uncertainty as to which aesthetic aspects were in focus during different phases of the interviews. Concretely, the interviews unambiguously addressed groove in the adjectival sense and as a rhythmic quality that is recognised across different forms of music while comprising features that are particular to each genre.

The goal of the present study is to identify practices that are essential to the musicians and producers who were interviewed and to articulate typical differences among the identified practices in order to shed light on a variety of possible ways to approach rhythmic shaping at the microlevel. This is important because discourse concerning microrhythm is a central part of an ongoing process of stylistic negotiation within and between groove-based genres. A jazz musician may, for example, claim that microtiming is crucial to groove, whereas an EDM producer might be more concerned with choosing and shaping sounds. Comparative research into different musical genres' various forms of valorisation, aesthetics and ways of hearing and perceiving microlevel features is thus long overdue.

Methods

We conducted in-depth semi-structured interviews (Kvale and Brinkmann 2009) with expert performers in the respective genres, which encourages in-depth responses and two-way communication. We sought professional performers/producers with long-term experience within the genre in question. All saw music as their primary area of work, and most were active in Norway, where the majority of the research was carried out. The exception was the samba interviews, which were conducted in the São Paulo and Rio de Janeiro regions of Brazil. In total, we interviewed 25 musicians and producers. (For an overview of genres and instruments, see Table 1. A complete list of interviewed artists and their websites appears in Appendix 1.) One interview typically lasted between 60 and 90 minutes.[3]

The interviews were conducted in 2017 and 2018 and carried out by a team of nine interviewers. For most of the interviews, two interviewers were present, one of whom was very familiar with the given genre, ethnographically, as an analyst, performer or producer. One of the senior researchers (Brøvig, Bøhler, Danielsen, Johansson) was present at every interview to ensure methodological reliability and strengthen the comparative dimension of the study. We used a semi-structured interview guide (see Appendix 2). We started by asking the informant about his or her

[3] The study was conducted in compliance with the ethical research guidelines of and approved by the Norwegian Centre for Research Data. The informants received written and oral information about the study and the voluntary nature of their participation. Written informed consent was provided by all the informants, which included that they agreed to be named in future publications.

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general view on what a good groove is, then moved on to more specific questions about the informants' reflections on the importance of timing, shaping sound, and microlevel timing–sound interactions, respectively. In the last part of the interview, we asked questions about specific topics that pertained to each genre, as well as about similarities and differences between their main genres and other genres with which they had experience. Some of the interviews also involved discussions during rehearsal- or performance-like conditions, meaning that the informants used their instruments to demonstrate particular features of playing technique and associated modes of rhythmic articulation.[4]

The interviews were transcribed and coded using a custom-made code book developed by the research group that followed the structure of the interview guide.[5] All relevant statements were coded with genre(s) and topic(s). We then did systematic searches in the material both within and across topics and genres and extracted all relevant statements pertaining to a particular topic or genre, or combinations thereof. Through this process, the most pertinent topics across genres, whether that be similarities or differences, emerged. These are discussed below after summarising the findings for each genre. Ultimately, exemplary and particularly illuminating statements were selected for inclusion in the article. The selected quotations were then translated into English by the researchers. When citing these interviews, we include the source to allow the reader to associate the insight with the individual responsible for it.

Five genres, five combinations of timing and sound

In the following, we first present our results for each of the genres: electronic dance music (EDM), hip-hop, jazz, samba and Scandinavian fiddle music. Then we focus on some particularly interesting findings across the five genres.

Tight timing and breathing dynamics: the shaping of sound in EDM

Several of the EDM producers noted that a good groove, groove here understood as a rhythmic pattern including its microrhythmic qualities, affords particular ways of moving, so they often mix while in a standing or dancing-ready position. This emphasis on being able to move reflects the fact that their music often is produced, mixed and mastered to function in a club setting as a means of encouraging people to move and dance and experience embodied pleasure. Accordingly, Charlotte Bendiks called her music 'body music'. Similarly, Espen Berg (from Seeb) argued: 'Electronic dance music is all about creating energy in the body'.

Several informants mentioned that they exploit the combination of tight and off-the-grid sounds to achieve this embodied quality of EDM grooves, grid here referring to the grid that marks beat and subdivision positions in a sequencer. Sometimes they shuffle sounds by milliseconds either behind or ahead of the reference grid (Bendiks), or they move a whole section of a track in this way. Knut Sævik (from Mungolian Jet Set) and the members of Seeb use track delay in tandem with the

[4] The interviews were conducted in Norwegian except for the samba interviews, which were conducted in Portuguese and translated into English by the authors.

[5] For transcription and coding we used the software f4transcript (https://www.audiotranskription.de/english/f4) and f4analysis (https://www.audiotranskription.de/english/f4-analyse).

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positioning of several sounds specifically to *accentuate* the grid. Berg from Seeb stated: 'If all the sounds are staggered at the same time, it wouldn't work'. Likewise, if the music consisted solely of straight sixteenth notes, it would have sounded lifeless and boring and even ceased to function, according to Berg.

Not surprisingly, the producers also employ quantisation to their tracks in different ways. Seeb often use the quantisation swing-percentage tool in Ableton Live to experiment with polyrhythmic patterns in which some of the subdivisions are swing-quantised within a certain 'pocket' of roughly 22–40 per cent swing (zero representing a straight sixteenth-note pattern and 100 per cent representing a sixteenth-note triplet shuffle beat). Sævik and Per Martinsen (Mental Overdrive) use quantisation when they want a strict grid-based aesthetic involving sixteenth-note subdivisions typical of techno.

However, this cultivation of 'super quantised' music with 'an immensely quantised clock running', as Martinsen puts it, also demands an interest in manipulating perceived timing at the microlevel. Rather than the sounds' physical placements (thinking in terms of waveforms), Martinsen reported that he concentrates on shaping their sonic features to impact microtiming. For example, he often works with the sounds' envelope, adjusting attack and release times: 'the extension of [the rise time of the attack by] slowly opening a hi-hat, for example, changes the whole groove'. Seeb also works with timing by manipulating the sonic features of rhythmic events. For example, they often add transients in order to add rhythmic impact or punch to a sound, and they use sidechain compression abundantly.[6] If, for example, a hi-hat stroke is momentarily compressed (or attenuated) whenever the bass drum is present (meaning that the bass drum serves as the compressor's trigger signal), it will acquire a completely different shape than it had originally, and the swing and energy will change accordingly thanks to the corresponding increase and decrease in its volume. Also Sævik finds that changing the envelope of the sound can have a big impact. He is also concerned with shaping timbral details in the sound of different instruments and says that this can impact the groove significantly: 'Is the hi-hat a "t-t-t" or is it a "tch"? [This] has a huge effect.'

The balance between the different sounds' levels, that is, relative intensity, also has a significant impact on how we experience the groove according to our informants. Increasing the loudness of sounds will automatically make them become more dominant in the overall sound and have more impact on the microrhythmic feel. Just two decibels in the wrong direction can, according to Martinsen, impoverish the whole groove, in the sense of staggering its flow. Like Martinsen, Sævik also finds that balancing the relative sound levels affects the experience of the *timing* aspects of the groove – loud sounds seem slow, he suggests, while soft sounds seem fast.

Because they all produce music for club speakers and settings, the EDM producers often foregrounded sounds in a low, even sub-bass, frequency area. In order to keep these dominating low-frequency sounds from masking one another and otherwise becoming muddy, all of the producers reported applying sidechain compression simply to 'tidy up' the sound. Martinsen described sidechaining as a means

[6] Sidechaining is a technique through which two input signals are inserted into the compressor instead of one, so that one of the signals, when it reaches a certain threshold, triggers the compressor to reduce the volume of the other signal, until the original signal falls below that threshold again and the volume of the attenuated signal returns to its initial level. This reaction creates space for the trigger-input signal while introducing a particular dynamic shape to the other signal.

of making the groove breathe: 'One of the most important things about groove is the gaps … If it [the track] is too busy, then the groove disappears, and you are left with a wall'. Martinsen, Bendiks and Berg (from Seeb) all advocate for a 'less-is-more' ideal, because it is so important to provide enough space for all of the sounds (although, as Berg emphasises, the soundscape is often much more complex than it actually sounds, with a single sound in fact comprising several layers of sound, for example).

In all, our examination of what EDM producers associate with a good groove demonstrates the vast impact of the manipulation of microlevel sonic features, which encompasses tweaking sounds and balancing the tracks' sound levels. Sound, in the sense of individual sounds' features, is thus a microrhythmic parameter that is *actively* shaped in EDM production. Active manipulation of microtiming at the millisecond level was also important to some of the producers, although the scale of their adjustments was often too fine-grained to be perceivable as adjustments in timing per se. Most of the producers were aware of the ways in which the choice of sounds as well as the various techniques for manipulating sound, such as side-chaining and dynamics, might affect the sound's perceived timing. They all find sonic features extremely significant for groove, and Bendiks simply stated that, in the music she produces, her sound *is* her groove.[7]

The elastic feel of hip-hop: choosing, combining, manipulating and moving sounds

According to Tommy Tee, virtually anything – down to the tiniest of details – could potentially 'spark' the right feeling in a hip-hop groove (in the sense of a genre-typical beat or pattern), but '[t]he choice of sounds is super, super, super, super important'. An effective composite kick drum is often produced by layering separate sounds with different sonic characteristics, for example. The typical kick drum in 2018 was, according to Tommy Tee, based on a low-tuned 808 kick[8] that is almost completely deprived of any attack (to represent the sub-range bass frequencies), combined with a dry and more processed kick layered on top of it. Lastly, a more resonant 'live-sounding kick' is stuck between these two layers, to fill in the mid-range frequencies and make the kick drum stick out more through smaller speakers, as well as provide more attack and better definition overall. When and how fast the bass drum sound fades away also makes a difference – whether the bass drum goes 'whmm' or 'wooohm', that is, influences the 'mood' of a track. The latter is more 'laid back', whereas the former is more 'on', Tee emphasises. He also sometimes lowers the kick drum pitch to achieve a heavier, more laid-back feel: 'If you move a kick drum up or down a few semitones, you will hear a big difference'.

The attack portion of a sound receives close attention from several other producers as well. According to Amund in Basmo Fam, 'slow' synth sounds have a long attack time and 'fast' ones have a short attack time. For snare drums, then, Amund prefers 'short and straight on'. Øyvind (also of Basmo Fam) says that whereas the timing of a fast attack sound feels very close to where one places the onset, brass sounds on a synth, where the sound 'swells' after the onset, are generally

[7] For a further discussion of Seeb's use of sidechain compression, and of the rhythmic effects of dynamic manipulation more generally, see Brøvig-Hanssen *et al.* (2020). For further discussion of temporal and sound-related aspects of EDM grooves, see Brøvig-Hanssen *et al.* (2022).

[8] '808 kick' refers to a software emulation of the kick drum of the Roland TR-808 drum machine.

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late or slow. Attacks are also controlled through sound processing. To make the snap of a kick-drum attack more evident, for example, Tommy Tee increases 'some frequencies in the upper register of the sound' using compression or EQ.

Erlend in the Kvam collective also associates slow beats with 'long pads, long slow sounds', and short sounds with a 'staccato vibe'. His main approach is to choose his sounds very deliberately and then manipulate them within the synth software. In the trap genre, the ideal is to align everything on the beat, but he thinks that if he limits himself to the grid-based sequencer in his preferred FL Studio software, the groove becomes a little too monotonous and rigid: 'Then you … have to go deeper, change a few things'. He then manipulates timing directly, moving hi-hats and melodic events later in time: 'If you can hear that a melody on a piano is produced by a computer, if every note hits perfectly on the beats, I change the notes so that everything is a little late'. He also uses plug-ins to chop up single tracks and twist the positioning of the fragments so that the whole rhythm changes.

Relatedly, several of the hip-hop producers reported a strong propensity towards unquantised recording and sequencing, or intuitively working 'off-the-grid' in digital sequencers. Knut Petter Sævik stressed how his approach to hip-hop is different from his approach to EDM, where everything comes down to 'inserting … removing … and moving things until it becomes just right'. For hip-hop grooves, he instead records himself over and over again playing various instruments with his own 'flawed' (off-the-grid) timing until 'it swings in the right way'. Similarly, Tommy Tee described how he once lost the ability to achieve the swing he desired, so he decided to stop quantising and instead practice playing and triggering his own drums and samples until he felt like he had established and naturalised 'his own swing'. Both Sævik and Tommy Tee reported that, although they might occasionally move a note that does not sit quite right in the groove, they would rather start over again from scratch than move too many notes, because, as Tommy Tee put it, 'then the whole point is gone. You just sit there and nerd yourself away'.

The members of Basmo Fam, on the other hand, almost always end up quantising a track, though they sometimes preserve synth-plucks and similar sounds just as they were recorded, in order to introduce some variation to the track's timing. Most of all, they seek a stable sonic basis. As Eirik from Basmo Fam explained: 'It seems as though it is easier for many rappers to start on top of … a simple loop, which we think is unfinished but still functions to keep the tempo. Then we can finish it [manipulate the timing] afterwards'. Kristian in Kholebeatz related the binary choice of quantisation *vs.* non-quantisation directly to the musical style in question. If he is producing East or West Coast hip-hop, he consciously moves events off the grid. If he is producing southern trap, the ideal is very different: 'May I call it robotic?' he asked rhetorically.

The hip-hop producers had different ideals and approaches in terms of the use of sampling. Kristian from Kholebeatz liked the fact that one has to take the sample's own rhythm into consideration. The members of Basmo Fam also noted that samples introduce variation to the timing. Both Tommy Tee and Sævik were very clear about the importance of the meticulous editing of a sample's start and end points in the interests of achieving the 'right' timing and avoiding lopsidedness when looping the sample. Conversely, Kholebeatz, uses deliberately inaccurate chopping of samples: 'Often I chop the sample slightly before the sample begins. … I chop it … perhaps half a second before. To get that laid-back West coast vibe'. Generally, he thinks that sampling leads to more playfulness: 'When you sample, you can …

find rhythms in that sample … it can be anything from a built-in drum roll that is a bit offbeat to a trumpet that you never would have thought of yourself, if you were to program it yourself'. That's what he likes with samples: 'You have to adjust to it [the sample], adjust to its "takt" [tactus], and then it might happen that you need to be 100% quantised, or that you have to lay back again'.

In sum, the hip-hop producers were very conscious of the ways in which the choice and combination of sounds, as well as the manipulation of the sounds' shape and sonic features impact the timing and feel of a groove. Some producers preferred what they referred to as flawed timing, whereas others mostly used quantised tracks, depending on the given style and subgenre. The quantised approach to hip-hop beats reportedly leaves room for the elaboration of rhythm and timing in the rapped parts, but often some layers are quantised and others manipulated to be off the grid through manual or computational procedures. Generally, the producers paid ample attention to the effects of sound, timing, as well as their interaction.

The perfection of collective 'time' in jazz

Several of our jazz informants talked about perfecting the groove, in the sense of playing the chosen rhythmic pattern in the most aesthetically satisfactory way, as a process of optimising a shared sense of 'time' through collective interaction. According to trumpet player Eckhard Baur, when people practice together, they come to feel the given rhythm in the same way. Guitarist Knut Værnes thinks that optimal interaction in a band 'is about listening'. Drummer Ola Øverby agrees: 'The coolest musicians keep a lot of air in the groove while at the same time being so insanely tuned into each other's time. I mean, how can you achieve that if nobody keeps the pace? [It is] as if they have a shared inner time which they connect to'. His bandmate vocalist Sofie Tollefsbøl says that groove is the starting point for everything she does as a singer and that she plays a part in *creating* that groove through the considerable freedom she has in terms of timing in the genre. Saxophone player Morten Halle, who has extensive experience with smaller 'chamber' jazz ensembles, also thinks that the timekeeping function is shared among all of the musicians:

> When you start to play jazz music, you think that bass and drums are the ones responsible for keeping time, and everybody else can do whatever they want. However, the Miles Davis quintet from 1965, which is a reference … on some of those recordings the rhythm section is 'abstracting' the beat completely. Miles Davis and Wayne Shorter had extremely good timing. It was no problem for them to keep the flow of the groove going when the others [the rhythm section] stopped playing.

This varies from style to style, though. For Baur, whose experience is mostly in the big band tradition, the drummer is the ultimate timing reference and has to negotiate among the different sections: 'If the horn section is expected to play laid back, the drummer has to divide himself in two. Everything that's related to the constant, steady rhythm is "in time", whereas every hit is timed together with us [the horn section]'. Generally, tiny adjustments in timing can change the whole feel and stylistic reference of a groove: 'A bit more shuffled is like going ten years back in time. A bit less shuffled, then we're suddenly in the fifties', drummer Øverby says.

In terms of the importance of sonic features, shaping the attack is mentioned by several of our interviewees. When bassist Ellen Andrea Wang wants to play in a pushed manner, she 'wants it to "pop" a little more, the attack [on the string] is

harder'. According to Wang, such 'popped' sounds always anticipate the beat. When playing behind, the attack is softer. Softer sounds are also more flexible: 'If the groove is going, soft sounds may "live" a little more timing-wise'. Similarly, guitarist Knut Værnes points out that when he wants to play in a laid-back manner, he often switches from a pick to his fingers to produce a softer sound. For vocalist Sofie Tollefsbøl, the sound of the words is important: 'That the word has a sound or a consonant … creates a rhythmic effect in a way'. Drummer Ola Øverby stresses the importance of dynamics when it comes to achieving a good groove: '[Dynamics] has an insane amount to say … It is in a way the second most important … after the actual timing'. He uses the snare drum as an example: 'If [the snare drum] is high dynamically, it has a completely different function in the beat than when it is low'.

Several informants also thought about how sonic and temporal features interact. Halle says, 'A sharp sound acts differently than a muffled sound, and therefore it has to be placed differently [in time] as well'. He thinks that rhythmically precise soundscapes call for sharp sounds. Tollefsbøl observes that a heavier sound can influence the timing of the whole band: 'The band starts playing behind the beat when the bass drum gets heavier. Hmm. Or it sounds thicker, kind of'. Øverby puts it this way: 'Quick and sharp, and soft and slow … There is something with the soft and slow that is kind of – that is more behind the beat in itself. While the bright or sharp and quick one is kind of earlier'. Guitarist Værnes talked about what to do timing-wise when one switches from plectrum to finger-playing – since the latter produces a softer sound, one must play the string earlier in order to remain on the beat.

Overall, the jazz musicians' primary focus was timing, but they also reflect on sonic qualities related to different playing techniques and how these enable them to articulate a note as sharp (early) or soft (late) and thus influence the timing feel. However, several of them tended to frame sonic features as something to adjust to in order to maintain the desired timing. All of our informants stressed that sharing an inner sense of pulse is crucial to making a jazz groove work and that the perfection of a collective, dialogical sense of timing is key to the process of musical interaction.

Samba: playing with timing, ghost notes and accentuation

In terms of what constitutes a good samba groove, many of our samba informants talked about the importance of specific patterns (*levadas*), and even used music transcriptions to visualise and specify those patterns and their internal syncopated structures during the interviews. At the same time, everyone pointed first and foremost to a musician's ability to interpret the music, microrhythmically moving beyond the prescribed patterns. According to pandeiro player Marcio Caparroz, the pandeiro pattern, for example, is characterised by a particular accentuation and microtiming of the sixteenth notes: 'One idiomatic thing about samba is the accentuation of the last note of the beat, and the first. The fourth and the first … I try to do this on the tambourine. The two other notes, then, are the opposite, that you don't accentuate. Try to make it sound lower. Give more value to the well-accented notes'. The surdo (bass drum), on the other hand, is experienced as lagging behind within the pandeiro rhythm because of the open sound that is allowed to resonate almost

beyond the next beat: 'It's as if you're late … Leaving the sound open makes the note last longer … the first semi-quaver note of the second period. It's almost late'.

Along these lines, many percussionists and guitarists argued for the importance of 'ghost notes'. Guimarães said, 'After playing samba for a while, I always found that specific combinations of ghost notes were crucial for the *suingue*. When I listened to João Bosco, Baden Powell, Rafael Rabelo [legendary samba guitarists], I realised that they fill in with these ghosted sixteenths notes'. Guimarães demonstrates the way in which these ghost notes act as a sort of complementary rhythm to a given pattern, 'filling in' most of the sixteenth notes that were not articulated by the pattern. The temporal structure and sonic shape of these ghost notes, as well as their interaction with the main pattern, constituted crucial tacit knowledge that was required to make the samba groove.[9]

Guimarães also argued that guitar phrasings are greatly influenced by rhythmic ideals originating with the singers and their tendency to phrase behind to cool down the other pulsating rhythms. More generally, patterns should be stretched temporally in the right direction and articulated with specific accents. According to guitarist, singer and percussionist Matheus Crippa, a samba groove that lacks such qualities would sound 'square and boring' (*quadrado*). Instead, the music should 'breathe' in its own way and express a human sense of playfulness and fun (*brincadeira*). The quality of playfulness resides in things like the musician's ability to suddenly displace the sounds a bit early or late, to change and alter the pattern, or to introduce a break that disrupts the whole flow of the groove for a moment before restoring its balance again. These microrhythmic variations are pleasurable surprises that make people smile, dance, and interact, Crippa argued, hence contributing to the 'joyful party' and social space that samba aimed to create.

Importantly, the different instruments (including their associated registers) that make up the samba groove have different roles with regard to phrasing, sonic shape and accentuation. Legendary samba drummer Oscar Bolão argued that some of the greatest surdo musicians always played a little bit behind, contributing the right feeling of balance in the lower register, one that was not stressed but rather calm and joyful, whereas the pandeiro pattern and the percussion instruments in the middle and upper registers typically pushed the samba groove forward a bit. He also tried to bring this pleasurable tension to the drum set, which meant both playing ahead of the beat (in the middle and upper registers) and behind the beat (in the lower register) at the same time. Musicians often referred to this aesthetic ideal as *balanço* ('balanced') and believed that too many simultaneous improvisations would undermine it. Samba singer and percussionist Toinho Melodia described *balanço* through the metaphor of musical waves:

> A really good samba groove has to have *balanço*, and the *balanço* is like a wave, you know, like these beautiful waves in the sea, that moves like this [he explains with a gesture by moving his hand], and it feels good, you know, just the right amount of spice, of movement, not too much, not too little, just so that you feel good. And what really contributes to this *balanço* is the surdo; it gives you a feeling of soil, of grounding.

Other informants pointed to the balancing function of the syncopated and more energetic patterns played in the middle and upper registers by the other percussion

[9] Guimarães referred to a YouTube video by João Bosco to illustrate this point: https://www.youtube.com/watch?v=dDromsIFfoY.

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instruments. As Bolão underscored, these sounds pushed the participating listener deeper into euphoria, and for him it was this particular combination of calmness and euphoria that characterised a good samba groove.

These comments on the instruments' different roles also relate to the more general idea of playing samba as a dialogic and interactive process. As Guimarães put it: 'The main thing is the ability to dialogue between the musicians, because the beat will be good because the dialogue between the people who play it is clear. The *suingue* does not exist in one instrument … but in how one is, for example, playing this thing [refers to a recorded example] and another does something else. Each fills the spaces, without anyone occupying the space of the other, and it is this combination that will be what generates the groove, the swing (*suingue*)'.

In sum, our informants stressed the importance of complementarity between the played rhythms, and of microrhythmically delaying and pushing rhythmic events to achieve the right overall feel. The sound and flavour of the instruments were also important, although the former, in particular, was considered to be inherent to the instrument itself. Playful timing, or the right combination of early and late timings in the dialogue between the different instruments – what was earlier described as 'waves in the sea' – was an ideal here. The right *suingue* also depended heavily on the performer's articulation of expression, including accentuating the right beats and adding the appropriate ghost notes.

Fiddle: melodic–rhythmic variation as groove-forming element

Within the Scandinavian fiddle traditions, the style-specific concept of groove ['takt'] is wedded to the fact that the music is meant for dancing. It is indeed striking that dance remains such an important reference point here, even as few of our informants regularly played for dancers. Correspondingly, the musicians' discourse about groove involved various metaphors of movement, such as lift, drive, flow and forward thrust. Movement also appeared more literally, in references to dancers' movements, and to the physical movements of the musician, including bowing patterns, foot stomping and ornamental fingerings. In what follows, more specific observations will focus on timing, sound and timing–sound interactions, respectively.

Among the fiddlers we interviewed, groove was not primarily associated with the temporal placement of sounds, although some did point to *variation* in their 'timing'. Anne Hytta and Anders Røine emphasised the importance of avoiding monotony by means of microrhythmic displacements of the regular distribution of beat durations.[10] In a similar vein, Herbjørn Liahagen and Ottar Kaasa described a tension-and-release strategy in which there is an alternation between 'holding back' and 'letting go' within the phrases, which produces not only beats of varying lengths but also significant fluctuations in the overall measure duration (cf. Johansson 2017). These strategies allude to the music being structured in long phrases or sentences of varying length, rather than short repetitive chunks (1–2–3,

[10] Note that the basic beat-duration patterns of these fiddle styles are asymmetrical: Tele-springar (Hytta and Kaasa) is long–average–short, while Valdres-springar (Røine) and Halling-springar (Liahagen) are short–long–average. See https://youtu.be/Iw8Iae5YRdI for examples. The video features the interviewed fiddlers performing in different styles of the springar tradition. It also highlights the stylistic features discussed in the present paragraph, including the rubber-band-like rhythmic feel and the constant variation of melodic–rhythmic phrases.

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1–2–3, etc.). Alongside these limited interests in timing, there was a strong urge to make tunes come alive rhythmically by considering every musical gesture to be open to microrhythmic alteration. Variation and deviation are recurring aspects of this effort, but in relation to preceding or alternative interpretations of musical gestures, not to some objective reference for the temporal placement of sounds. Liahagen cautioned, 'When I speak of deviations, I'm simply referring to deviations from the last time I played the same motif'.

Within the fiddle tradition, as in the jazz and samba tradition, the concept of sound is closely tied to the qualities of the instrument and the fine-tuned interaction between instrument and performer. Kaasa and Hytta repeatedly characterised an ideal sound as a successful compromise between softness (and richness) and sharpness – 'a rounded timbral space' that also affords clarity and transparency in rhythmic and ornamental articulation, onset quality, and timbral variation. On that note, all of the fiddlers talked about and played for us the alternation of softer and sharper sounds as a key feature of a groovy rhythmic performance. In addition, Røine emphasised dynamic range and the importance of finding 'the point of balance at which the string sound and the resonance from the instrument meet'. At that sweet spot, the volume is not maxed out, which allows for dynamic variations in both directions.

When the relationships among sonic features, timing and groove were brought into the discussion, fiddlers pointed to the ways in which the fiddle sounds and responds, and the impact of these qualities on the temporal domain of performance and experience. On a more detailed level, Hytta, Liahagen and Kaasa talked about 'fast' and 'slow' fiddles in terms of different rhythmic styles of playing, which in turn demand various forms and degrees of responsiveness, precision and clarity. As an example of how such musical features interact, Liahagen noted that some fiddlers are particularly good at creating and maintaining a continuous ringing sound in the instrument, partly through certain patterns of intonation (that is, finger placement and the corresponding pitching of notes). He also claimed that sound such as this 'affects the experience of rhythm and flow in a temporal sense as well … to achieve a good groove … there can't be any empty spaces within the fiddle, in a way … So, one sort of has to develop a good sound in the fiddle as well, to get the proper forward thrust'. Both Hytta and Liahagen associated a bad sound with a bad (or undanceable) groove. In terms of explicit timing/sound interactions, our informants showed some inclination to associate sharp sounds with early attacks, and softer sounds and slow onsets with a more ambiguous temporal positioning. Interestingly, the ambiguity of these vague or 'secret' (Hytta) attacks was in itself seen as an important rhythmic quality.

In synthesising these observations, we found that a unifying thread among the fiddlers was that groove is conceptualised as a multiparameter and dynamic phenomenon. It is multiparameter in the sense that timing and duration, the dynamics of tone production, the way in which the melody is articulated, and the way in which the sound of the instrument is utilised to propel the music forward are equally important aspects of what is associated with a good groove. It is dynamic in the sense that a proper balance of weight, flow and drive arises via the interactions among all aspects of the music, which mutually influence one another during the course of performance. One implication of this character is that there is no particular timing and/or accentuation pattern (that is, there is no generalised groove template) that exists independent of the particularities of the individual performance, or that

can be translated between different tunes. It is instead a performance's unique combination of musical features that determines its musically viable timings and accentuations. In this genre, then, variation is seen as an important contributor to groove across several aspects of rhythmic performance: the choice of accented notes; the phrasing of the music via bowing patterns, rhythmic subdivisions and ornamentations; the alternation between sharper and softer onsets, and the different sound colours of the instrument; and melodic and intonational variation.

Five genres – five ways of shaping microrhythm

There were a number of affinities among the five genres in the ways in which groove and timing/sound relationships featured in the discourse. On an overarching level, we note – as have many other scholars – that groove is often associated with movement and embodiment.[11] First, the music was created with the aim of making listeners move their bodies. Secondly, we also noted that rhythmic qualities of the sounding music (broadly defined) are often identified using movement metaphors, such as 'lift', 'sway', 'flow', 'breathing' and 'forward thrust'.

On a more detailed level, we saw striking affinities between two or more genres regarding particular aspects of sound–timing interactions. In both the computer-based genres and the fiddle genre, microrhythmic design is as much about modelling the sounds' sonic features as it is about adjusting their timing. Jazz seems to be an exception in this regard: here the microrhythmic discourse is very much focused on timing. Another observation is that in all of the played genres – that is, samba, jazz and fiddle – playful manipulation of the flow of the groove during the course of performance is an ideal. Informants in all three genres also shared the view that the physical constraints and handling of the instruments shape timing patterns. This observation is related to the notion that the sound(s) of a given instrument/sound source fill a particular function within the microrhythmic design. In samba, for example, delayed events are often played by instruments in the lower register (that is, surdo) and pushed by instruments in the upper register (that is, agogo, pandeiro). As to timing flexibility, both EDM and certain sub-styles of jazz are rather 'tight', meaning that they rely upon a rather precise (virtual) timing reference. In jazz, a shared sense of time is crucial, whereas in EDM most sounds are located on the grid or only milliseconds off this reference. In hip-hop and fiddle, on the other hand, timing is more flexible. In hip-hop the pulse might have rather wide 'beat bins' (Danielsen 2010) and allow for asynchronous positioning of beat-related events; in the fiddle genre, the duration of beats may vary considerably.

In terms of overall groove ideals, and how timing, the shaping of sound and timing/sound relations contribute to reaching these ideals, we found a cross-generic tendency to emphasise the shape or sonic evolution of a sound or segment. At the microrhythmic level, this relates to how an individual sound evolves over time and/or how one sound transitions into another. As to longer segments, it relates to the sonic evolution of a rhythmic phrase or basic pattern. The importance of how sounds and segments are shaped in time is recurrently thematised in the discourse

[11] There is a vast literature on the relationship between musical rhythm and embodied movement; for a selective overview, see Roholt (2014).

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about feel or groove in all the genres, albeit with reference to different musical features and expressive devices.

Another cross-generic tendency is the tendency to value the experienced tension between different layers or components of a musical sequence. This ideal of *rhythmic friction* featured in our informants' discourses along two axes: along the horizontal axis, relating to the temporal displacement of rhythmic events in relation to some actual or virtual reference, and along the vertical axis, relating to experiential tensions between synchronous sounds belonging to different layers and within composite sounds. Overall, then, the musicians' discourses converge in tendencies to emphasise the 'organic' and 'lively' (as opposed to the static and feeble).

Notably, these meta-analytical statements concern principal similarities across the interviews. An equally important finding is the variety of ways in which these experiential qualities are achieved. Importantly in this regard, the mentioned examples of rhythmic friction and dynamic sound shapes are not limited to the dimensions of timing and duration but also include features of the sounds themselves (shape, timbre and intensity). This means that a sense of rhythmic friction and/or dynamic shapes might arise from the various interactions among several parameters and features, thus transcending the dimensions of timing and/or sound, as further discussed below.

Our findings also support the notion of active and passive domains of performance action, as put forward by Johansson (2010a, 2017). The active domain refers to conscious, directly controlled actions and decisions within the music-making process. The passive domain refers to instances where a particular musical feature is not directly or intentionally controlled but rather the result or side effect of other features.[12] In concrete terms, the precise placement of a rhythmic event may be the result of an active decision, or it may be the passive outcome of other performance decisions. For example, it could be argued that beat timing is an active parameter within the jazz and EDM genres (consciously placing the attack behind, on, or ahead of the timing reference). Within the fiddle genre, on the other hand, beat timing is largely a passive parameter, in that the varying durations of beats are often a secondary effect of melodic, ornamental and dynamic variations. The hip-hop producers' discourse suggested a middle position. Some hip-hop producers actively controlled the timing of individual notes to achieve a laid-back feel. Others promoted the notion of 'flawed' timing, achieved by means of using samples from recordings in which the timing profile in question is (passively) embedded. Some also actively chose sounds with a certain shape to achieve a certain feel with no attention to timing as such. Conversely, in many jazz and samba contexts, sound is more of a given attribute of the instrument and follows passively from the timing of notes and articulation of melodies.

We also note that it is necessary to inform the active/passive dichotomy with a sense of whether one's subjects are more or less aware of and/or more or less concerned with a particular musical feature of a groove. At one end of the scale, musicians are neither aware of nor concerned with it. At the other end of the scale, the feature in question is thought to be crucial to the groove, and there is complete awareness of its operation. Between these poles, there are a number of possible

[12] In the following discussion, we suggest that the passive domain may also include features that are indirectly 'controlled' or at least affected by the articulation of actively shaped features.

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balances to be struck among these complementary categories. Musicians may be aware of and concerned with a particular feature or quality but lack the means to control it directly. As an example, the hip-hop producers' 'flawed timing', achieved by means of trial and error, is only retrospectively and holistically assessed, not directly controlled *as* timing as such. Likewise, fiddlers allegedly use intonational and dynamic variation to affect the overall sound, which, in turn, is envisaged to affect the overall rhythmic flow of the performance. However, the resulting complex, layered configuration of musical features – while certainly important – can hardly be considered to be actively controlled. On the other hand, the EDM producers' strategic and conscious choice of sounds and use of sidechaining, reverb, or other processing effects to impact the perceived timing of a sound, would be an example of a feature that is achieved indirectly but often actively controlled.

Conclusion

The study clearly substantiates the multiparameter nature of musical performance and experience, providing qualitative empirical support for the assumption that temporal and sonic features interact and overlap. Our comparative approach also shows that such musical features at the microlevel of rhythm interact in *particular* ways that are typical of the genre. Moreover, it confirms that practitioners within the respective genres have substantial knowledge of these particular configurations and utilise this knowledge in musical practice. On a more general level, we see that these different configurations, which all involve interaction across the timing and sound dimensions, tend to represent various forms of rhythmic friction and/or dynamic shapes at the microlevel of rhythm.

Finally, on a methodological level our study shows that configurations of sonic and temporal features can be translated into a discursive level of analysis via questions related to the relative importance of different elements, whether and how they are thought to interact, and the degree of direct and/or intentional control over particular features and their interaction. Along these lines, we emphasise that the analyst must attend to the relationship between explicit and implicit elements of the informants' discourse. Simply put, if a musical feature is not in focus, it might mean that it is not important, but it might also mean that its importance is taken for granted or is even unconscious. To reach this level of understanding requires a properly contextualised interpretation of the ethnographic data. Our analysis of discourses of timing and sound in five groove-based genres has highlighted this challenge.

We would also like to point out some limitations of the chosen approach. Above all, it remains that a significant part of our informants' discourse is probably embedded in their *practice*, meaning that their verbal statements are not exhaustive of the relevant modes of knowing. To meet this methodological challenge, future research could benefit from an even stronger degree of practice-based participant involvement. On this note, we also acknowledge that the extent to which musical concepts are verbalised varies among the informants and that verbalised accounts are coded in ways that are particular to the genre in question. This introduces challenges related to translating such accounts into a language that allows for comparison between the genres. We still think that our study represents a significant step towards a richer understanding of how timing/sound relationships feature in the discourses and practices of music-makers across genres and traditions.

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Appendix 1: interviewees in alphabetical order by first name

Anders Røine, fiddle (https://npsmusic.no/artist/anders-roine/)
Anne Hytta, fiddle (http://www.annehytta.com/)
Basmo Fam: Amund, Øyvind and Eirik, hip-hop (http://oslorecords.com/artists/basmobeats)
Charlotte Bendiks, EDM (https://www.facebook.com/djcharlottebendiks, https://soundcloud.com/charlotte-bendiks)
Eckhard Baur, jazz (http://baur.no/Eckhard_Baur/Home.html)
Ellen Andrea Wang, jazz (http://www.ellenandreawang.com/)
Erlend Lyngstad, hip-hop
Espen Berg (Seeb), EDM (http://seebmusic.com)
Felipe Guimares, samba (https://www.pranayamacomunicacao.com/felipe-bemol)
Herbjørn Liahagen, fiddle
Knut Petter Sævik, EDM (https://www.discogs.com/artist/269382-Knut-S%C3%A6vik)
Knut Værnes, jazz (https://en.wikipedia.org/wiki/Knut_V%C3%A6rnes)
Kristian Hole, EDM (https://no.wikipedia.org/wiki/Kholebeatz)
Marcio Caparroz, samba
Matheus Crippa, samba (https://prosas.com.br/empreendedores/22949)
Morten Halle, jazz (https://en.wikipedia.org/wiki/Morten_Halle)
Ola Øverby, jazz (http://stageway.no/artister/fieh/)
Oscar Bolão, samba
Ottar Kaasa, fiddle (http://www.felemakar.no/)
Per Martinsen, EDM (https://en.wikipedia.org/wiki/Mental_Overdrive)
Sofie Tollefsbøl, jazz (http://stageway.no/artister/fieh/)
Tommy Tee, hip-hop (https://no.wikipedia.org/wiki/Tommy_Tee)
Toninho Melodia, samba

Appendix 2: interview guide

- Introduction to the TIME project
- Information about the interview and video documentation; presentation of information letter; signing of consent form

Topic: *Timing–sound interaction at the microlevel of auditory perception*

Overarching research questions:

How do sound-related features influence the temporal placement of sounds in music, as well as auditory perception in general?

How does this dynamic vary with genre/cultural context? [These are not interview questions but just a reminder to the interviewer.]

1. Questions related to the performance/rehearsal (if relevant):

1.1. Do you have any remarks on the performance/rehearsal (anything in particular that deserves attention)?

1.2. Why did you do [. . .] (refer to concrete examples from the performance/rehearsal)?

2. General questions:

2.1. What factors are important to making your music sound like it does?

2.2. What is important when it comes to timing and sound in your music?

3. Groove:

3.1. What is important when it comes to a good groove in your music?

3.1.1. What do you do to achieve this end?

3.2. How do you think and work to achieve the desired interactions among instruments/sounds?

3.3. What playing techniques, effects, and/or editing options do you consider important when it comes to groove, timing, and rhythm?

3.3.1. Is any of this particularly challenging/difficult for you?

3.3.2. How have changes in technology affected the way you work with groove and sound in your music?

3.4. To what degree and in what ways are you engaged in working with feel and time in your music?

3.4.1. [Possible follow-up question] Would you say that this work is unique to your sound or typical of your genre?

4. Sound and timing:

4.1. What is important when it comes to good sound in your music? What is a good sound?

4.1.1. What aspects are essential to creating a good sound in your music, and what are the challenges involved in doing so?

4.2. What are your thoughts on how sound might have an impact on groove?

4.2.1. [Possible follow-up question] How does the sound of various instruments (or synthesised sources) affect the groove, the timing, and rhythmic relationships?

4.2.2. To what extent can changes in a sound (e.g. timbre, intensity, envelope) affect the way in which we perceive its timing?

4.3. How do you work with sound and groove?

4.3.1. Are you intentionally combining different sounds, or possibly treating them differently, to create rhythmic friction in the music?

4.4. Can you give examples of a sharp/fast sound and a soft/slow sound?

4.4.1. How would you illustrate an (a) early, (b) on the beat and (c) late/behind sound with your instrument? / How do you go about producing a sound that is perceived as (a) early, (b) on the beat and (c) late/behind, respectively?

4.5. How do you use sharp/fast sounds and soft/slow sounds differently when it comes to the crafting of sound and groove?

4.5.1. Is there any difference between sharp/fast sounds and soft/slow sounds when it comes to how we experience the sound's location in relation to the beat?

4.5.2. Is there any difference in how you *place* these sounds in relation to the beat?

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4.5.3. Are you especially occupied with combining, and possibly contrasting, these sounds?

5. Questions that are particular to the genre in question (if relevant):

[This category was added to ensure that genre-specific issues related to particular instruments, production techniques etc. were covered in the interviews. In most cases, these issues emerged naturally during the regular questions (1–4).]

6. Questions for listening examples (if relevant):

[During some of the interviews the informants referred to specific tracks/recordings (their own or other artists') to highlight particular aesthetic features. These references were followed up by questions regarding how they exemplified aspects of groove, sound and/or timing/sound relations.]

7. Comparative questions:

7.1. Can you name any similarities or differences when it comes to the interaction between musicians/timing/sound/processing in your tradition compared to other music traditions with which you are familiar?
7.2. To what extent can individual sounds represent the soundscape of the genre? Which sounds are most representative?

(Possible additional questions that are particular to the genre in question.)

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