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## Abstract

*We present a framework for discussing tonality in Electronic Dance Music (EDM) which highlights how tonal techniques are employed creatively throughout EDM. While most musicological analysis of EDM focuses on rhythm, we contend that composer/producers of EDM play with a sense of tonality that often defies traditional analytic techniques. The rich tonality of EDM tracks may be illuminated by using our framework, which is broader and more contextually relevant to EDM than standard western classical music approaches to analysis. The framework consists of four attributes that are used to describe the nature of tonality over the course of the music: rate of tonal change, tonal stability, pitch/noise ratio and number of independent pitch streams. We will define and illustrate these attributes using numerous audio examples. In a practical sense, our framework may be useful for generating more detailed discussions and analysis of tonality in EDM and may lay the basis for formal systems of tonal analysis of EDM in the future.*

## 1. Introduction

It is often observed that rhythm in EDM genres is of greater significance than in many other styles of music (Butler 2006: p 4-5; Neill 2002; Shapiro 2000) and, as a result, the growing body of musicological analysis of EDM appears to have overlooked the significance of tonality to some extent. This paper highlights how tonality, if conceived of more broadly than in western classical music, is employed creatively throughout EDM. This may assist in debunking the notion that the tonal elements of EDM and EDM are merely a simplification of the more mature and complex systems of tonality from classical music. EDM may *appear* simple at best, or incoherent at worst, through traditional tonal frameworks. However, our framework shows how EDM composer/producers can play with the same sense of tonality but in ways that often defy traditional analytic techniques. As a broad framework, no particular notational system is provided; moreover the concepts are expressed purely through sonic examples.

### 1.1 Defining Electronic Dance Music

We adopt a broad notion of EDM which includes any form of metric electronic music based on loops and layers of different synthesised or sampled instruments and sounds. Overlapping styles include house, techno, electronica, downbeat, instrumental hip-hop, break-beat, and

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many others. While 'pop music' is not necessarily excluded from EDM, a number of the styles within EDM would clearly be outside of pop music, for example, minimal techno. Musically, the focus of pop music is more on vocals and lyrics, while EDM is defined here as being more concerned with rhythm and instrumental elements. Following the tradition of EDM (Shapiro 2000: p 77-78), a piece of music will be referred to as a 'track' rather than a 'song' partly due to the lack of traditional, lyrical style 'singing'.

### 1.2 Tonality in a modern context

Tonality is defined here as the way a sense of tonic pitch is, or is not, suggested in the music and the way other pitches, if present, are organised with respect to it and each other to achieve particular musical effects. This is a slight broadening of the term originally coined by Fétis (in Reti 1958:7) due to the surprisingly diverse nature of tonality in EDM which does not always conform to the narrower definitions typically applied to classical music that deal primarily with chords and scales (Huron 2006:175; Reti 1958; Shenker 1935). While it would be *possible* for examples of EDM to be described purely in these terms, in a significant number of cases, if this were the *only* focus, there would be very little to say, despite the obvious widespread appreciation of the music. In a similar way to the low information classification of EDM as simply "4/4", it would be a vast oversight to declare that "minimal techno is drone-based" and leave it at that.

Despite the overarching influence of a western harmonic heritage, EDM producers, simply through using new technology and often without formal music education, are less occupied with traditional notions of tonality. In such examples it is more revealing instead to explore atonicity (the apparent lack of tonic), tonal ambiguity, the subtle introduction of tonality through intuitively non-tonal voices, or the harmonic properties of overtones and their manipulation within a single note. At the other extreme, one might imagine that unnecessarily complex tonal analysis may be prompted during passages where a synthesizer chord is played as though it were a lead ([musical example 1](#)) – it would be simpler to treat the part as it appears to have been produced and perceived. This would obviously involve a subjective judgement call, however the aim of this paper is to describe enough of the tonality of EDM so as to convey an idea of the

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\* The musical examples referred to throughout this paper are available on the ACMC08 CD and online at [www.lemu.org](http://www.lemu.org)

range of techniques and possibilities within the genre. It should not, however, be construed as a theoretical attempt to authoritatively encapsulate all that is possible and denote precise generative likelihoods. The current musicological literature on EDM (Butler 2006; Keller 2003) tends to revolve primarily around the rhythm, due to its importance; as discussed above. Literature on pop musicology does not often deal with “musical analysis” (Beard and Gloag 2005:11) so much as cultural theory (Hawkins, et al. 2007) and when analysis does occur, tonality does not appear to be discussed in detail (Tagg 1982). As well as this, the musical interest in pop music is primarily in the vocals and this does not adequately relate to the more instrumental (non-vocal), repetitive and drone oriented styles of EDM. The analytical musicology of acousmatic and electro-acoustic music also encounters problems of sonic analysis but to a much larger extent than EDM. While various approaches (Battier 2003; Hirst 2003; Windsor 1995) are somewhat relevant, there currently does not appear to be a framework for tonality that is suitable for EDM and so the following descriptive continuums were conceived, drawing from a variety of other music theories: rate of tonal change over time, the amount of recognisably pitched sounds, the level of harmonic coherence within the audible pitch set and the degree of polyphony. We will explain these attributes and use them to define EDM. The objective here is to express the tonality of the EDM paradigm and should not be construed as an attempt at defining music for any other purpose. Throughout the explanation of terms, we will present key examples from EDM and apply the descriptive tonal attributes to them in order to build evidence for their suitability in defining EDM. As well as this, some sense of the genre may be expressed through the audible examples.

## 2.1 Rate of Tonal Change (Horizontal)

The rate of Tonal Change (TC) attribute relates to the level of activity within tonal parts – at one extreme, the entire track consists of a constant drone of tonic and/or pitch-class set without changing over time ([musical example 2](#)). At a level above this we might observe drones that shift pitch only once in a whole track or at the end of a lengthy cycle ([musical example 3](#)). A higher level of TC might involve typical chord progressions in the bass line, such as the very common two-chord ([musical example 4](#)) or four-chord ([musical example 5](#)) varieties. Such progressions tend to gravitate to an underlying tonic (Bukofzer 1947 in Thomson). At a higher rate still, the bass line could form a riff that dances around an implied fundamental bass (Grant 1978) or “Urlinie” (Schenker 1980), an imagined bass line that can be reduced from notes over a span of time ([musical example 6](#); [musical example 7](#)). Above this level, we might consider lead riffs which are changing in such a way and at such a rate as to contribute to ambiguity of the underlying tonic. This is typified by the “solo” ([musical example 8](#)). It should be noted that TC is derived from the sum of activity in the various pitched parts. For example in ([musical example 9](#)) three voices can be heard: the bass that doubles the kick, the mid-high register synthesizer fulfilling the role of bass, and

the higher-register lead vibes, all different but adding up roughly to a mid level of TC overall – that is, the tonic and related pitches are not constant, but also are not so wildly variable as to confuse the tonality. Over the entire track the TC does not change dramatically. Having defined TC and provided an example of how it might be roughly gauged, it is now possible to examine how EDM overall can be described in terms of TC.

Overall, EDM is skewed more towards the “drone” end of the spectrum than the “solo”, with most tracks consisting of two, three or four primary chords in a progression and many consisting of a drone. The solo is, on the whole, a rare occurrence in EDM, although it occurs more commonly in related genres that are similar to pop music in terms of structure and emphasis on the lead-part for interest, for example, the excerpt above ([musical example 8](#)). These observations apply to whole pieces of music, whereas if the time span is narrowed onto a particular section, the level of TC may deviate drastically. For example, during a fill section, there is generally an increase in TC either through transformation of a pitched part ([musical example 10](#)) or addition of a pitched cue ([musical example 11](#)), while during a breakdown the opposite is often true, due to the introduction of sustained pads ([musical example 12](#)). In other instances ambiguity in the breakdown is partially conveyed through higher levels of TC in a kind of solo ([musical example 13](#)). The tendency for EDM to have low to mid levels of TC, to be more “drone” oriented than “solo” oriented, can be contrasted with classical music which, with continual variation and key modulation, has a relatively high level of TC. Some might argue that EDM in particular should be listened to at the macroscopic level of the DJ’s set and that at this timescale significant TC would occur. However, if one considers an orchestral work of the same length, it seems natural that the differences in TC between the two genres would remain. The broad genre of Pop music sits mostly in the middle, with complex lead elements and clichéd chromatic key shifts representing the upper boundary of TC and the more popular elements of EDM representing the lower boundary.

## 2.2 Tonal Stability (Vertical)

Tonal Stability (TS) is an estimate of how strong the sense of tonality (as tonicity) is, with primary reference to the tonic, but also to the idealised pitch schemas that the listener carries with them, for example, the minor and major scales. EDM has a mid-level of TS, but varies quite substantially. At the least stable end of the TC continuum, we could envisage pitches that do not suggest a particular tonic and do not relate to any of the scale intervals ever experienced by the listener. Above this, there may be recognisable intervals, but still no strong sense of tonic, as is often the case with whole tone scales. At the mid level, a tonic would be identifiable, but many of the other pitches may be accidentals or extraneous scale degrees that are less fundamental or less “similar” to the tonic. Above this, the tonic may be forcefully emphasised, featuring fundamental intervals such as the fifth, fourth and octave more strongly. The extreme of TS would feature only the octave.

One might ask: why are the intervals of fifth, fourth and octave given such a fundamental role in establishing tonality? Empirical qualitative research supports the claim that they are judged as “stable” and “strong” in musical

terms (Huron 2006:145). The special fundamental role of these intervals is also apparent in the musicology of most other civilisations (Thomson 1999). These intervals are readily perceived as being similar on neurological (Weinberger 1999) and cognitive (Krumhansl 1979) levels. This also extends to the chords I, IV and V (Krumhansl 1983). On a physical level, the ratio of 2:3 (the fifth), produces a shorter macro-cycle ( $2 \times 3 = 6$ ) between the two frequencies than any other ratio below 1:2 thus could be considered as something of a “best fit” on a physical level – while perfect ratios only exist in metaphysical realms, small inconsistencies in tuning, 2.03:3 for example, are typically overlooked during tonal perception, an argument made earlier by Theodore Lipps in 1900 (Thomson 1999:89). Due to all of these musical, neurological, cognitive and physical reasons we consider music which features the octave, fifth and fourth intervals to have a higher TS than other intervals.

In addition to the perfect intervals, pitch-class sets which are familiar to listeners will appear to have higher TS than those that are not. There is a lack of evidence for any particular scale with non-perfect intervals being more or less intrinsically viable from a musical perspective – that is, scales appear to be learnt (Thomson 1999), which is not to deny the evidence of certain affordances of the human mind to guide this learning, for example our propensity for five to nine discrete categories (Baddeley 1994). Because of this, and from experience of extended exposure to unfamiliar pitch-class sets, it is reasonable to assume an increase in TS for any pitch-class set over time. Within scales themselves, pitches have particular functions and can add to the TS by reinforcing a familiar pitch schema. Correlating surface pitches with **key profiles** is one way to assess the TS of a musical sequence and this formal approach is explained by Temperly (2007:53). Accidentals and pitches that are outside the dominant tonal schematic will also reduce the TS if they occur more often than is typical. This is supported by empirical music psychology studies which found that people have a notion that certain pitches fit a tonal context much better than others (Huron 2006:148), the individual judgements being averaged into a key profile.

As mentioned, EDM is considered to mostly have mid-level TS. This is justified because, in the vast majority of cases, there is a clear tonic, regular scales are used; most commonly pentatonic minor, followed by minor and Mixolydian (major with flattened seventh). Tonal movement in chord progressions is often between I and V if binary ([musical example 14](#)), or progressions that include V or IV if ternary or quaternary ([musical example 15](#)). Sequences with lower TS have less “perfect” intervals in their bass lines or a copiosity of unfamiliar accidentals ([musical example 16](#)). Tracks with higher TS are pure monotonic drones which span multiple octaves ([musical example 17](#)). As with the other attributes mentioned, TS is dynamic, often changing during fills and breakdowns. As argued by Huron (2006:160-161) and others, the sequence of pitches also contributes to stability, however the details would be a distraction to this current discussion. Nonetheless, the principal is exemplified here ([musical example 18](#)) where a random-walk and arpeggio are played together, outlining a pitch-class set, but not assisting in the definition of tonic.

In comparison, classical music can be considered to have mid-level TS for similar reasons, but deviating towards less TS rather than more, particularly when considering the more recent periods of tonal complexity. By way of contrast, pop music has mid-high TS due to the preva-

lence of standard scales, chords, I-IV-V and fifth based progressions.

## 2.3 Pitch/Noise Ratio

The clarity of pitches has a direct effect on the ability of the listener to develop a sense of tonality – for example, in the case of total noise where there are no discernible tones, it is impossible to conceive of the TC (rate of tonal change) and TS (tonal stability). As a result, the Pitch/Noise Ratio (PNR) is considered here to be a relevant attribute of tonality, particularly for electronic music, which has always involved a significant amount of sonic expression. The continuum can be envisaged with purely untuned and/or distorted percussive sounds and noises at the lower end ([musical example 19](#)). The highest PNR is music made from pure tones.

EDM overall has a mid range of PNR, but varying substantially between sub-genres and individual tracks. In particularly minimal instances, the percussive sounds are usually tuned in some way so as to suggest a basic tonality, or there is a very subtle application of tones, for example, the high-hat and kick ([musical example 20](#)). In other cases, sound effects such as ring modulation are used to introduce tones ([musical example 21](#)). In contrast, down-tempo artists such as Board of Canada are known for their rich tones ([musical example 22](#)), although in the main sections these tones are usually accompanied by unpitched drums. Boards of Canada often “detune” their synthesizers, which provides a distinctive sound and does not obstruct the identification of tones. However, some other forms of pitch shifting can disturb pitch clarity and thus would have to be considered as having lower PNR ([musical example 23](#); [musical example 24](#)). Despite this, it should be noted that foreign and abnormal tuning systems are sometimes used, and these are not considered as having any less PNR due to the tones being quite perceivable ([musical example 25](#); [musical example 26](#)). A temporary decrease in PNR is often observed during fills, breakdowns and transitions, the dissolution of tonality being associated with increased tension or intensity. For example, DJ Shadow reduces the PNR through a record slow-down ([musical example 27](#)). The mid PNR of EDM can be contrasted with the high PNR of classical music; mid-to-high level of PNR in pop music; and the low level of PNR in acousmatic and electro-acoustic music. This is justified as most orchestral voices have a distinct pitch, including some of the percussive parts such as timpanis and triangles. In pop music, there is a heavy emphasis on tonality and pitch clarity and more conventional use of sounds than in EDM, mainly due to more conventional instrumentation and less emphasis on electronic media to assist expression. The sound-objects used to compose acousmatic and electro-acoustic music are often not easily recognisable as clear pitches and so have a low PNR. The PNR describes the clarity of tones for a given piece of music, while the TS and TC describe how these tones are organised to effect the tonality.

## 2.4 Number of Independent Pitched Streams (IPS)

The number of Independent Pitched Streams (IPS) relates to the number of pitched voices that can be identified as operating independently and simultaneously. At the lowest end of the continuum is a single pitched

voice/part, at the highest end is a dense texture built from numerous voices and in the centre is the typical three to five part tonal voicing of EDM and pop music. Usually there is one bass, one or two leads, and one or two accompaniments. Classical orchestral music can be distinguished by a high number of IPS. It should be noted that while a particular number of IPSs might be clearly identifiable through careful analysis, it is more common for listeners to concentrate on a single stream or texture at a time (Bregman, 1990).

While mid-level IPS is typical in EDM, there is often deviation from this, sometimes with extended periods of none ([musical example 19](#)), one ([musical example 20](#)), two ([musical example 28](#)) and three ([musical example 29](#)) or more pitched voices.

A subjective judgement call is sometimes needed to determine whether a part contains multiple streams or not. As shown by Bregman (1990), a single sequence of tones, if played with alternating pitches that are related beyond a certain interval, it will be more likely to be perceived as two separate streams, albeit with the focus generally on one or the other. Alternatively, a synthesizer chord that always consists of the same intervals in parallel might more easily be classified as a single stream of an interesting 'chord-like' timbre ([musical example 1](#)).

### 3. Conclusion

In summary, a framework for discussing tonality in EDM has been presented and applied to a brief synoptic analysis of tonality in EDM, using a number of audible examples. Four terms have been introduced: TC, TS, PNR and IPS. TC relates to the rate of tonal change, from drone through to solo. TS relates to the stability or strength of the perceived tonality at any point in time, from the strong sense of fundamental tone brought about by octaves and perfect intervals through to the vaguer sense of tonality implied by accidentals and atonal pitches. PNR relates to the clarity of the pitches, from pure tones to noise. IPS relates to the number of independent streams that it is possible to discern.

Each of these descriptive dimensions are independent of one another and all of them relevant to the unique sense of tonality that may or may not be instilled in the individual listener of EDM. While some concepts, such as stream segregation, have been studied previously, the framework we present here appears unique in its combined application of concepts to EDM, particularly in the context of tonality.

It should be noted that exploration of this framework for tonality in EDM is at an early stage – future research would involve more precise definitions, ultimately to the point where the framework is formalised into a generative theory that could be executed on a computer.

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